FINAL

Phase Two Environmental Site Assessment

North Portion of 3770 Montrose Road
Niagara Falls, Ontario

Prepared for:

Forest Gate Advisors Inc.
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1.0 EXECUTIVE SUMMARY

Pinchin Ltd. (Pinchin) was retained by Forest Gate Advisors Inc. (the Client), to complete a Phase Two Environmental Site Assessment (ESA) of the north portion of the property located at 3770 Montrose Road in Niagara Falls, Ontario (hereafter referred to as the Site, Phase One Property or Phase Two Property). The Phase Two Property is presently developed with a partial two-storey commercial building formerly occupied by a Canadian Tire retail store and automotive repair centre (Site Building A) and a single-storey multi-tenant commercial building (Site Building B).

The Phase Two ESA was conducted at the request of the Client in relation to the future redevelopment of the Phase Two Property from commercial to residential land use. A Record of Site Condition (RSC) submittal to the Ontario Ministry of Environment, Conservation and Parks (MECP) is a mandatory requirement when a land use changes to a more sensitive land use and as such, to support the RSC submission, the Phase Two ESA was conducted in accordance with the Province of Ontario's *Ontario Regulation 153/04: Records of Site Condition – Part XV.1 of the Act*, as amended (O. Reg. 153/04).

The objectives of this Phase Two ESA were to assess the soil and groundwater quality in relation to six areas of potential environmental concern (APECs) and related potentially contaminating activities (PCAs) and contaminants of potential concern (COPCs) identified in a Phase One ESA completed by Pinchin in accordance with O. Reg. 153/04. The identified APECs, PCAs and COPCs are summarized in Tables 1 and 2 (all Tables are provided within Section 9.0).

The Phase Two ESA was completed by Pinchin between December 6, 2021 and January 12, 2022, and included the advancement of six boreholes at the Phase Two Property, two of which were completed as groundwater monitoring wells to facilitate the sampling of groundwater and the assessment of groundwater flow. One surface soil sample was also collected due to drilling limitations caused by the presence of underground utilities. The boreholes were advanced to depths ranging from approximately 3.05 to 6.10 metres below ground surface (mbgs). Select soil samples collected from each of the borehole locations, as well as the surface soil sample location, were submitted for laboratory analysis of volatile organic compounds (VOCs), petroleum hydrocarbons (PHCs) fractions 1 through 4 (F1-F4), polycyclic aromatic hydrocarbons (PAHs) and/or polychlorinated biphenyls (PCBs). In addition, groundwater samples were collected from each of the newly-installed monitoring wells, as well as one previously-installed monitoring well, and submitted for laboratory analysis of VOCs, PHCs (F1-F4) and PAHs.

Based on Site-specific information, the applicable regulatory standards for the Phase Two Property were determined to be the *"Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition",* provided in the MECP document entitled, *"Soil, Ground Water and Sediment Standards for*

Use Under Part XV.1 of the Environmental Protection Act" dated April 15, 2011 *(Table 2 Standards)* for medium- to fine-textured soils and residential/parkland/institutional property use.

The laboratory results for the submitted soil and groundwater samples indicated that all reported concentrations for the parameters analyzed met the corresponding *Table 2 Standards*.

It is the opinion of the Qualified Person (QP) who supervised the Phase Two ESA that the applicable *Table 2 Standards* for soil and groundwater at the Phase Two Property have been met as of the Certification Date of January 12, 2022 and that no further subsurface investigation is required in relation to assessing the environmental quality of soil and groundwater at the Phase Two Property.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.

2.0 INTRODUCTION

A Phase Two ESA is defined as an “assessment of property conducted in accordance with the regulations by or under the supervision of a QP to determine the location and concentration of one or more contaminants in the land or water on, in or under the property”. Under O. Reg. 153/04, the purpose of a Phase Two ESA is as follows:

- To determine the location and concentration of contaminants in the land or water on, in or under the Phase Two Property;
- To obtain information about environmental conditions in the land or water on, in or under the Phase Two Property necessary to undertake a Risk Assessment, in accordance with O. Reg. 153/04, with respect to one or more contaminants of concern; and
- To determine if applicable Site Condition Standards and standards specified in a Risk Assessment for contaminants on, in or under the Phase Two Property were met as of the certification date by developing an understanding of the geological and hydrogeological conditions at the Phase Two Property and conducting one or more rounds of field sampling for all contaminants associated with any APEC identified in the Phase Two ESA sampling and analysis plan (SAP) and for any such contaminants identified during subsequent Phase Two ESA activities and analyses of environmental conditions at the Phase Two Property.

This Phase Two ESA was conducted at the request of the Client in relation to the future redevelopment of the Phase Two Property from commercial to residential land use. An RSC submittal to the MECP is a mandatory requirement when a land use changes to a more sensitive land use and as such, to support the RSC submission, the Phase Two ESA was conducted in accordance with O. Reg. 153/04.

The overall objectives of this Phase Two ESA were to assess the soil and groundwater quality in relation to APECs and related COPCs identified in a Phase One ESA completed by Pinchin, the findings of which were summarized in the report entitled “*Phase One Environmental Site Assessment*, *North Portion of 3770 Montrose Road, Niagara Falls, Ontario*”, completed by Pinchin for the Client and dated December 6, 2021. The property assessed by the Pinchin Phase One ESA is referred to herein as the Phase One Property. The Phase Two ESA was conducted on the whole Phase One Property, at specific APECs identified during the Phase One ESA, and the Phase One Property and Phase Two Property have the same boundaries.

2.1 Site Description

This Phase Two ESA was completed for the north portion of the property located at the municipal address of 3770 Montrose Road, Niagara Falls, Ontario. The Phase Two Property is 5.454 hectares (13.477

acres) in area and is bounded by a multi-tenant commercial shopping plaza to the south (i.e., south portion of 3770 Montrose Road), a vegetated area followed by the Queen Elizabeth Way (QEW) highway to the east, residential land use to the north and Montrose Road followed by residential land use to the west. A Key Map showing the Phase Two Property location is provided on Figure 1 and a detailed plan of the Phase Two Property and surrounding lands is provided on Figure 2 (all Figures are provided within Section 9.0).

The Phase Two Property is improved with a vacant commercial building on the north-central portion (Site Building A) that was occupied by a Canadian Tire retail store and automotive centre from its construction in 1995 until 2020. The Phase One Property is also developed with a multi-tenant commercial building on the east portion (Site Building B) that is presently occupied by various commercial tenants with multiple vacant units.

A summary of the pertinent details of the Phase Two Property is provided in the following table:

Detail	Source/Reference	Information
Legal Description	Legal Survey Drawing provided by the Client, Service Ontario Parcel Register	Part of Lots 62 and 71; Township of Stamford; being Part 7 on 59R-7092; City of Niagara Falls
Municipal Address	Niagara Navigator (http://maps.niagararegion.ca/navigator), Client	3770 Montrose Road, Niagara Falls, Ontario L2H 3C8
Parcel Identification Number (PIN)	ServiceOntario Parcel Register	64293-0406 (LT)
Current Owner	ServiceOntario Parcel Register, Client	Cassone Dwellings (BT) Inc.
Owner Contact Information	Client	Daniel Marinovic c/o Cassone Dwellings (BT) Inc. danielm@forestgategroup.com 289-553-7009
Current Occupant	Site reconnaissance	Site Building A – Vacant Site Building B – Physiotherapy Clinic, The Wine Place, Niagara Medical Supplies, TEW & Associates, vacant units
Occupant Contact Information	Site reconnaissance, Interviews	McCOR Management (current property manager) 21 St. Clair Avenue East, Suite 500, Toronto, ON M4T 1L9 416-494-3191

Detail	Source/Reference	Information
Client Contact Information	Authorization to Proceed Form for Pinchin Proposal	Forest Gate Advisors Inc.
Site Area	Niagara Navigator (http://maps.niagararegion.ca/navigator)	4.454 hectares (13.477 acres)
Current Zoning	Zoning By-law No. 2005-119, dated July 25, 2005 (Amendment to Zoning By-law No. 79-200)	SC – Planned Shopping Centre Commercial Zone
Centroid UTM Coordinates	Garmin GPSMAP 64s, NAD 83, Accuracy +/- 3 m	652692 Easting
		4775704 Northing
		Zone 17T

A legal survey showing the Phase Two Property is provided in Appendix A (all Appendices are provided in Section 10.0).

2.2 Property Ownership

The entirety of the Phase Two Property is currently owned by Cassone Dwellings (BT) Inc. Contact information for the Phase Two Property owner is provided in the preceding section.

Pinchin was retained by Mr. Daniel Marinovic of the Client to conduct the Phase Two ESA of the Site. Contact information for Mr. Marinovic is provided in the preceding section.

2.3 Current and Proposed Future Uses

The Phase Two Property is presently utilized for commercial purposes and it is Pinchin’s understanding that the Client intends to redevelop the Phase Two Property for residential land use.

Given that the future land use is changing to a more sensitive land use, there is a mandatory requirement that an RSC be filed as per Section 168.3.1 of the Province of Ontario’s *Environmental Protection Act.*

2.4 Applicable Site Condition Standards

The Phase Two Property is a commercial property located within the City of Niagara Falls and the proposed future land use is residential. It is Pinchin’s understanding that the south portion of the Phase Two Property is located within a highly vulnerable aquifer, based on a review of the Niagara Peninsula Conservation Authority’s (NPCA) Watershed Explorer.

Bedrock was not encountered at any of the boreholes completed at the Phase Two Property during the Phase Two ESA, which were advanced to a maximum depth of approximately 6.1 mbgs and, as such, the Phase Two Property is not a shallow soil property as defined in Section 43.1 of O. Reg. 153/04.

The Phase Two Property does not contain a water body nor is it located within 30 metres of a water body and the use of standards for properties situated within 30 metres of a water body is not required.

Section 41 of O. Reg. 153/04 states that a property is classified as an "environmentally sensitive area" if the pH of the surface soil (less than or equal to 1.5 mbgs) is less than 5 or greater than 9, if the pH of the subsurface soil (greater than 1.5 mbgs) is less than 5 or greater than 11, or if the property is an area of natural significance or is adjacent to or contains land within 30 metres of an area of natural significance. A total of five representative soil samples (including one sample collected as part of a Phase II ESA completed by Pinchin in 2021) collected from the boreholes advanced at the Phase Two Property were submitted for pH analysis. The pH analytical results are summarized in Table 3. The pH values measured in the submitted soil samples were within the limits for non-sensitive sites. The Phase Two Property is also not an area of natural significance and it is not adjacent to, nor does it contain land within 30 metres of, an area of natural significance. As such, the Phase Two Property is not an environmentally sensitive area.

As discussed further in Section 6.4, based on the results of grain size analysis completed on representative soil samples collected during the Phase Two ESA and the observed stratigraphy at the borehole locations at the Phase Two Property, it is the QP's opinion that over two-thirds of the overburden at the Phase Two Property is medium- to fine-textured as defined by O. Reg. 153/04. Therefore, the soil at the Phase Two Property has been considered medium- to fine-textured for the purpose of establishing the applicable MECP Site Condition Standards.

Based on the above, the appropriate Site Condition Standards for the Phase Two Property are the Table 2 Standards for:

- Medium and fine-textured soils; and
- Residential/parkland/institutional property use.

As such, all analytical results have been compared to these *Table 2 Standards*.

3.0 BACKGROUND INFORMATION

3.1 Physical Setting

The Phase Two Property is located in the north portion of the City of Niagara Falls at an elevation of approximately 194 metres above mean sea level (mamsl). The topography of the Phase Two Property is generally flat with a sloped drainage area along the north portion. The properties surrounding the Phase Two Property are at an equivalent grade. There are no drainage features (e.g., open ditches or swales) present on-Site. Surface water (e.g., storm runoff) is inferred to run overland and drain into the on-Site municipal storm sewer catch basins or the vegetated low-lying area on the northeast portion of the Site.

There are no open water bodies or areas of natural significance located on-Site. The only water body identified within the Phase One Study Area was Shriner's Creek, which is located approximately 150 m south of the Phase One Property. A plan showing the Phase One Study Area is presented on Figure 3. The nearest major water body to the Phase Two Property is the Niagara River, located approximately 3.9 kilometres (km) east of the Phase Two Property at an elevation of approximately 90 mamsl.

A review of the official plan for the City of Niagara Falls indicated that the lands bordering the creek to the south are designated as an Environmental Conservation Area, which is situated approximately 150 m south of the Phase One Property. A review of the NPCA's Watershed Explorer indicated that the south portion of the Phase One Property, as well as the property located adjacent to the south (i.e., south portion of 3770 Montrose Road) are located within areas designated as a Highly Vulnerable Aquifer. No other designations were identified in the Phase One Study Area based on Pinchin's review of the official plan and NPCA information.

The records review indicated that the Phase One Property and all other properties within the Phase One Study Area are presently serviced by a municipal drinking water system.

The records review did not identify the presence of wells at the Phase One Property that supply water for human consumption or for agricultural purposes. However, the Water Well Information System database search completed by Environmental Risk Information Services identified two water wells used for human consumption within the Phase One Study Area outside of the Phase One Property. It is unknown whether these wells currently exist.

3.2 Past Investigations

3.2.1 Summary of Previous Environmental Investigations by Others

Reports summarizing the following environmental investigations completed by others and by Pinchin and pertaining to the Phase Two Property were reviewed as part of the Pinchin Phase One ESA:

- "*Phase I Environmental Site Assessment, 3770 and 3930 Montrose Road, Niagara Falls, Ontario*", prepared by Pinchin for Forest Gate Financial Corp., dated June 17, 2021 (2021 Pinchin Phase I ESA Report); and
- "*Phase II Environmental Site Assessment, 3770 and 3930 Montrose Road, Niagara Falls, Ontario*", prepared by Pinchin for Forest Gate Financial Corp., dated June 18, 2021 (2021 Pinchin Phase II ESA Report).

A summary of the salient information identified in the above-referenced reports is provided below.

2021 Pinchin Phase I ESA Report

The 2021 Pinchin Phase I ESA was completed in general accordance with the Canadian Standards Association (CSA) document entitled "*Phase I Environmental Site Assessment, CSA Standard Z768-01*" dated November 2001 (reaffirmed 2016), for the properties 3770 and 3930 Montrose Road, which includes the Phase One Property as well as the south portion of 3770 Montrose Road and the property located further south. The scope of work included a review of readily available historical and regulatory records, a Site reconnaissance, interviews, and a review of previous environmental reports completed for the properties located at 3770 and 3930 Montrose Road. Of these, the following included an assessment of the Phase One Property:

- "*Phase I Environmental Site Assessment, Mount Carmel Centre, Niagara Falls, Ontario*", prepared by AMEC for Craft Acquisitions Corporation and dated March 18, 2014 (2014 AMEC Phase I ESA Report); and
- "*Groundwater Sample Event at the Canadian Tire Automotive Service Centre, 3770 Montrose Road, Niagara Falls, Ontario*", prepared by Terrapex Environmental Ltd. (Terrapex) for River Realty Development (1976) Inc. and dated May 30, 2014 (2014 Terrapex Groundwater Sampling Report).

The 2014 AMEC Phase I ESA Report identified the former Canadian Tire automotive servicing department within the east portion of Site Building A, including four aboveground storage tanks (ASTs) and nine inground hydraulic hoists reported at the time, as a potential issue of environmental concern that warranted further investigation. Based on Pinchin's review of the 2014 AMEC Phase I ESA Report, two new oil ASTs were located within the southeast corner of Site Building A and one waste oil AST was located adjacent to the north exterior elevation of Site Building A. The precise locations of the inground hoists were unknown, with the exception of two observed within a photograph taken as part of the 2014 AMEC Phase I ESA Report.

The 2014 Terrapex Groundwater Sampling Report consisted of the sampling of three existing groundwater monitoring wells (MW-N, MW-E and MW-S) located immediately north, east and south of the automotive servicing operations at the Canadian Tire within Site Building A. All three existing monitoring wells were monitored for the presence of liquid phase hydrocarbons. The depth to groundwater ranged from 2.23 mbgs at MW-S to 2.58 mbgs at MW-E. Samples from each groundwater monitoring wells were submitted for laboratory analysis of benzene, toluene, ethylbenzene and xylenes (collectively referred to as "BTEX") and petroleum hydrocarbons (PHCs) in the F1 to F4 fraction ranges (F1-F4). All three groundwater samples satisfied the Table 3 Standards (medium/fine-grained soil, industrial/commercial/community land use, non-potable groundwater environment) of the *MECP Standards* (*Table 3 ICC Standards*). Pinchin noted that other potential contaminants of concern (PCOCs) associated with automotive services centres were not included within the laboratory analysis. **Pinchin reviewed the analytical data presented in the 2014 Terrapex Groundwater Sampling Report and compared it to the currently applicable *Table 2 Standards*. All reported concentrations of PHCs (F1-F4) and BTEX in groundwater met the *Table 2 Standards*.**

At the time of Pinchin's Site reconnaissance in May 2021, the Phase One Property was in a similar configuration to the present day (i.e., Site Building A was vacant and Site Building B was occupied by a few commercial tenants with several vacant units). The south portion of 3770 Montrose Road and 3930 Montrose Road were occupied by various commercial tenants. Pad-mounted, oil-cooled transformers were present on the east-central, southeast and southwest portions of 3770 Montrose Road (i.e., off-Site) and on the northeast portion of 3930 Montrose Road.

The findings of the 2021 Pinchin Phase I ESA identified the following potential issue of environmental concern at the Phase One Property:

- A Canadian Tire automotive repair/service centre occupied the east portion of Site Building A from approximately 1995 to 2020. Historical records indicated that ten service bays each equipped with a hydraulic hoist were present within the automotive servicing area. Waste oil and new oil ASTs were also formerly present within the automotive servicing area.

The following additional potential issues of environmental concern were identified during the 2021 Pinchin Phase I ESA that were associated with the properties located to the south of the Phase One Property and not deemed to be applicable to the Phase One Property:

- A Gales Gas Bar retail fuel outlet (RFO), with associated underground storage tanks (USTs) and fuel pumping stations, was located at 7537 Thorold Stone Road. Five single-walled gasoline or diesel USTs were installed at this property in the 1980s. This property had also been registered as a generator of light fuels and other specified inorganics wastes from 1992 until 2010. This property is located approximately 280 m south of the Phase One Property, outside of the Phase One Study Area; and
- Staining and stressed vegetation, resulting from an apparent leak, was observed in the vicinity of the pad-mounted, oil-cooled transformer located on the southeast portion of 3770 Montrose Road (off-Site). This transformer is located approximately 150 m south of the Phase One Property and represented an off-Site PCA.

Based on the above-noted findings, Pinchin recommended the completion of a Phase II ESA.

At the time of the 2021 Pinchin Phase I ESA, a salt storage enclosure was located on the northeast portion of the Site, for use on on-Site roads and parking areas for safety reasons during winter conditions.

Pinchin noted that although there is the potential for salt-related parameters such as sodium adsorption ratio (SAR) and electrical conductivity (EC) in soil and sodium and chloride in groundwater to be present at concentrations exceeding the applicable Site Condition Standards, the exemption provided in Section 49.1 of Ontario Regulation 153/04 can been applied and, as such, these parameters would be deemed to meet the Site Condition Standards and would not need to be further assessed. Pinchin also noted that, should this area of the Site be redeveloped in the future, consideration should be given to assessing the soil/groundwater at that time and developing a soil management plan, if required. **At the time of Pinchin's Site reconnaissance in October 2021, this salt storage had been removed from this area and a temporary salt stockpile was stored on the concrete floor surface within the east portion of Site Building A. These road salting activities represents a PCA at the Phase One Property. However, it was the opinion of the $\mathrm{QP}_{\mathrm{ESA}}$ supervising the Phase One ESA that, although salt-related parameters such as SAR and EC in soil and sodium and chloride in groundwater may be present at concentrations exceeding the *Table 2 Standards*, the exemption provided in Section 49.1 of O. Reg. 153/04 can been applied. As such, these parameters would be deemed to meet the Site Condition Standards and do not require further assessment as part of a Phase Two ESA.**

2021 Pinchin Phase II ESA Report

The Phase II ESA completed by Pinchin in June 2021 was completed in general accordance with the CSA document entitled "*Phase II Environmental Site Assessment, CSA Standard Z769-00 (R2018)*", dated 2000 and reaffirmed in 2018. The purpose of the Phase II ESA was to address potential issues of environmental concern identified in the 2021 Pinchin Phase I ESA Report.

The scope of work included the advancement of three interior boreholes within the east portion of Site Building A (BH04, BH05 and BH06) and one exterior borehole completed as a groundwater monitoring well (MW03) immediately east of Site Building A (downgradient of former automotive repair/service operations). Additional work was completed (i.e., new boreholes and sampling of existing groundwater monitoring wells) at the property located at 3930 Montrose Road; however, this work was completed to address an RFO located outside of the Phase One Study Area and is therefore not relevant to the Phase One Property. A surface sample was collected in the vicinity of the transformer leak observed on the southeast portion of 3770 Montrose Road, which identified impacts of PHCs (F2, F3 and F4) (i.e., concentrations exceeding Table 9 of the *MECP Standards*) in surficial soil in the vicinity of the transformer.

Borehole MW03, completed on the Phase One Property, was advanced to a depth of 6.71 mbgs; however, the monitoring well was installed at a depth of 4.57 mbgs. The depth to groundwater was measured to be 3.25 mbgs on June 4, 2021. Boreholes BH04, BH05 and BH06 were advanced to depths of 2.29 mbgs, 2.90 mbgs and 2.13 mbgs, respectively. Soil samples were submitted for laboratory analysis of PHCs (F1-F4), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). A groundwater sample collected from MW03 was submitted for analysis of PHCs (F1-F4), VOCs and PAHs.

All reported concentrations of PHCs (F1-F4), VOCs and PAHs in soil and groundwater met the then applicable *Table 3 ICC Standards*. **Pinchin compared the analytical data to the currently applicable *Table 2 Standards*. All reported concentrations of PHCs (F1-F4), VOCs and PAHs in soil and groundwater met the *Table 2 Standards*. As discussed in Section 3.2.3 of this report, this analytical data has been included in Tables 3 and 7, along with the analytical results of this Phase Two ESA. In addition, the borehole logs for MW03, BH04, BH05 and BH06 have been included in Appendix C.**

3.2.1.1 Previous Environmental Report Summary

Based on Pinchin's review of the above-referenced previous environmental reports, the following PCAs were identified within the Phase One Study Area that were considered to result in APECs at the Phase One Property:

- Historical automotive repair/servicing operations, from approximately 1995 to 2020, located within the east portion of Site Building A.
- Nine inground hydraulic hoists located within the automotive service centre within the east portion of Site Building A.
- Two new oil ASTs located within the southeast corner of the automotive service centre within Site Building A.
- One waste oil AST located adjacent to the north exterior elevation of the automotive service centre at Site Building A.
- Historical salt storage area located northeast of Site Building B (road salting activities).

The following additional PCAs were identified in the reviewed reports within the Phase One Study Area but were not considered to result in APECs at the Phase One Property:

- A leaking transformer and associated PHC impacts in surficial soil located on the southeast portion of 3770 Montrose Road (i.e., 150 m south of the Phase One Property).
- A transformer located on the east-central portion of the South Portion of 3770 Montrose Road (i.e., 85 m south of the Phase One Property).
- A transformer located on the southwest portion of the South Portion of 3770 Montrose Road (i.e., 150 m south of the Phase One Property).

- A transformer located on the northeast portion of 3930 Montrose Road (i.e., 195 m south of the Phase One Property).

3.2.2 Pinchin Phase One ESA Summary

From October 29, 2021 through December 6, 2021, Pinchin conducted a Phase One ESA in support of the future filing of an RSC for the Phase Two Property. The Phase One ESA consisted of a Site visit, interviews with Site personnel, records review, evaluation of information, and preparation of a written report which was completed under the supervision of a QP. A plan showing the Phase One Study Area is attached as Figure 3.

The Phase One ESA was completed recently (i.e., within the same month as the start of the Phase Two ESA) and in accordance with the requirements of O. Reg. 153/04. Therefore, the information provided within the Phase One ESA Report is considered adequate such that it can be relied upon for the purpose of this Phase Two ESA and future filing of an RSC.

Based on information obtained during the Phase One ESA, a total of six PCAs and corresponding APECs and COPCs were identified that could potentially affect the environmental condition of the subsurface media on, in or under the Phase Two Property. The COPCs associated with each APEC were determined based on a review of the PCAs and substances associated with the related activities, and on several sources of information, including but not limited to, Pinchin's experience with environmental contamination and hazardous substances, common industry practices for analysis of such contaminants and point sources, literature reviews of COPCs and associated hazardous substances, and evaluations of contaminant mobility and susceptibility for migration in the subsurface.

Table 1 presents the PCAs and their associated APECs and COPCs. Identified on-Site and off-Site PCAs are summarized in Table 2 and their locations are shown on Figure 4 (on-Site PCAs) and Figure 5 (off-Site PCAs). APECs at the Phase Two Property are illustrated on Figures 6A and 6B.

3.2.3 Use of Previous Analytical Data

The soil and groundwater data from the 2021 Pinchin Phase II ESA Report are considered to be of adequate quality and can be relied upon in assessing soil and groundwater conditions at the Site. The report including these data was reviewed, and no issues related to data quality were identified. Sampling procedures were acceptable and although quality assurance/quality control (QA/QC) samples were not collected, Pinchin's SOPs were followed during sample collection and no quality issues related to field sampling or laboratory methods were noted or anticipated. Furthermore, the soil and groundwater data within the report were obtained within the last year (i.e., May and June of 2021) and are considered representative of current Site conditions. The soil and groundwater analytical data from the 2021 Pinchin Phase II ESA are included, along with the analytical data from this Phase Two ESA, in Tables 3 and 7.

Pinchin notes that the information provided in the 2014 Terrapex Groundwater Sampling Report was reviewed for the purpose of identifying APECs pertaining to the Phase Two Property during the Phase One ESA. The groundwater data from the 2014 Terrapex Groundwater Sampling Report were obtained more than five years ago, and are considered too old and potentially unrepresentative of current conditions at the Phase Two Property. Furthermore, insufficient samples were collected for QA/QC purposes and Pinchin cannot confirm whether the methods utilized to obtain the analytical data conform to the present-day minimum requirements stipulated in O. Reg. 153/04 for the purpose of filing an RSC. As such, this groundwater analytical data was not relied upon in preparing this Phase Two ESA report.

4.0 SCOPE OF INVESTIGATION

4.1 Overview of Site Investigation

The scope of work for this Phase Two ESA was prepared to address the APECs identified at the Phase Two Property and consisted of the following:

- Preparation of a health and safety plan and arranged for the completion of underground utility locates prior to the commencement of drilling activities.
- Development of a detailed SAP prior to the advancement of the boreholes and the installation of the monitoring wells. The SAP was outlined in the document entitled "*Sampling and Analysis Plan for Phase Two Environmental Site Assessment, 3770 Montrose Road, Niagara Falls, Ontario*", dated December 1, 2021, which is provided in Appendix B. Based on Pinchin's knowledge of the surrounding properties and known hydrogeological conditions, boreholes were advanced at the Phase Two Property to maximum depths ranging between approximately 3.05 and 6.10 mbgs.
- Retaining Strata Drilling Group Inc. (Strata) to advance boreholes and complete monitoring well installations using a Geoprobe 7822DT™ drill rig. Strata is licensed by the MECP in accordance with Ontario Regulation 903 (as amended) (O. Reg. 903) to undertake borehole drilling/well installation activities. Strata advanced six boreholes at the Phase Two Property to investigate the potential for soil contaminants associated with the APECs identified in the Phase One ESA. Two of the advanced boreholes were instrumented with a monitoring well in accordance with O. Reg. 903 for the purpose of monitoring hydrogeological conditions and groundwater quality on-Site.
- Collection of soil samples at regular intervals within each borehole.
- Field screening of soil samples for visual/olfactory evidence of impacts as well as for petroleum-derived vapours in soil headspace using a combustible gas indicator (CGI)

calibrated to hexane and VOC-derived vapours in soil headspace using a photoionization detector (PID).

- Submission of a minimum of one “worst case” soil sample from each borehole for chemical analysis of:
    - PHCs (F1-F4);
    - VOCs;
    - PAHs; and/or
    - Polychlorinated Biphenyls (PCBs).
- Collection of one surface soil sample, using hand tools, and submission of the sample for laboratory analysis of PHCs (F1-F4), and PCBs.
- Development of both of the newly-installed monitoring wells and redevelopment of one previously-installed monitoring well prior to the collection of groundwater samples.
- Submission of one representative groundwater sample from both of the newly-installed monitoring wells and one previously-installed monitoring well for the chemical analysis of the following parameters:
    - PHCs (F1-F4);
    - VOCs; and
    - PAHs.
- Submission of two duplicate soil samples and one duplicate groundwater sample for chemical analysis of the above-noted parameters for QA/QC purposes.
- Submission of one trip blank for the soil sampling program for the chemical analysis of VOCs for QA/QC purposes.
- Submission of one trip blank for the groundwater sampling program for the chemical analysis of VOCs for QA/QC purposes.
- Submission of three representative soil samples for the laboratory analysis of grain size and four representative soil samples for the laboratory analysis of pH in order to confirm the appropriate MECP Site Condition Standards.
- Conducting groundwater monitoring at both of the newly-installed groundwater monitoring wells and one previously-installed groundwater monitoring well by measuring the depth to groundwater from both top of casing and ground surface reference points, and assessing the presence/absence of non-aqueous phase liquid (NAPL), using an oil/water interface probe. The depth to groundwater was also measured in each of the newly-installed

monitoring wells completed as part of a geotechnical investigation being completed concurrently with this Phase Two ESA (findings reported under separate cover).

- Completion of an elevation survey to establish the elevations of the boreholes and newly-installed monitoring wells as well as the previously-installed monitoring well relative to a benchmark with a known elevation.
- Obtaining UTM coordinates for the boreholes and newly-installed monitoring wells as well as the previously-installed monitoring well using a portable Global Positioning System (GPS) device.
- Comparison of the soil and groundwater analytical results to the *Table 2 Standards*.
- Preparation of a report (this report) documenting the findings of the Phase Two ESA which meets the reporting requirements listed in *Schedule E* and *Table 1 – Mandatory Requirements for Phase Two Environmental Site Assessment Reports* of O. Reg. 153/04.

4.2 Media Investigated

The scope of work for this Phase Two ESA was prepared to address the APECs and corresponding media at the Phase Two Property as identified through completion of the Phase One ESA.

The media of concern for the Phase Two ESA were soil and groundwater. Pinchin included the assessment of groundwater as part of the Phase Two ESA to investigate groundwater quality in relation to historical automotive service and repair operations on-Site (APEC-1), including nine former inground hydraulic hoists (APEC-4). Note that due to the historical automotive service/repair operations at the Phase Two Property, the Phase Two Property is an enhanced investigation property requiring mandatory sampling and analysis of groundwater. Pinchin did not conduct sediment sampling as part of this Phase Two ESA as there are no surface water bodies and, therefore no sources of sediment, present on-Site.

For assessing the soil at the Phase Two Property for the presence of COPCs, a total of six boreholes were advanced at the Phase Two Property for the purpose of collecting soil samples. Select “worst case” samples collected from each of the boreholes, were submitted for laboratory analysis of the COPCs.

For assessing the groundwater at the Phase Two Property for the presence of COPCs, groundwater monitoring wells were installed in two of the boreholes completed at the Phase Two Property to permit the collection of groundwater samples. Groundwater samples, comprising samples collected from each of the newly installed monitoring wells (i.e., MW101 and MW102) as well as one previously installed monitoring well (i.e., MW03) were submitted to the analytical laboratory for analysis of the COPCs.

4.3 Phase One Conceptual Site Model

A conceptual site model (CSM) has been created to provide a summary of the findings of the Phase One ESA. The Phase One CSM is summarized in Figures 1 through 6 which illustrate the following features within the Phase One Study Area, where present:

- Existing buildings and structures.
- Water bodies located in whole or in part within the Phase One Study Area.
- Areas of natural significance located in whole or in part within the Phase One Study Area.
- Drinking water wells located at the Phase One Property.
- Land use of adjacent properties.
- Roads within the Phase One Study Area.
- PCAs within the Phase One Study Area, including the locations of tanks.
- APECs at the Phase One Property.

The following provides a narrative summary of the Phase One CSM:

- The Phase One Property is an irregularly-shaped parcel of land approximately 58,000 m^2 (5.8 hectares) in area located at the east side of Montrose Road, approximately 340 m north of Thorold Stone Road, in the City of Niagara Falls. The Phase One Property is improved with a vacant commercial building on the north-central portion (Site Building A) that was occupied by a Canadian Tire retail store and automotive centre from its construction in 1995 to 2020. The Phase One Property is also developed with a multi-tenant commercial building on the east portion (Site Building B) that is presently occupied by various commercial tenants with multiple vacant units.
- No water bodies were identified within the Phase One Study Area, with the exception of one creek (“Shriner’s Creek”) which is located approximately 150 m south of the Phase One Property. The nearest major water body is the Niagara River, which is located approximately 3.9 km east of the Phase One Property.
- No areas of natural significance were identified within the Phase One Study Area.
- No drinking water wells were located on the Phase One Property.
- A multi-tenant commercial plaza is located adjacent to the south of the Phase One Property (i.e., south portion of 3770 Montrose Road). The surrounding area to the west consists of Montrose Road, followed by single-family residential dwellings along South Wood Drive and Mount Carmel Boulevard. The surrounding area to the north consists of

residential land use. A corridor of vacant, undeveloped land is situated immediately east of the Phase One Property, followed by the QEW and then residential land use.

- A total of eleven PCAs were identified within the Phase One Study Area, consisting of seven PCAs at the Phase One Property and four PCAs within the Phase One Study Area, outside of the Phase One Property. The four off-Site PCAs, shown on Figure 5, are not considered to result in APECs given their locations/distances from the Phase One Property and downgradient/transgradient locations relative to the inferred groundwater flow direction. The remaining seven on-Site PCAs result in APECs at the Phase One Property. Figures 6A and 6B provide a detailed summary of the APECs and associated PCAs and COPCs.
- Underground utilities at the Phase One Property provide potable water, natural gas, electrical, telephone, cable and sewer services to the Site Building. The natural gas, telephone, electrical, water and sanitary sewer services enter Site Building A via underground lines running from Montrose Road. These utilities are expected to traverse the area south of Site Building A and run east towards Site Building B. Stormwater is captured in several catch basins located throughout the parking area, which are expected to connect to the municipal storm sewer along Montrose Road. In addition, a concrete storm sewer traverses the north portion of the Site and is expected to discharge into the drainage swale located on the northeast portion of the Site. Plans were not available to confirm the depths of these utilities but they are estimated to be located approximately 0.5 to 3 mbgs. The known depth to groundwater at the Phase One Property is approximately 3.25 mbgs, and the utility corridors are expected to be situated just above the water table. As such, the potential for utility corridors to act as preferential pathways for contaminant distribution and transport in the event that shallow subsurface contaminants exist at the Phase One Property is considered low.
- The Phase One Property and the surrounding properties located within the Phase One Study Area are located within glaciolacustrine deposits of clay plains (west portion and surrounding properties to the west) and sand plains (east portion and surrounding properties to the east) as the dominant landforms with the primary native materials consisting of silt and clay with minor sand and gravel. Bedrock is expected to consist of sandstone, shale, dolostone and/or siltstone of the Lockport Formation at a depth of approximately 11 mbgs. During previous on-Site environmental investigations, the soil stratigraphy was observed to consist of silty clay overlying clayey silt.
- The Phase One Property is relatively flat with little relief, with the exception of a depressed area on the northeast portion for drainage purposes. The area surrounding the

> Phase One Property slopes gradually to the east towards the Niagara River. Local groundwater flow is inferred to be to the southeast, based on the topography of the area surrounding the Phase One Property, the location of Shiner's Creek and the location of the Niagara River. Regional groundwater flow is inferred to be to the north towards Lake Ontario.

The majority of the exterior of the Phase One Property consists of paved parking areas and access routes. According to the Site Representative, salt has historically been applied to the parking area for safety reasons during winter conditions to remove snow and ice. This salt was formerly stored on the paved area northeast of Site Building B. At the time of Pinchin's site reconnaissance, this salt stockpile had been temporarily moved to the interior of Site Building A (concrete floor within the east portion). These road salting activities represent a PCA at the Phase One Property. However, it is the opinion of the QP_{ESA} supervising the Phase One ESA that, although salt-related parameters such as SAR and EC in soil and sodium and chloride in groundwater may be present at concentrations exceeding the applicable Site Condition Standards, the exemption provided in Section 49.1 of O. Reg. 153/04 can been applied. As such, these parameters would be deemed to meet the Site Condition Standards and do not require further assessment as part of a Phase Two ESA.

According to the chain of title search results, Dominion Canners Limited (later Canadian Canners Limited) owned a portion of the Phase One Property from 1920 to 1955. Based on Pinchin's review of aerial photographs, portions of the Phase One Property consisted of agricultural fields during that time. However, these appeared to be row crops (i.e., no apparent orchards observed) and therefore the large-scale application of pesticides at the Phase One Property is considered unlikely.

There were no deviations from the Phase One ESA requirements specified in O. Reg. 153/04 or absence of information that have resulted in uncertainty that would affect the validity of the Phase One CSM.

4.4 Deviations from Sampling and Analysis Plan

No notable constraints and limitations with respect to the SAP were documented during the field activities, and as such Pinchin has conducted the Phase Two ESA in a manner generally consistent with the SAP provided in Appendix B.

4.5 Impediments

Pinchin had full access to the Phase Two Property throughout the completion of the Phase Two ESA.

5.0 INVESTIGATION METHOD

5.1 General

The Phase Two ESA field work was conducted in accordance with Pinchin's standard operating procedures (SOPs) as provided in the SAP, which have been developed in accordance with the procedures and protocols provided in the MECP document entitled "*Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario*", dated December 1996, in the Association of Professional Geoscientists of Ontario document entitled *"Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended)"*, dated April 2011, and in O. Reg. 153/04.

In addition, Pinchin's SOP for groundwater sampling using low-flow purging and sampling procedures follows the United States Environmental Protection Agency Region I document entitled *"Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells"* dated January 19, 2010 (Low Flow Sampling Protocol).

No deviations from Pinchin's SOPs occurred during the Phase Two ESA.

5.2 Drilling

Pinchin retained Strata to advance a total of six boreholes (MW101, MW102 and BH103 through BH106) at the Phase Two Property between December 6 and 7, 2021 to investigate the potential presence of COPCs associated with the APECs identified in the Phase One ESA. Two of the advanced boreholes (MW101 and MW102) were completed as monitoring wells in accordance with O. Reg. 903 for the purpose of monitoring hydrogeological conditions and groundwater quality on-Site. The boreholes were drilled to a maximum depth of 6.10 mbgs using a Geoprobe 7822DT™ drill rig. Upon completion of the drilling and monitoring well installations, Strata completed and filed a Water Well Record with the MECP for the well cluster in accordance with O. Reg. 903.

The locations of the boreholes and monitoring wells are provided on Figures 7A and 7B. Section 6.10.2 includes a table summarizing the boreholes and monitoring wells completed to investigate each of the APECs. A description of the subsurface stratigraphy encountered during the drilling program is documented in the borehole logs included in Appendix C. Well completion details and elevation data are provided in Table 4 and on the borehole logs provided in Appendix C.

Measures taken to minimize the potential for cross-contamination during the borehole drilling program included:

- The use of dedicated, disposable PVC soil sample liners for soil sample collection during direct-push drilling.
- The use of dedicated, pre-cleaned augers for each borehole location.

- The extraction of soil samples from the interior of the sampling device (where possible), rather than from areas in contact with the sampler walls.
- The cleaning of all non-dedicated drilling and soil sampling equipment (i.e., split-spoon sampler, auger flights, spatulas used for sample collection) before initial use and between sample and borehole locations.
- The use of dedicated and disposable nitrile gloves for all soil sample handling.

Soil samples were collected from boreholes MW102, BH103, BH104 and BH105 at continuous intervals during direct-push drilling at a general frequency of one soil sample for every 0.76 metres drilled. Soil samples were collected from boreholes MW101 and BH106 at regular intervals during auger drilling and split-spoon sampling at a general frequency of one soil sample for every 0.76 metres drilled.

5.3 Soil Sampling

Soil samples were collected in the boreholes at continuous or regular 0.76 intervals using 5.1 centimetre (cm) inner diameter (ID) direct push soil samplers with dedicated single-use sample liners (boreholes MW102, BH103, BH104 and BH105) or 5.1 centimetre (cm) ID split-spoon samplers (boreholes MW101 and BH106).

Discrete soil samples were collected from the dedicated sample liners or from the split-spoon samplers by Pinchin personnel using a stainless-steel spatula. Dedicated and disposable nitrile gloves were worn during the collection of each soil sample. A portion of each sample was placed in a resealable plastic bag for field screening and a portion was containerized in laboratory-supplied glass sampling jars or vials, with the appropriate preservative as required by the analytical method. Following sample collection, the sample jars/vials were placed into dedicated coolers with ice for storage pending transport to Bureau Veritas Laboratories (BV Labs) in Mississauga, Ontario.

Subsurface soil conditions were logged on-Site by Pinchin personnel at the time of borehole drilling. Based on the soil samples recovered during the borehole drilling program, the soil stratigraphy at the drilling locations generally consists of granular fill material comprised beneath the asphalt and concrete surfaces, to a maximum depth of approximately 0.20 mbgs, followed by silty clay overlying clayey silt with some fine sand, which extended to the maximum investigation depth of 6.10 mbgs. Moist to wet soil conditions were generally observed below 2.0 mbgs.

No odours or staining were observed in the soil samples collected during the borehole drilling program, with the exception of minor black staining from 2.59 to 2.74 mbgs in borehole MW102.

A detailed description of the subsurface stratigraphy encountered during the borehole drilling program is documented in the borehole logs included in Appendix C.

One surface soil sample (SS01) was also collected from the vicinity of the on-Site transformer located south of Site Building A (i.e., APEC-2) on December 6, 2021. The sample was obtained by hand digging with a shovel, then collecting the soil samples using a stainless steel trowel to a depth of 0.30 mbgs. The stratigraphy was observed to consist of moist, dark brown silty clay topsoil with cobbles. No odours or staining were observed in the surface soil sample collected.

5.4 Field Screening Measurements

Soil samples were collected at each of the sampling intervals during the drilling and surface soil sampling activities and analyzed in the field for VOC-derived and petroleum-derived vapour concentrations in soil headspace with an RKI Eagle 2™ equipped with a PID and a CGI operated in methane elimination mode. The soil samples collected for field-screening purposes were placed in resealable plastic bags. The plastic bags were stored in a warm environment for a minimum of five minutes and agitated in order to release organic vapours within the soil pore space prior to analysis with the PID and CGI.

Based on a review of the operator’s manual, the RKI Eagle 2™ PID has an accuracy/precision of up to 0.1 parts per million (ppm). The PID was calibrated prior to field use by the equipment supplier, Maxim Environmental & Safety Inc. (Maxim) according to Maxim’s standard operating procedures. In addition, the PID calibration was tested at the beginning of each day of drilling activities (beginning on the second day of drilling) against a Maxim-provided isobutylene gas standard with a concentration of 100 ppm. The gas standard was stored in a gas cylinder and delivered to the PID via a regulator valve. An in-field re-calibration of the PID was conducted (using the gas standard in accordance with the operator’s manual instructions) if the calibration check indicated that the PID’s calibration had drifted by more than +/- 10%.

Based on a review of the operator’s manual, the RKI Eagle 2™ CGI has an accuracy/precision of up to +/- 25 ppm, or +/- 5% of the reading (whichever is greater). The CGI was calibrated prior to field use by Maxim according to Maxim’s standard operating procedures. In addition, the CGI calibration was tested at the beginning of each day of drilling activities (beginning on the second day of drilling) against a Maxim-provided hexane gas standard with a concentration of 15% LEL. The gas standard was stored in a gas cylinder and delivered to the CGI via a regulator valve. An in-field re-calibration of the CGI was conducted (using the gas standard in accordance with the operator’s manual instructions) if the calibration check indicated that the CGI’s calibration had drifted by more than +/- 10%.

In general, the soil samples with the highest measured vapour concentrations (i.e., “worst case”) from a given borehole were submitted for laboratory analysis. Sample depth and visual and olfactory observations of potential contaminants were also used in conjunction with the vapour concentrations in making the final selection of “worst case” soil samples for laboratory analysis.

5.5 Groundwater Monitoring Well Installation

Following soil sampling, Strata installed a groundwater monitoring well in boreholes MW101 and MW102, under the full-time monitoring of a Pinchin field representative. To accommodate the well installations, each borehole was overdrilled using 21 cm (8.25-inch) diameter hollow stem augers to a maximum depth of 6.10 mbgs using the Geoprobe 7822DT™ drill rig.

The monitoring wells were constructed with 51-millimetre (2-inch) ID flush-threaded schedule 40 polyvinyl chloride (PVC) risers followed by a 3.05 metre length of No. 10 slot PVC screen. Each well screen was sealed at the bottom using a threaded cap and each riser was sealed at the top with a lockable J-plug cap. Silica sand was placed around and above the screened interval to form a filter pack around the well screen. A layer of bentonite was placed above the silica sand and was extended to just below the ground surface. A 7.62 cm ID Schedule 40 PVC outer casing, approximately 15 cm in length, was installed in each well around the top of the riser and into the top of the bentonite seal. A bentonite seal was then placed between the riser and outer casing. A protective flush-mount cover was installed at the ground surface over each riser pipe and outer casing and cemented in place.

All monitoring wells were installed in accordance with O. Reg. 903. The monitoring well construction details are provided in Table 4 and on the borehole logs in Appendix C. Upon completion of the monitoring well installations, Strata completed and filed a Water Well Record with the MECP for the well cluster.

No additional soil sampling or groundwater sampling was completed during the well installations.

Monitoring wells MW101 and MW102 were developed between January 4 and January 6, 2022 in accordance with Pinchin's SOP for well development by purging until dry three times using dedicated inertial pumps comprised of Waterra polyethylene tubing and foot valves. Existing monitoring well MW03 had been previously developed within the last seven months as part of the 2021 Pinchin Phase II ESA activities, and therefore was purged to dryness once (on January 4, 2022) prior to sampling activities. The well development activities were completed a minimum of 24 hours prior to the groundwater sampling activities.

Measures taken to minimize the potential for cross-contamination during well installation and well development included the following:

- The use of dedicated, pre-cleaned augers for overdrilling each borehole location.
- The use of dedicated and disposable nitrile gloves for handling well materials during well installation and during well development.
- The use of dedicated inertial pumps for each well.

- The cleaning of the submersible pump and associated wiring between monitoring well locations by rinsing with a solution of Alconox™ detergent and distilled water. Distilled water was also utilized to flush the interior of the pump between monitoring well locations.

5.6 Groundwater Field Measurements of Water Quality Parameters

Water quality parameters were measured during the low-flow purging and sampling procedure completed on January 12, 2022 at monitoring wells MW03, MW101 and MW102.

Measurements of the water quality parameters oxidation-reduction potential, dissolved oxygen, temperature, specific conductance, pH and turbidity were made during purging using a flow-through cell and a Horiba U-52™ water quality meter (Horiba Water Quality Meter). The Horiba Water Quality Meter was calibrated prior to use by the equipment supplier (Maxim) in accordance with the manufacturer's specifications.

Field-measured parameters were recorded from the Horiba Water Quality Meter at regular intervals in order to determine stabilized groundwater geochemical conditions and hence representative groundwater sampling conditions, in general accordance with the criteria stipulated in the Low Flow Sampling Protocol.

It should be noted that representative groundwater sampling conditions were determined by Pinchin personnel utilizing the field parameter stabilization criteria noted within the Low Flow Sampling Protocol.

5.7 Groundwater Sampling

Both monitoring wells installed by Pinchin as part of the Phase Two ESA and one existing monitoring well (i.e., MW03 installed by Pinchin in May 2021) were sampled. The monitoring wells were sampled a minimum of 24 hours after the completion of well development activities (see Section 5.5). All monitoring wells were sampled in accordance with the Low Flow Sampling Protocol as described below.

Well purging was completed using a Geotech™ submersible bladder pump and Geotech™ controller powered by a 12-Volt battery. Compressed air was delivered to the bladder pump unit via 47-millimetre (3/16-inch) ID polyethylene tubing. Groundwater was returned to the surface from the bladder pump via dedicated 0.64-cm (1/4-inch) ID polyethylene tubing. A Horiba U-52 Water Quality Meter connected to a flow-through cell was used to monitor water quality parameters during groundwater purging to assess whether water quality parameter stabilization was achieved prior to sample collection. The flow rate of the bladder pump was adjusted to minimize drawdown of the water table and the introduction of sediment into the samples.

Once field parameter stabilization was achieved, groundwater samples were collected at each well using the bladder pump and dedicated polyethylene tubing by pumping groundwater directly into new laboratory-supplied sample bottles at a pumping rate of less than 0.5 litres per minute.

As appropriate, laboratory sample bottles were pre-filled by BV Labs with preservatives intended to preserve the collected groundwater samples prior to analysis.

Following sample collection, the sample bottles were placed into dedicated coolers with ice for storage pending transport to BV Labs.

5.8 Sediment Sampling

Sediment sampling was not completed as part of this Phase Two ESA.

5.9 Analytical Testing

All collected soil and groundwater samples were delivered to BV Labs for analysis. BV Labs is an independent laboratory accredited by the Canadian Association for Laboratory Accreditation. Formal chain of custody records of the sample submissions were maintained between Pinchin and the staff at BV Labs. BV Labs conducted the laboratory analysis in accordance with the MECP document entitled *"Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act"* dated March 9, 2004 and revised on July 1, 2011 (*Analytical Protocol)*.

5.10 Residue Management Procedures

Soil cuttings generated by the borehole drilling program were containerized in seven 205-L drums and two 20-L pails that were stored adjacent to the south boundary of the Phase Two Property.

One composite soil sample (representative of the excess soil cuttings generated by the borehole drilling program) collected from the boreholes was submitted for the laboratory analysis of the leachate concentrations of inorganics, VOCs, PCBs and benzo(a)pyrene in accordance with the Toxicity Characteristic Leachate Procedure (TCLP) analysis as per Ontario Regulation 347/90 (O. Reg. 347/90) in order to characterize the soil cuttings for off-Site disposal purposes. The TCLP analytical results are provided in the Laboratory Certificate of Analysis in Appendix D which illustrate that the excess soil cuttings are classified as non-hazardous waste in accordance with O. Reg. 347/90.

Excess water produced during well purging activities was containerized in eight 20-L clean, sealed plastic pails stored adjacent to the east elevation of Site Building A. Excess fluids produced during equipment cleaning were placed within the pails of purge water.

Pinchin notes that at the time of writing, the drums of excess soil cuttings, purge water and equipment cleaning fluids have not been removed from the Phase Two Property. Pinchin will assist the Client in arranging for disposal of these materials by MECP-approved waste haulers at MECP-approved waste management facilities.

5.11 Elevation Surveying

On January 19, 2022, Pinchin completed a vertical elevation survey of select borehole and monitoring well locations using a Topcon RL-H5A Self-Leveling Laser Level and receiver. The elevations of the boreholes/monitoring wells were tied to a benchmark (geotechnical monitoring well MW6), which had been previously surveyed as part of a geotechnical investigation and had a geodetic reference elevation of 194.685 mamsl).

The UTM coordinates of each monitoring well and borehole were determined by Pinchin using a hand-held GPS device (i.e., Garmin GPSMAP 64s).

A summary of the well elevation survey data is provided in Table 4.

5.12 Quality Assurance and Quality Control Measures

The QA/QC protocols that were followed during borehole drilling, soil and groundwater sampling so that representative samples were obtained are described in the following subsections.

5.12.1 Sample Containers, Preservation, Labelling, Handling and Custody of Samples

Soil and groundwater samples were containerized within laboratory-prepared sample containers in accordance with the *Analytical Protocol*.

The following soil sample containers and preservatives were used:

- VOCs and PHCs (F1): 40 millilitre (mL) glass vials with septum-lids, pre-charged with methanol preservative.
- PHCs (F2-F4), PAHs, PCBs, pH and grain size: 120 or 250 mL unpreserved clear glass wide-mouth jars with a Teflon^{TM}–lined lid.

The following groundwater sample containers and preservatives were used:

- VOCs and PHCs (F1): 40 mL clear glass vials with septum-lids, pre-charged with sodium bisulphate preservative.
- PHCs (F2-F4): 250 mL amber glass bottles with Teflon^{TM}–lined lids, pre-charged with sodium bisulphate preservative.
- PAHs: 250 mL unpreserved amber glass bottles with Teflon^{TM}–lined lids.

Trip blank water samples for VOC parameter analysis were provided by BV Labs in 40 mL clear glass vials filled with VOC-free water.

The soil sampling trip blank for VOCs analysis consisted of two 40 mL clear glass vials that were pre-charged with methanol preservative.

Each soil, groundwater and QA/QC sample was labelled with a unique sample identifier along with the company name, sampling date, Pinchin project number and analysis required.

Each sample was placed in a cooler on ice immediately upon collection and prior to submission to BV Labs for analysis.

5.12.2 Equipment Cleaning Procedures

Dedicated, single-use PVC sample liners were used for soil samples collected from boreholes MW102, BH103, BH104 and BH105, which precluded the need for drilling equipment cleaning during soil sample collection. Equipment utilized in soil sample collection and handling (i.e., spatulas used to remove soil from the sample liners) was cleaned with a solution of Alconox™ detergent and potable water followed by a distilled water rinse prior to initial use and between samples.

During auger drilling, the split-spoon samplers used to collect soil samples from boreholes MW101 and BH106 were cleaned before initial use and between samples using an Alconox™/potable water mixture followed by a distilled water rinse. The augers used to drill the boreholes were pre-cleaned by Strata prior to arrival at the Site.

During groundwater sampling activities, the Geotech™ bladder pump used for purging and sampling was cleaned before initial use and between well locations by flushing with a solution of Alconox™ detergent and potable water followed by flushing with distilled water. New bladders were also installed in the pump before initial use and between well locations. During groundwater monitoring activities, the oil/water interface probe used to measure water levels and the YSI Water Quality Meter used for groundwater field parameter measurements were cleaned with a solution of Alconox™ detergent and potable water followed by a distilled water rinse prior to initial use and between well locations.

5.12.3 Field Quality Control Measures

A total of two field duplicate soil samples were collected by Pinchin during the Phase Two ESA for analysis of one or more of the COPCs. The frequency of field duplicate soil sample analysis complied with the requirement that one field duplicate soil sample is analyzed for every ten regular soil samples submitted for analysis of the COPCs. The soil sample field duplicate pairings and corresponding analytical schedules are summarized as follows:

- Soil sample “BH104-3” and its corresponding field duplicate “DUP09” were submitted for laboratory analysis of VOCs, PHCs (F1-F4) and PAHs.
- Soil sample “BH106-1” and its corresponding field duplicate “DUP16” were submitted for laboratory analysis of PCBs.

One field duplicate groundwater sample was collected by Pinchin during the Phase Two ESA for analysis of the COPCs. The frequency of field duplicate groundwater sample analysis complied with the requirement that one field duplicate groundwater sample is analyzed for every ten regular groundwater samples submitted for analysis of the COPCs. The groundwater sample field duplicate pairing and corresponding analytical schedule are summarized as follows:

- Groundwater sample “MW102” and its corresponding field duplicate “DUP999” were submitted for laboratory analysis of VOCs, PHCs (F1-F4) and PAHs.

One laboratory-prepared trip blank was analyzed for VOC parameters to comply with the requirement that one trip blank is analyzed for each submission of groundwater samples for VOC parameter analysis. As a further field quality control measure, one soil sampling trip blank was analyzed for VOCs.

The calibrations of the RKI Eagle 2™ PID/CGI used for field screening and the Horiba Water Quality Meter used for water quality parameter measurements were checked by the equipment supplier (Maxim) prior to use in the field by Pinchin.

Maxim completed the calibration checks in accordance with the equipment manufacturers’ specifications and/or Maxim’s SOPs. As described in Section 5.4, calibration checks and recalibration (if required) were completed daily for the RKI Eagle 2™ PID/CGI during the drilling and surface soil sampling program.

5.12.4 QA/QC Sampling Program Deviations

There were no deviations from the QA/QC sampling program outlined in the SAP.

6.0 REVIEW AND EVALUATION

6.1 Geology

Based on the stratigraphic information obtained from the soil samples recovered during the drilling activities completed as part of the Phase Two ESA and the 2021 Pinchin Phase II ESA, the ground surface at the Phase Two Property is underlain by granular fill materials to a maximum depth of approximately 0.5 mbgs. The native soil underlying the surficial fill materials is generally comprised of silty clay to a depth ranging from approximately 0.9 mbgs to 1.7 mbgs, overlying clayey silt with some fine sand to the maximum borehole completion depth of 6.7 mbgs. The water table is located within this clayey silt unit at a depth of approximately 2.4 to 2.7 mbgs and this uppermost water bearing unit represents an aquitard.

The following table provides a summary of the primary geologic units observed during borehole drilling at the Phase Two Property:

Geologic Unit	Estimated Thickness (metres)	Top Elevation (mamsl)	Bottom Elevation (mamsl)	Properties
Granular Fill	0.05 – 0.5	194.8 – 195.0	194.2 – 194.9	Unsaturated
Silty clay/ clayey silt (aquitard)	> 6.2	192.9 – 194.9	<188.0	Saturated below 2.4 to 2.7 mbgs (water table)

The overburden/bedrock interface was not encountered during the drilling activities. Based on geological data published by the Ontario Geological Survey, bedrock is expected to consist sandstone, shale, dolostone and/or siltstone of the Lockport Formation at an elevation of approximately 183 mamsl. Based on this information, the overburden thickness at the Phase Two Property is expected to be approximately 11 to 12 metres.

Cross-sections summarizing the subsurface geological conditions within the area of the east portion of Site Building A (i.e., APEC-1, APEC-4, APEC-5 and APEC-6) have been provided as Figures 8A to 8C.

The APECs investigated by the Phase Two ESA related to PHCs, VOCs and PAHs related to historical on-Site automotive repair/servicing operations and associated historical ASTs. Impacts on groundwater quality, if any, from these contaminants would be expected in the shallow groundwater zone and, as such, the water table groundwater quality (aquitard) was assessed during the Phase Two ESA.

No groundwater impacts were identified in the clayey silt aquitard and, as such, assessment of groundwater quality at deeper depths was not required.

6.2 Groundwater Elevations and Flow Direction

The wells screens in each monitoring well installed by Pinchin were of a consistent length (i.e., 3.05 metres). All monitoring wells were installed at depth intervals intended to investigate groundwater quality in the shallow groundwater zone within the clayey silt aquitard. Given that PHCs were a COPC for groundwater at the Phase Two Property, the monitoring wells were installed at the Phase Two Property such that the well screens intersected the water table.

The following summarizes the findings of a groundwater monitoring event completed on January 4, 2022:

- The depths to groundwater measured within the on-Site monitoring wells installed within the aquitard ranged from 2.44 mbgs at monitoring well MW03 to 2.57 mbgs at both monitoring wells MW101 and MW102.
- The calculated groundwater elevations within the groundwater monitoring wells installed within the aquitard ranged between 192.33 mamsl at MW03 and 192.38 mamsl at MW101 and MW102.

- No NAPL thicknesses were measured with the oil/water interface probe in any of the groundwater monitoring wells.

The following summarizes the findings of groundwater monitoring events completed on January 5 and January 6, 2022:

- The depths to groundwater measured within monitoring wells MW101 and MW102 were generally consistent with the previous round of measured water levels. The maximum change in depth to groundwater was observed at monitoring well MW102, where the water level increased by 0.06 metres between the two events.

The following summarizes the findings of a groundwater monitoring event completed on January 12, 2022:

- The depths to groundwater within the monitoring wells installed for geotechnical purposes across the Site were measured in addition to the monitoring wells installed within APECs, which were also screened within the clayey silt aquitard with 3.05 m screens from approximately 3.05 to 6.10 mbgs.
- The depths to groundwater measured within the on-Site monitoring wells installed within the aquitard ranged from 1.33 mbgs at monitoring well MW1 to 3.02 mbgs at monitoring well BH9.
- The calculated groundwater elevations within the groundwater monitoring wells installed within the aquitard ranged between 191.59 mamsl at BH9 and 193.03 mamsl at monitoring well MW3.
- No NAPL thicknesses were measured with the oil/water interface probe in any of the groundwater monitoring wells.

The surveyed ground surface elevations adjacent to each well and measured distance between the ground surface elevations and tops of the well riser pipes were utilized in conjunction with the measured depths to groundwater to calculate the groundwater level elevation data. The measured depths to groundwater and calculated groundwater elevation measurements, and the results of NAPL monitoring for all monitoring events are summarized in Tables 5 and 6, respectively.

The inferred groundwater flow vectors and calculated groundwater elevation contour intervals at the Phase Two Property based on depth to groundwater measurements on January 12, 2022 are shown on Figure 9. The groundwater elevation contours were created using Golden Software Incorporated's 'Surfer' contouring software version 10.7.972 (updated March 5, 2012) by applying a 'triangulation with linear interpolation' gridding method with 0.2 metre contour spacing.

All depth to groundwater measurements in each of the on-Site groundwater monitoring wells, including the monitoring wells installed for geotechnical investigation purposes, were used to calculate the groundwater elevation contours. As shown on Figure 9, the calculated groundwater surface elevation contours indicate that groundwater flow across the Phase Two Property is generally to the southeast.

The groundwater depth data collected over the course of all monitoring events indicate that the temporal fluctuations in the unconfined water table appear to be minimal. Interaction of the groundwater at the Phase Two Property with buried utilities is possible given that the water table in some areas of the Phase Two Property is located at approximate depths of between 1.3 and 3.0 mbgs and the utilities are expected to be located at depths ranging from approximately 0.5 to 3 mbgs. However, given that no groundwater impacts were identified at the Phase Two Property, preferential migration of contaminants along utilities is not considered to be a concern.

6.3 Groundwater Hydraulic Gradients

6.3.1 Groundwater Horizontal Hydraulic Gradients

The plotted groundwater surface elevation contours (as shown on Figure 9) were utilized to estimate horizontal hydraulic gradient values for the aquitard at the Phase Two Property. The horizontal hydraulic gradient can be estimated by dividing the difference between two groundwater contour values by the distance between the two plotted groundwater contours. The distance between select groundwater contours can be determined by drawing a straight line which transects each contour in a perpendicular fashion on the plotted groundwater contour figure.

By utilizing groundwater contours which are closely spaced, the estimated maximum horizontal hydraulic gradient for the unconfined aquifer at the Phase Two Property is approximately 0.010.

By utilizing groundwater contours which are more distantly spaced, the estimated minimum horizontal gradient for the unconfined aquifer at the Phase Two Property is approximately 0.001.

By utilizing the two most distant (highest and lowest) groundwater elevation contours plotted at the Phase Two Property, a normalized horizontal hydraulic gradient value for the unconfined aquifer at the Phase Two Property using groundwater surface elevations measured on January 12, 2022 was estimated to be approximately 0.005.

6.3.2 Groundwater Vertical Hydraulic Gradients

Nested monitoring wells were not installed at the Phase Two Property as part of the Phase Two ESA. As such, vertical hydraulic gradients were not determined.

6.4 Soil Texture

Two soil samples collected from the boreholes advanced at the Phase Two Property were submitted for 75 micron single-sieve grain size analysis. The soil samples selected for analysis were considered to be representative of the two primary stratigraphic units observed at the borehole locations, which were a native silty clay unit and a native clayey silt unit. As indicated in Table 3, both soil samples (BH104-2 and BH106-2) were classified as fine-textured (96.7% fine-grained soil).

Based on these grain size analysis results and the observed stratigraphy at the borehole locations at the Phase Two Property, it is the QP's opinion that over two-thirds of the overburden at the Phase Two Property is medium and fine-textured as defined by O. Reg. 153/04. Therefore, the soil at the Phase Two Property was interpreted to be medium- to fine-textured for the purpose of determining the MECP Site Condition Standards applicable to the Phase Two Property.

6.5 Soil Field Screening

Soil vapour headspace concentrations measured in the soil samples collected as part of this Phase Two ESA are presented in the borehole logs. Soil vapour headspace values measured with the CGI in methane elimination mode ranged from less than 5 ppm by volume (ppm$_v$) in several of the collected soil samples to a maximum of 90 ppm$_v$ in soil sample MW101-7 collected from borehole MW101 at a depth of approximately 4.57 to 5.18 mbgs. Soil vapour headspace values measured with the PID ranged from less than 1 ppm$_v$ in several of the collected soil samples to a maximum of 2 ppm$_v$ in soil sample MW101-1, collected from borehole MW101 at a depth of approximately 0.20 to 0.61 mbgs.

One most apparent "worst case" soil sample, based on vapour concentrations as well as visual and/or olfactory considerations, groundwater depths and contaminant characteristics, recovered from each borehole was submitted for laboratory analysis of VOCs, PHCs (F1-F4) and/or PAHs.

Soil vapour headspace concentrations measured in the surface soil sample (SS01) were less than 5 ppm$_v$ (CGI) and less than 1 ppm$_v$ (PID). Soil sample SS01 was submitted for laboratory analysis of PHCs (F1-F4) and PCBs.

6.6 Soil Quality

A total of six boreholes were advanced and one surface soil sample was collected at the Phase Two Property at the locations shown on Figures 7A and 7B in order to assess for the presence of subsurface impacts resulting from the APECs identified in the Pinchin Phase One ESA. Select soil samples were collected from each of the advanced boreholes and surface soil sample and submitted for laboratory analysis of the COPCs. The soil sample locations, depths and laboratory analyses are summarized in Table 3 and in the borehole logs. Table 3 also includes the locations, depths and laboratory analyses of the soil samples collected as part of the 2021 Pinchin Phase II ESA within the APEC areas and the relevant borehole logs have been included in Appendix C.

The soil sample analytical results were compared to the *Table 2 Standards* and the following subsections provide a discussion of the findings.

6.6.1 VOCs

The soil sample analytical results for VOCs, along with the corresponding *Table 2 Standards*, are presented in Table 3. As indicated in Table 3, all reported concentrations of VOCs in the soil samples submitted for analysis were below the *Table 2 Standards*.

Pinchin notes that due to high moisture content and/or low weight of soil provided in soil sample DUP09 (field duplicate of soil sample BH104-3), the laboratory reportable detection limits (RDLs) for VOC parameters bromomethane, 1,2-dichloroethane, 1,1-dichloroethylene, 1,3-dichloropropene, ethylene dibromide, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane and vinyl chloride were raised to levels above the *Table 2 Standards*. However, given that these parameters were not detected in any other soil or groundwater samples collected at the Site, including the corresponding soil sample BH104-3 for this field duplicate sample, it is the QP’s opinion that these VOC parameters are unlikely to be present in soil sample DUP09 at concentrations above the *Table 2 Standards*.

6.6.2 PHCs (F1-F4)

The soil sample analytical results for PHCs (F1-F4), along with the corresponding *Table 2 Standards*, are presented in Table 3. As indicated in Table 3, all reported concentrations of PHCs (F1-F4) in the soil samples submitted for analysis were below the *Table 2 Standards*.

6.6.3 PAHs

The soil sample analytical results for PAHs, along with the corresponding *Table 2 Standards*, are presented in Table 3. As indicated in Table 3, all reported concentrations of PAHs in the soil samples submitted for analysis were below the *Table 2 Standards*.

6.6.4 PCBs

The soil sample analytical results for PCBs, along with the corresponding *Table 2 Standards*, are presented in Table 3. As indicated in Table 3, all reported concentrations of PCBs in the soil samples submitted for analysis were below the *Table 2 Standards*.

6.6.5 General Comments on Soil Quality

The soil sample results show no evidence of chemical or biological transformations of chemical parameters in the subsurface.

Given that groundwater sampling at the Phase Two Property has not identified any impacts related to VOCs, PHCs (F1-F4) and PAHs (see Section 6.7), there is no evidence that the soil at the Phase Two Property is acting as a contaminant source for the groundwater.

The soil sample analytical results also show no evidence of NAPLs in the subsurface at the Site. In addition, no evidence of NAPL was observed during borehole drilling.

6.7 Groundwater Quality

Groundwater samples were collected from monitoring wells MW03, MW101 and MW102 and submitted for analysis of the COPCs to assess for the presence of subsurface impacts within the APECs identified in the Pinchin Phase One ESA. The locations of the monitoring wells are shown on Figures 7A and 7B. The groundwater sample collection depths and laboratory analysis are summarized in Table 7.

The groundwater sample analytical results were compared to the *Table 2 Standards* and the following subsections provide a discussion of the findings.

6.7.1 VOCs

The groundwater analytical results for VOCs, along with the corresponding *Table 2 Standards*, are presented in Table 7. As indicated in Table 7, all reported concentrations of VOCs in the groundwater samples submitted for analysis were below the *Table 2 Standards.*

6.7.2 PHCs (F1-F4)

The groundwater analytical results for PHCs F1-F4, along with the corresponding *Table 2 Standards*, are presented in Table 7. As indicated in Table 7, all reported concentrations of PHCs F1-F4 in the groundwater samples submitted for analysis met the *Table 2 Standards.*

6.7.3 PAHs

The groundwater analytical results for PAHs, along with the corresponding *Table 2 Standards*, are presented in Table 7. As indicated in Table 7, all reported concentrations of PAHs in the groundwater samples submitted for analysis met the *Table 2 Standards*.

6.7.4 General Comments on Groundwater Quality

The groundwater sample results show no evidence of chemical or biological transformations of chemical parameters in the subsurface.

As discussed in Section 6.6.5, soil sampling at the Phase Two Property did not identify any impacts related to VOCs, PHCs (F1-F4) and PAHs. As such, there is no evidence that the soil at the Phase Two Property is acting as a contaminant source for the groundwater.

The groundwater sample analytical results also show no evidence of NAPLs in the subsurface at the Site. In addition, no evidence of NAPL was observed during groundwater monitoring and sampling.

6.8 Sediment Quality

Sediment sampling was not completed as part of this Phase Two ESA.

6.9 Quality Assurance and Quality Control Results

QA/QC comprises technical activities that are used to measure or assess the effect of errors or variability in sampling and analysis. It may also include specification of acceptance criteria for the data and corrective actions to be taken when they are exceeded. QA/QC also includes checks performed to evaluate laboratory analytical quality, checks designed to assess the combined influence of field sampling and laboratory analysis and checks to specifically evaluate the potential for cross contamination during sampling and sample handling.

The QA/QC samples collected and submitted for analysis by Pinchin during the Phase Two ESA consisted of the following:

- Field duplicate soil and groundwater samples to assess the suitability of field sampling methods and laboratory performance.
- A trip blank water sample to assess whether ambient conditions during transport of groundwater sample containers from the analytical laboratory to the Phase Two Property and back to the analytical laboratory may have biased the groundwater sample results with respect to volatile constituents.
- A trip blank sample for PHC soil sampling to assess whether ambient conditions during transport of soil sample containers to the Phase Two Property and back to the analytical laboratory may have biased the soil sample results with respect to volatile constituents.

In addition to the above, laboratory quality control activities and sample checks employed by BV Labs included:

- Method blanks - where a clean sample is processed simultaneously with and under the same conditions (i.e., using the same reagents and solvents) as the samples being analyzed. These are used to confirm whether the instrument, reagents and solvents used are contaminant free.
- Laboratory duplicates - where two samples obtained from the sample container are analyzed. These are used to evaluate laboratory precision.

- Surrogate spike samples - where a known mass of compound not found in nature (e.g., deuterated compounds such as toluene-d8) but that has similar characteristics to the analyzed compounds is added to a sample at a known concentration. These are used to assess the recovery efficiency.
- Matrix spike samples - where a known mass of target analyte is added to a matrix sample with known concentrations. These are used to evaluate the influence of the matrix on a method's recovery efficiency.
- Use of standard or certified reference materials - a reference material where the content or concentration has been established to a very high level of certainty (usually by a national regulatory agency). These are used to assess accuracy.

The results of the field QA/QC samples are discussed in the following subsections.

6.9.1 Soil Duplicate Results

During borehole soil sampling activities, a total of two separate soil duplicate sample pairs were submitted for laboratory analysis. The field duplicate samples were collected by vertically splitting the soil cores into two halves, with one half collected as the regular sample and the other half collected as the field duplicate sample.

The quality of the analytical results was evaluated by calculating relative percent differences (RPDs) for the parameters analyzed for the original and field duplicate samples. The RPD for each parameter was calculated using the following equation:

$$\text{RPD} = \frac{(\text{Original Concentration} - \text{Duplicate Concentration}) \times 100}{(\text{Original Concentration} + \text{Duplicate Concentration})/2}$$

An RPD was not calculated unless the parameter concentration in both the original and duplicate sample had detectable concentrations above the corresponding practical quantitation limit for the parameter, which is equal to five times the lowest laboratory reportable detection limit (RDL).

The calculated RPDs for the original and field duplicate soil samples have been compared to performance standards provided in the *Analytical Protocol.* Pinchin notes that although these performance standards only strictly apply to laboratory duplicate samples, they have been considered suitable for comparison to the field duplicate soil sample results as well.

Each of the calculated RPDs met the corresponding performance standards.

Based on Pinchin's review of the calculated RPD values for the submitted soil sample duplicate pairings, the level of observed variance in the reported analytical results is considered acceptable for the purpose of meeting the data quality objectives of this Phase Two ESA.

6.9.2 Groundwater Sample Duplicate Results

During groundwater sampling activities, one groundwater duplicate sample pair, consisting of groundwater sample “MW102” and its corresponding field duplicate “DUP999”, were submitted for laboratory analysis of VOCs, PHCs and PAHs.

The calculated RPDs for the original and field duplicate groundwater samples have been compared to performance standards provided in the *Analytical Protocol.* Pinchin notes that although these performance standards only strictly apply to laboratory duplicate samples, they have been considered suitable for comparison to the field duplicate groundwater sample results as well.

Each of the calculated RPDs met the corresponding performance standard.

Based on Pinchin’s review of the calculated RPD values for the submitted groundwater sample duplicate pairing, the level of observed variance in the reported analytical results is considered acceptable for the purpose of meeting the data quality objectives of this Phase Two ESA.

6.9.3 Groundwater Trip Blank Results

A trip blank sample, consisting of VOC-free water contained within a set of VOC sample vials, was prepared by BV Labs and accompanied the VOC groundwater sample containers during transportation to the Phase Two Property and was stored in the cooler with the VOC groundwater samples in the field and during transportation back to BV Labs. The trip blank sample was submitted to BV Labs for chemical analysis for VOCs during the groundwater sampling activities completed as part of this Phase Two ESA.

As indicated in Table 7, VOC parameters analyzed in the trip blank sample were not detected above the laboratory RDLs. These findings indicate that ambient conditions during the transportation of the sample containers to and from the Phase Two Property, and during groundwater sampling, did not positively bias the VOCs parameter analytical results for the groundwater samples.

6.9.4 Soil Trip Blank Results

One laboratory-prepared methanol vial accompanied the vials used for VOC and PHCs (F1) soil sampling during transportation of the sample containers from BV Labs to the Phase Two Property, during soil sampling on December 6 and 7, 2021 at the Phase Two Property, and during transportation of the soil samples from the Phase Two Property to BV Labs. The trip blank sample was submitted to BV Labs for analysis of VOCs.

As indicated in Table 3, VOC parameters analyzed in the soil trip blank sample were not detected above the laboratory RDLs. These findings indicate that ambient conditions during the transportation of the sample containers to and from the Phase Two Property and during soil sampling did not positively bias the VOC analytical results for the soil samples collected on December 6 and 7, 2021.

6.9.5 Deviations from Analytical Protocol

There were no deviations from the holding times, preservation methods, storage requirements and container types specified in the *Analytical Protocol* during the completion of the Phase Two ESA.

6.9.6 Laboratory Certificates of Analysis

Pinchin has reviewed the laboratory Certificates of Analysis provided by BV Labs for the samples submitted during the Phase Two ESA and confirms the following:

- All laboratory Certificates of Analysis contain a complete record of the sample submission and analysis and meet the requirements of Section 47(3) of O. Reg. 153/04.
- A laboratory Certificate of Analysis has been received for each sample submitted for analysis during the Phase Two ESA.
- All laboratory Certificates of Analysis have been included in full in Appendix D.
- All of the analytical data reported in the Certificates of Analysis have been summarized, in full, in Tables 3 and 7.

6.9.7 Laboratory Comments Regarding Sample Analysis

BV Labs routinely conducts internal QA/QC analyses in order to satisfy regulatory QA/QC requirements. The results of the BV Labs QA/QC analyses for the submitted soil samples are summarized in the laboratory Certificates of Analyses provided in Appendix D. Also included in Appendix D are all correspondences between the laboratory and staff at Pinchin.

The following summarizes comments noted by BV Labs on the laboratory Certificates of Analysis for the submitted soil samples:

- Laboratory Certificate R6948411 – Detection limits were raised due to high moisture content and/or low weight of soil provided for VOC/F1 analysis in soil sample DUP09. This resulted in the laboratory RDLs for select VOC parameters being raised to levels above the *Table 2 Standards*. However, given that these parameters were not detected in any other soil or groundwater samples collected at the Site, including the corresponding soil sample BH104-3 for this field duplicate sample, it is the QP’s opinion that these VOC parameters are unlikely to be present in soil sample DUP09 at concentrations above the *Table 2 Standards*. As such, Pinchin does not consider this result to be an issue of significant concern and it has no impact on the overall interpretation of the analytical data.
- Laboratory Certificate R6948411 – The recovery in the matrix spike was not calculated for several PAH parameters as the relative difference between the concentration in the

parent sample and the spike amount was too small to permit a reliable recovery calculation. The overall QA/QC analysis met acceptable laboratory criteria. As such, Pinchin does not consider this to be an issue of significant concern and it has no impact on the overall interpretation of the analytical data.

- Laboratory Certificate R6948411 – The duplicate RPD was not calculated for several VOC, PHC, PAH and leachable parameters. The concentrations in the sample and/or duplicate was too low to permit a reliable RPD calculation. The overall QA/QC analysis met acceptable laboratory criteria. As such, Pinchin does not consider this to be an issue of significant concern and it has no impact on the overall interpretation of the analytical data.
- Laboratory Certificate R6948411 – The recovery was above the upper control limit in a spiked blank for leachable total PCB, which may represent a high bias in some results for flagged analytes. However, since the leachable total PCB in the TCLP sample was below the applicable criteria, this potential high bias has no impact.
- Laboratory Certificate R6948411 – The recovery or RPD for leachable fluoride, leachable WAD cyanide and leachable nitrate was outside control limits. However, the laboratory noted that the overall quality control for this analysis meets acceptability criteria.

The following summarizes comments noted by BV Labs on the laboratory Certificates of Analysis for the submitted groundwater samples:

- Laboratory Certificate R6969932 – BV Labs indicated that all groundwater sample vials submitted for laboratory analysis of VOCs and PHCs F1 contained visible sediment. Based on Pinchin's field observations, the volume of sediment in the submitted groundwater sample containers was a trace to minor amount. Given that these parameters are volatile constituents and are not expected to sorb to soil particles, the presence of trace to minor amounts sediment in the sample vials is not anticipated to result in significant sample bias. Furthermore, Pinchin notes that all reported concentrations of PHCs F1 for the submitted groundwater samples were below the corresponding *Table 2 Standard*. As such, the presence of sediment does not alter the conclusion that the concentrations of PHCs F1 in the submitted groundwater samples are below the *Table 2 Standards*.
- Laboratory Certificate R6969932 – BV Labs indicated that all groundwater sample containers submitted for laboratory analysis of PHCs (F2-F4) and PAHs contained visible sediment that was included in the laboratory extraction. Based on Pinchin's field observations, the volume of sediment in the submitted groundwater sample containers

was a trace to minor amount. These parameters have a tendency to sorb to soil particles. As such, the reported concentrations of PHCs (F2-F4) and PAHs in the submitted groundwater samples may be positively biased. However, Pinchin notes that all reported concentrations of PHCs (F2-F4) and PAHs for the submitted groundwater samples were below the corresponding *Table 2 Standards*. As such, the presence of sediment does not alter the conclusion that the concentrations of PHCs (F2-F4) and PAHs in the submitted groundwater samples are below the *Table 2 Standards*.

- Laboratory Certificate R6969932 – The recovery in the matrix spike was not calculated for PHC F2 and select PAH parameters. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation. The overall QA/QC analysis met acceptable laboratory criteria. As such, Pinchin does not consider this to be an issue of significant concern and it has no impact on the overall interpretation of the analytical data.
- Laboratory Certificate R6969932 – The duplicate RPD was not calculated for several VOC and PHC parameters. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation. The overall QA/QC analysis met acceptable laboratory criteria. As such, Pinchin does not consider this to be an issue of significant concern and it has no impact on the overall interpretation of the analytical data.

The results of the QA/QC analyses were reviewed by the project staff at BV Labs and observed to be within the laboratory’s internal requirements. Pinchin has also reviewed the laboratory Certificates of Analysis and has confirmed that the results of the analyses are acceptable for the purpose of meeting the data quality objectives of this Phase Two ESA.

The following general comments apply to the laboratory Certificates of Analysis received from BV Labs as part of this Phase Two ESA:

- The temperatures of the submitted soil and groundwater samples upon receipt met the sample preservation requirements of the *Analytical Protocol* of 5 ± 3ºC (i.e., between 2 and 8ºC).
- The custody seal was present and intact on all submissions.

6.9.8 QA/QC Sample Summary

The overall evaluation of the QA/QC sample results indicates no issues with respect to field collection methods and laboratory performance, and no apparent bias due to ambient conditions at the Phase Two Property and during transportation of the sample containers/samples to and from the analytical laboratory.

As such, it is the QP's opinion that the soil and groundwater analytical data obtained during the Phase Two ESA are representative of actual Site conditions and are appropriate for meeting the objective of assessing whether the soil and groundwater at the Phase Two Property meets the applicable MECP Site Condition Standards.

6.10 Phase Two Conceptual Site Model

The Phase Two Property comprises the northern portion of the property holding municipal address 3770 Montrose Road in Niagara Falls, Ontario. The Phase Two Property is bounded by a multi-tenant commercial shopping plaza to the south (i.e., south portion of 3770 Montrose Road), a vegetated area followed by the QEW highway to the east, residential land use to the north and Montrose Road followed by residential land use to the west. A key map showing the Phase Two Property location is provided as Figure 1.

A Phase One CSM was created during the Pinchin Phase One ESA in order to provide a detailed visualization of the APECs which could occur on, in, under, or affecting the Phase Two Property. The Phase One CSM is summarized in Figures 1 through 6B, which illustrate the following features within the Phase One Study Area, where present:

- Existing buildings and structures.
- Water bodies located in whole or in part within the Phase One Study Area.
- Areas of natural significance located in whole or in part within the Phase One Study Area.
- Drinking water wells located at the Phase One Property.
- Land use of adjacent properties.
- Roads within the Phase One Study Area.
- PCAs within the Phase One Study Area, including the locations of tanks.
- APECs at the Phase One Property.

The following subsections expand on the Phase One CSM with the information collected during the completion of the Phase Two ESA.

6.10.1 Potentially Contaminating Activities

The Phase One ESA identified a total of 11 PCAs within the Phase One Study Area. These PCAs consisted of seven PCAs at the Phase Two Property and four PCAs within the Phase One Study Area, outside of the Phase Two Property. The seven on-Site PCAs were interpreted as potentially affecting the environmental condition of the subsurface media on, in or under the Phase Two Property and were considered to result in APECs. Identified on-Site and off-Site PCAs are summarized in Table 2 and their locations are shown on Figure 4 (on-Site PCAs) and Figure 5 (off-Site PCAs).

6.10.2 Areas of Potential Environmental Concern

Table 1 summarizes the APECs identified at the Phase Two Property, as well as their respective PCAs, COPCs and the media that could potentially be impacted. APECs at the Phase Two Property are illustrated on Figures 6A and 6B. The Phase Two ESA included an assessment of soil, or soil and groundwater quality within each of the APECs.

The following table summarizes the boreholes, monitoring wells and surface soil samples completed to investigate each of the APECs:

APEC	Soil Investigation Location	Groundwater Investigation Location
APEC-1	MW03, BH04, BH05, BH06, MW101, MW102, BH103, BH104, BH105	MW03, MW101, MW102
APEC-2	SS01	NA
APEC-3	BH106	NA
APEC-4	BH04, BH05, BH06, MW101, MW102	MW101, MW102
APEC-5	BH105	NA
APEC-6	BH103	NA
APEC-7	APEC not characterized, as Section 49.1 of O. Reg. 153/04 is deemed applicable.	

The Phase Two ESA relied on soil and groundwater data obtained during previous subsurface investigations completed by Pinchin in 2021. These investigation locations have been included in the table above. Additional groundwater monitoring wells (MW1, MW3, MW5, MW6, BH9) were installed by Pinchin as part of a geotechnical investigation completed concurrently with the Phase Two ESA.

A summary of the findings for each of the APECs is provided below.

APEC-1

A Canadian Tire automotive repair/service centre operated out of the east portion of Site Building A from approximately 1995 until 2020. These former operations represented a PCA that required investigation as part of the Phase Two ESA. The subsurface investigation of APEC-1 completed by Pinchin as part of this Phase Two ESA and the Phase II ESA completed earlier in 2021 included nine boreholes (MW03, BH04, BH05, BH06, MW101, MW102, BH103, BH104 and BH105), three of which were completed as groundwater monitoring wells (MW03, MW101 and MW102). Soil and groundwater samples were submitted for laboratory analysis of PHCs, BTEX, VOCs and PAHs. All soil and groundwater samples collected from these boreholes/monitoring wells met the *Table 2 Standards*. As such, no impacts to soil or groundwater were identified in relation to APEC-1.

APEC-2

A pad-mounted, oil-cooled transformer is located in the parking area south of Site Building A. No evidence of leaks or staining was observed on or in the vicinity of the transformer. The use of this transformer represented a PCA that required investigation as part of the Phase Two ESA. Due to the presence of utilities within the area, and the associated limitations for drilling, Pinchin collected a surface soil sample (SS01) from the ground surface in the immediate vicinity of the transformer using hand tools. The soil sample, which was advanced to a maximum depth of 0.30 mbgs, was submitted for laboratory analysis of PHCs and PCBs. The reported concentrations of PHCs and PCBs were below the *Table 2 Standards*, and, as such, no soil impacts were identified in relation to APEC-2.

APEC-3

A pad-mounted, oil-cooled transformer is located in the grassed area to the northeast of Site Building B. No evidence of leaks or staining was observed on or in the vicinity of the transformer. The use of this transformer represented a PCA that required investigation as part of the Phase Two ESA. A borehole (BH106) was advanced in the vicinity of the transformer and a “worst case” soil sample collected from this borehole was submitted for laboratory analysis of PHCs and PCBs. The reported concentrations of PHCs and PCBs were below the *Table 2 Standards*, and, as such, no soil impacts were identified in relation to APEC-3.

APEC-4

Based on Pinchin’s review of previous reports completed by others, nine inground hydraulic hoists were reportedly present within the east portion of Site Building A (the former Canadian Tire automotive centre). However, the precise locations of these former hoists within the east portion of Site Building A are unknown. At the time of Pinchin’s Phase One ESA Site reconnaissance, the infrastructure had been removed and the concrete floor repoured. As such, no evidence of the former hoists remained. One photo was provided in the appendix of the 2014 AMEC Phase I ESA report which suggested that the hoists were present within the central portion of former Canadian Tire automotive servicing bays. The historical presence of inground hoists represented a PCA that required investigation as part of the Phase Two ESA. Soil samples collected from boreholes BH04, BH05, BH06, MW101, MW102 and BH104 were submitted for laboratory analysis of PHCs and BTEX. Groundwater samples collected from monitoring wells MW101 and MW102 were also submitted for laboratory analysis of PHCs and BTEX. All soil and groundwater samples collected from these boreholes/monitoring wells met the *Table 2 Standards*. As such, no impacts to soil or groundwater were identified in relation to APEC-4.

APEC-5

Based on Pinchin's review of previous reports completed by others, two new oil ASTs were formerly located within the southeast corner of Site Building A (the former Canadian Tire automotive centre). This historical presence of ASTs represented a PCA that required investigation as part of the Phase Two ESA. A borehole (BH105) was advanced within APEC-5 and a "worst case" soil sample was submitted for laboratory analysis of PHCs, BTEX and PAHs. The reported concentrations of PHCs, BTEX and PAHs were below the *Table 2 Standards* and as such, no soil impacts were identified in relation to APEC-5.

APEC-6

Based on Pinchin's review of aerial photographs as well as previous reports completed by others, a waste oil AST and waste antifreeze AST were formerly located adjacent to the north exterior elevation of Site Building A (associated with former Canadian Tire automotive centre operations). This historical presence of ASTs represented a PCA that required investigation as part of the Phase Two ESA. A borehole (BH103) was advanced within APEC-6 and a "worst case" soil sample was submitted for laboratory analysis of PHCs, BTEX and PAHs. The reported concentrations of PHCs, BTEX and PAHs were below the *Table 2 Standards* and as such, no soil impacts were identified in relation to APEC-6.

APEC-7

APEC-7 is related to on-Site road salting/de-icing activities, and although there is the potential for salt-related parameters such as SAR and EC in soil and sodium and chloride in groundwater to be present at concentrations exceeding the applicable Site Condition Standards, the exemption provided in Section 49.1 of Ontario Regulation 153/04 can been applied and, as such, these parameters would be deemed to meet the Site Condition Standards and do not need to be further assessed.

6.10.3 Subsurface Structures and Utilities

Underground utilities which are known or inferred to be present at the Phase Two Property include natural gas, telephone and electrical lines, and municipal water, storm and sanitary sewer lines.

A natural gas line enters the northwest corner of the Phase Two Property (from Montrose Road) and traverses the north portion of the Site, then diverges southeast and then south along the rear of Site Building B. An additional natural gas line, as well as a water service, communication line and main electrical service enter the Phase Two Property from the west boundary of the Phase Two Property and traverse the parking area to the south of Site Building A, eventually entering Site Building A along the south and east elevations or continuing in an eastward direction towards Site Building B. In addition, various electrical lines traverse the Phase Two Property along the south, central and northeast portions. Stormwater is captured in several catch basins located throughout the parking area, which are expected to connect to the municipal storm sewer along Montrose Road. In addition, a concrete storm sewer traverses the north portion of the Site and is expected to discharge into the drainage swale located on the northeast portion of the Site. The approximate locations of the known underground utilities are illustrated on Figures 7A and 7B.

Interaction of the groundwater at the Phase Two Property with buried utilities is possible given that the water table in some areas of the Phase Two Property is located at approximate depths of between 1.3 and 3.0 mbgs and the utilities are expected to be located at depths ranging from approximately 0.3 to 3 mbgs. However, given that no soil or groundwater impacts were identified at the Phase Two Property, preferential migration of contaminants along utilities is not considered to be a concern.

6.10.4 Physical Setting

Based on the work completed as part of this Phase Two ESA, the following subsections provide a summary of the physical setting of the Phase Two Property.

Stratigraphy

The observed stratigraphy at the borehole locations completed for the Phase Two ESA generally consisted of granular fill materials (associated with the pavement structure or building base) to a maximum depth of approximately 0.5 mbgs, overlying native soil comprised of silty clay to a depth ranging from approximately 0.9 mbgs to 1.7 mbgs, overlying clayey silt with some fine sand to the maximum borehole completion depth of 6.7 mbgs, which is interpreted to represent an aquitard. The borehole locations are shown on Figures 7A and 7B. Cross-sections summarizing the subsurface geological conditions at the time of the Phase Two ESA have been provided as Figures 8A to 8C.

Hydrogeological Characteristics

Based on groundwater elevation measurements, the groundwater flow direction in the aquitard at the Phase Two Property was estimated to be towards the southeast (see Figure 9).

The horizontal hydraulic gradient within the unconfined aquifer at the Phase Two Property was estimated to be 0.005. The clayey silt unit is interpreted to be an aquitard. No additional information regarding the hydraulic conductivity, groundwater flow velocity or vertical gradients is available for the aquitard.

Depth to Bedrock

Bedrock was not encountered at any of the borehole locations up to the maximum depth drilled of approximately 6.71 mbgs and based on the available water well records, bedrock depth at the Phase Two Property is approximately 11 mbgs.

Depth to Water Table

The water table at the Phase Two Property is located within the shallow clayey silt unit that has been interpreted to be an aquitard. The monitoring wells were designed to have the well screens intercept water-bearing soil, which was encountered at depths generally below 3.0 mbgs. The depth to the water table across the Phase Two Property ranges from approximately 1.3 to 3.0 mbgs, suggesting that groundwater is under a confined condition. The corresponding groundwater elevations from the January 12, 2022 measurements ranged between 190.03 m at MW3 in the northeast corner and 191.59 m at BH9 in the southeast corner.

Applicability of Section 35 of O. Reg 153/04 – Non-Potable Site Condition Standards

The Site Condition Standards for potable groundwater use have been applied to the Phase Two Property and non-potable Site Condition Standards as per Section 35 of O. Reg. 153/04 are not applicable.

Applicability of Section 41 of O. Reg 153/04 – Environmentally Sensitive Area

Section 41 of O. Reg. 153/04 states that a property is classified as an "environmentally sensitive area" if the property is within an area of natural significance, the property includes or is adjacent to an area of natural significance or part of such an area, the property includes land that is within 30 m of an area of natural significance or part of such an area, the soil at the property has a pH value for surface soil less than 5 or greater than 9 or the soil at the property has a pH value for subsurface soil less than 5 or greater than 11.

The Phase Two Property is not located in or adjacent to, nor does it contain land within 30 m of, an area of natural significance. Furthermore, the pH values measured in the submitted surface and subsurface soil samples were within the limits for non-sensitive sites. As such, the Phase Two Property is not an environmentally sensitive area as defined by Section 41 of O. Reg. 153/04.

Applicability of Section 43.1 of O. Reg 153/04 – Shallow Soil Property and Proximity to a Water Body

Section 43.1 of O. Reg. 153/04 states that a property is classified as a "shallow soil property" if one-third or more of the area consists of soil less than 2 m in depth.

Bedrock was not encountered at any of the borehole locations, all of which were extended to depths below 2.0 mbgs. As such, the Phase Two Property is not a shallow soil property as defined by Section 43.1 of O. Reg. 153/04.

As per Section 43.1 of O. Reg. 153/04, the proximity of the Phase Two Property to a water body must be considered when selecting the appropriate Site Condition Standards.

The Phase Two Property does not include all or part of a water body, it is not adjacent to a water body and it does not include land within 30 m of a water body. As such, Site Condition Standards for use within 30 m of a water body were not applied.

Excess Soil Imported to Phase Two Property

No excess soil was imported to the Phase Two Property during completion of the Phase Two ESA.

Proposed Buildings and Other Structures

Pinchin understands that the future use of the Phase Two Property will be for a residential development that is still in the planning stages and the configuration of the Phase Two Property, including proposed building locations, has yet to be confirmed.

6.10.5 Applicable Site Condition Standards

Based on the grain size analysis of representative soil samples collected during the Phase Two ESA and the observed stratigraphy at the borehole locations, Pinchin concluded that over two-thirds of the overburden at the Phase Two Property is medium- to fine-textured as defined by O. Reg. 153/04 and Site Condition Standards for coarse-textured soil were not applied.

Based on the information obtained from the Phase One and Two ESAs, the appropriate Site Condition Standards for the Phase Two Property are:

- "Table 2: Full Depth Generic Site Condition Standards for Use in a Potable Ground Water Condition", provided in the Ontario Ministry of the Environment, Conservation and Parks (MECP) document entitled, "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act" dated April 15, 2011 (*Table 2 Standards*) for:
  - Medium/fine-textured soils; and
  - Residential/parkland/institutional property use.

6.10.6 Contaminants Exceeding Applicable Site Condition Standards in Soil

All soil samples collected during the Phase Two ESA met the applicable *Table 2 Standards* for the parameters analyzed. The soil results are shown on Figures 10A through 13.

6.10.7 Contaminants Exceeding Applicable Site Condition Standards in Groundwater

All groundwater samples collected during the Phase Two ESA met the applicable *Table 2 Standards* for the parameters analyzed. The groundwater results are shown on Figures 14A through 16B.

Although the static groundwater levels are above the top of the monitoring well screens at MW101 and MW102 (as shown on the cross sections Figures 8B and 8C), it should be noted that there were no visual or olfactory hydrocarbon odours or sheen within soil or groundwater during sampling or monitoring activities, and as such, it is the QP's opinion that the Site has been adequately assessed with respect to PHCs and BTEX.

6.10.8 Meteorological and Climatic Conditions

The groundwater table was observed to fluctuate slightly in elevation (i.e., a maximum difference of 9 centimetres) over four dates of groundwater monitoring completed on January 4, January 5, January 6 and January 12, 2022. The minor temporal groundwater table fluctuations are expected to have had a minimal effect on potential contaminant distribution throughout the Phase Two Property. Also, prior to redevelopment, the majority of the Phase Two Property was either covered by pavement or by the Site Buildings, which is expected to have limited the influence of meteorological and climatic conditions on contaminant distribution and migration in the subsurface. As such, and given that soil and groundwater quality met the *Table 2 Standards*, it is the QP's opinion that meteorological or climatic conditions have not influenced the distribution or migration of the contaminants at the Phase Two Property.

6.10.9 Soil Vapour Intrusion

No volatile parameters were identified at concentrations exceeding the *Table 2 Standards*. As such, soil vapour intrusion into the current or future buildings at the Phase Two Property is not considered a concern.

6.10.10 Contaminant Exposure Assessment

Given that all soil and groundwater samples collected during the Phase Two ESA met the applicable *Table 2 Standards*, Pinchin considered that an evaluation of potential exposure pathways and receptors was unnecessary.

6.10.11 Applicability of Section 49.1 Exemptions

The majority of the exterior of the Phase Two Property consists of paved parking areas and access routes. According to the Site Representative, salt has historically been applied to the parking area for safety reasons during winter conditions to remove snow and ice. This salt was formerly stored on the paved area northeast of Site Building B. This on-Site road salting represents a PCA resulting in an APEC the Phase One Property (APEC-7). However, it is the opinion of the QP_{ESA} supervising the Phase One ESA that, although salt-related parameters such as sodium adsorption ratio and electrical conductivity in soil and sodium and chloride in groundwater may be present at concentrations exceeding the applicable Site Condition Standards (i.e., *Table 2 Standards*), the exemption provided in Section 49.1 of O. Reg. 153/04 is applicable and, as such, these parameters would be deemed to meet the Site Condition Standards and further assessment of APEC-7 is not required.

7.0 CONCLUSIONS

Pinchin completed a Phase Two ESA at the Phase Two Property in accordance with the requirements stipulated in O. Reg. 153/04 for the purpose of filing an RSC. The RSC is required by the Client in relation to the future redevelopment of the Phase Two Property from commercial to residential land use.

The Phase Two ESA completed by Pinchin included the advancement of six boreholes at the Phase Two Property, two of which were completed as groundwater monitoring wells to facilitate the sampling of groundwater, and the resampling of one existing groundwater monitoring well previously installed by Pinchin.

Based on Site-specific information, the applicable regulatory standards for the Phase Two Property were determined to be the *Table 2 Standards* for residential land use and medium/fine-textured soils. Soil samples were collected from each of the borehole locations and submitted for laboratory analysis of VOCs, PHCs (F1-F4), PAHs and/or PCBs. In addition, groundwater samples were collected from the two newly-installed monitoring wells, as well as one previously-installed monitoring well, and submitted for laboratory analysis of VOCs, PHCs (F1-F4) and PAHs.

The laboratory results for the submitted soil and groundwater samples indicated that all reported concentrations for the parameters analyzed met the corresponding *Table 2 Standards*. The maximum reported soil and groundwater concentrations for the parameters analyzed are summarized in Tables 8 and 9, respectively.

It is the opinion of the QP who supervised the Phase Two ESA that the applicable *Table 2 Standards* for soil and groundwater at the Phase Two Property have been met as of the Certification Date of January 12, 2022 and that no further subsurface investigation is required in relation to assessing the environmental quality of soil and groundwater at the Phase Two Property.

7.1 Signatures

This Phase Two ESA was undertaken under the supervision of Francesco Gagliardi, C.E.T. LET, QP_{ESA} and Erik Enders, P.Geo., QP_{ESA} in accordance with the requirements of O. Reg. 153/04 to support the filing of an RSC for the Phase Two Property.

7.2 Terms and Limitations

This Phase Two ESA was performed for Forest Gate Advisors Inc. (Client) in order to investigate potential environmental impacts at the north portion of 3770 Montrose Road in Niagara Falls, Ontario (Site). The term recognized environmental condition means the presence or likely presence of any hazardous substance on a property under conditions that indicate an existing release, past release, or a material threat of a release of a hazardous substance into structures on the property or into the ground, groundwater, or surface water of the property. This Phase Two ESA does not quantify the extent of the current and/or recognized environmental condition or the cost of any remediation.

Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations. Samples have been analyzed for a limited number of contaminants that are expected to be present at the Site, and the absence of information relating to a specific contaminant does not indicate that it is not present.

No environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions on a property. Performance of this Phase Two ESA to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions on the Site, and recognizes reasonable limits on time and cost.

This Phase Two ESA was performed in general compliance with currently acceptable practices for environmental site investigations, and specific Client requests, as applicable to this Site.

This report was prepared for the exclusive use of the Client, subject to the terms, conditions and limitations contained within the duly authorized proposal for this project. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted.

If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time.

8.0 REFERENCES

The following documents provided information used in this report:

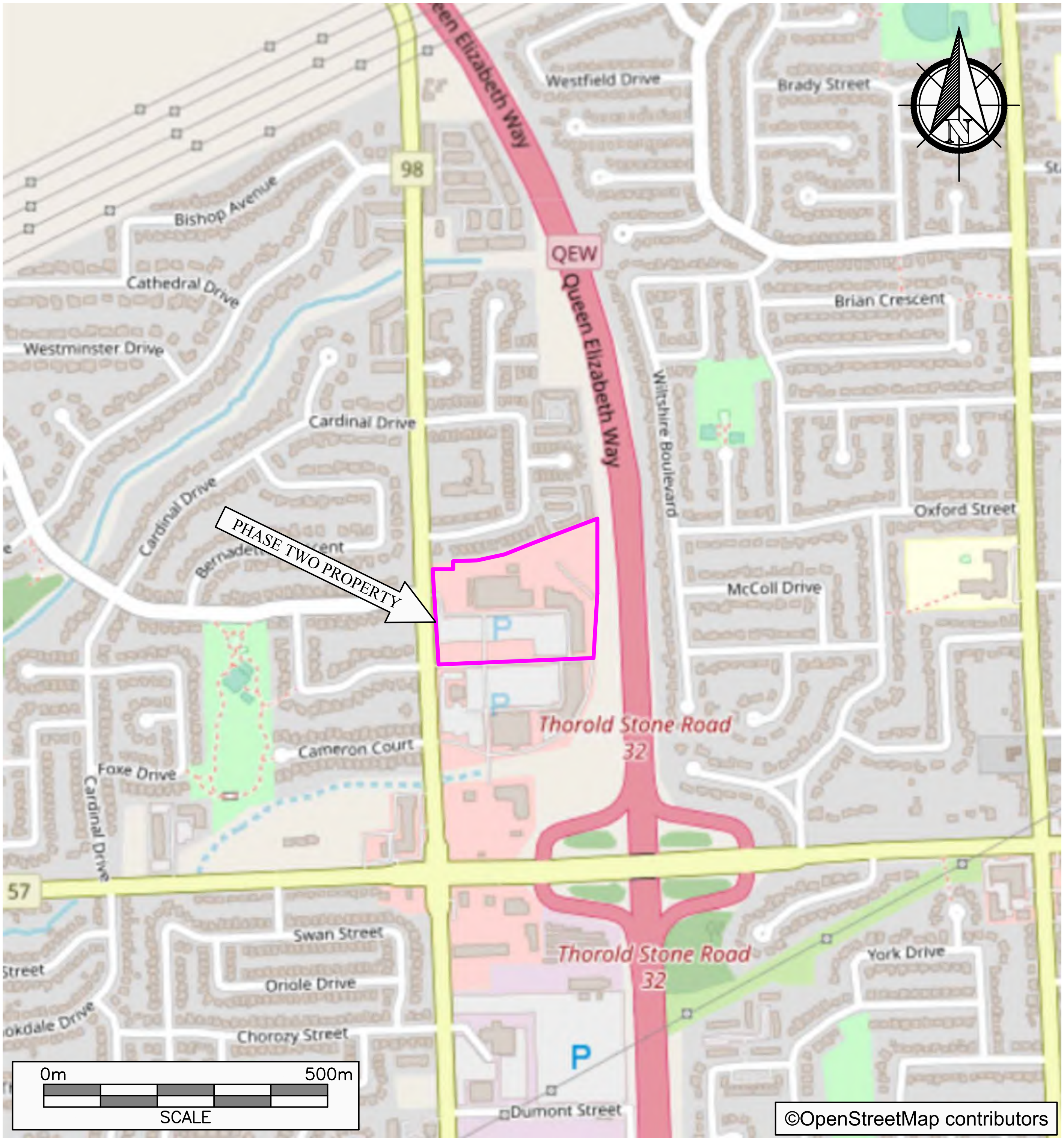
- Pinchin Ltd. *Phase I Environmental Site Assessment, 3770 and 3930 Montrose Road, Niagara Falls, Ontario*. June 17, 2021.

- Pinchin Ltd. *Phase II Environmental Site Assessment, 3770 and 3930 Montrose Road, Niagara Falls, Ontario*. June 18, 2021.
- Pinchin Ltd. Phase One Environmental Site Assessment, North Portion of 3770 Montrose Road, Niagara Falls, Ontario. December 6, 2021.
- Association of Professional Geoscientists of Ontario. Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended). April 2011.
- Ontario Ministry of the Environment. Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario. December 1996.
- Ontario Ministry of the Environment. Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. March 9, 2004 amended July 1, 2011.
- Ontario Ministry of the Environment. Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. April 15, 2011.
- Province of Ontario. Environmental Protection Act, R.S.O 1990, Chapter E.19.
- Province of Ontario. R.R.O. 1990, Regulation 347, General – Waste Management, as amended by Ontario Regulation 234/11.
- Province of Ontario. Ontario Regulation 153/04: Records of Site Condition – Part XV.1 of the Act. As amended.
- U.S. Environmental Protection Agency - Region 1. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Revised January 19, 2010.

\\pinchin.com\ham\Job\296000s\0296202.000 ForestGate,3770Montrose,Falls,EDR,RSC\0296202.001 ForestGate,3770Montrose,Falls,EDR,PHTWO\Deliverables\Phase Two ESA\296202.001 Final Phase Two ESA, N Portion of 3770 Montrose Rd, Niagara Falls, ON Mar 2022.docx

Template: Master Report for RSC Phase Two ESA Report – Unimpacted Site, EDR, October 16, 2020

9.0 FIGURES AND TABLES



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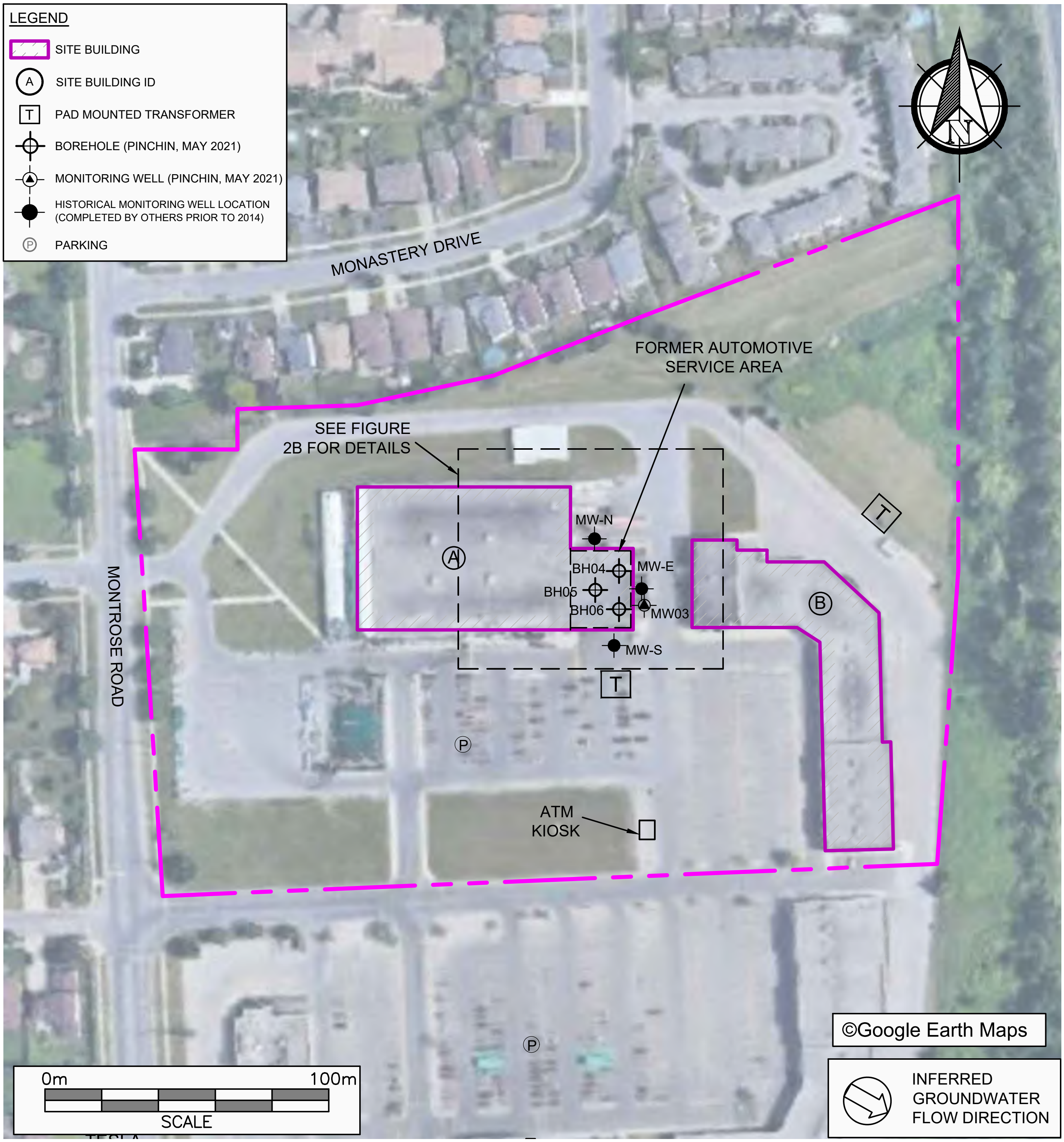
PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME			FIGURE NO.
KEY MAP			1
SCALE AS SHOWN	PROJECT NO. 296202.001	DATE MARCH 2022	



PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

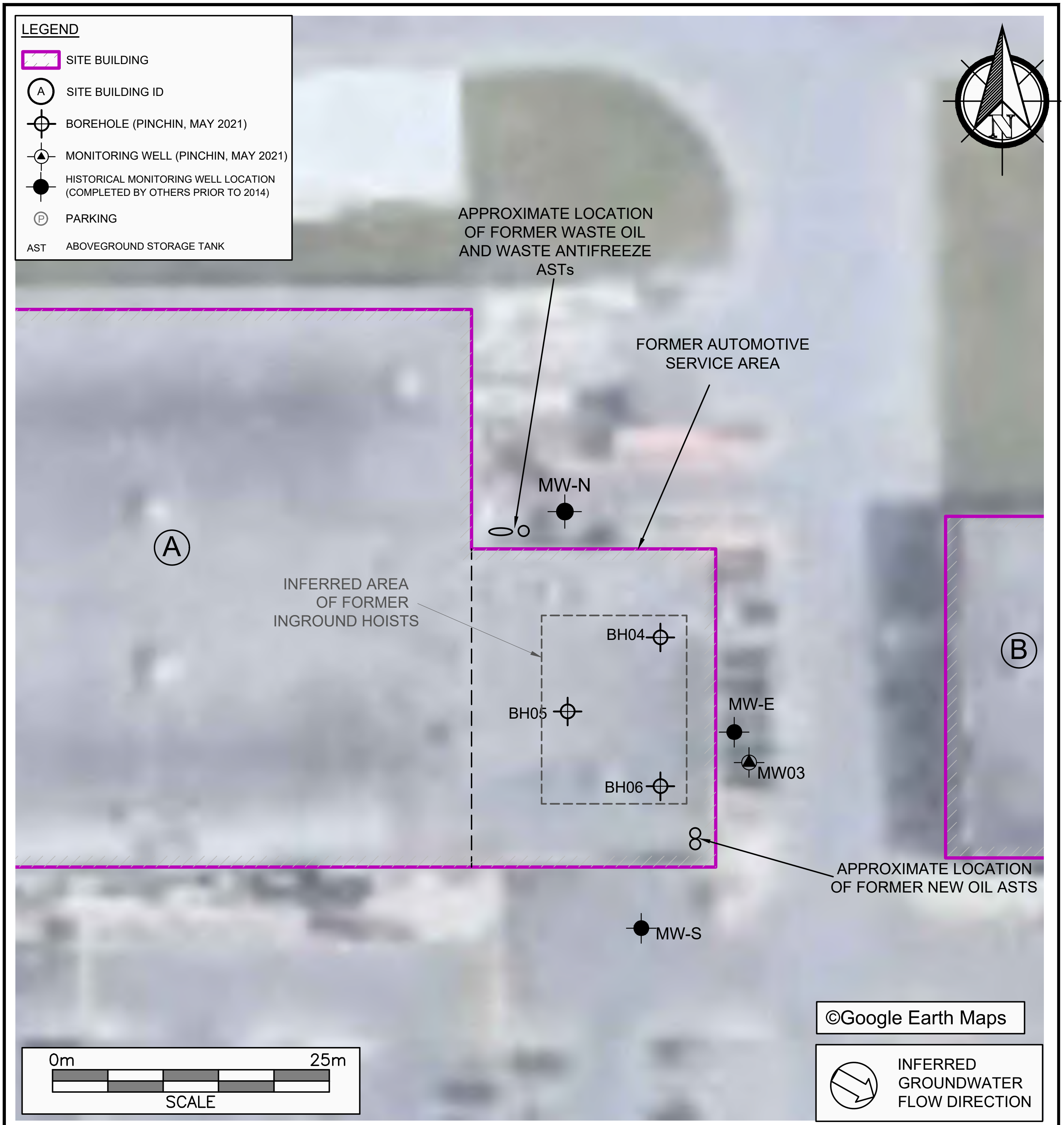
FIGURE NAME
PHASE TWO PROPERTY

FIGURE NO.
2

SCALE
AS SHOWN

PROJECT NO.
296202.001

DATE
MARCH 2022



PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

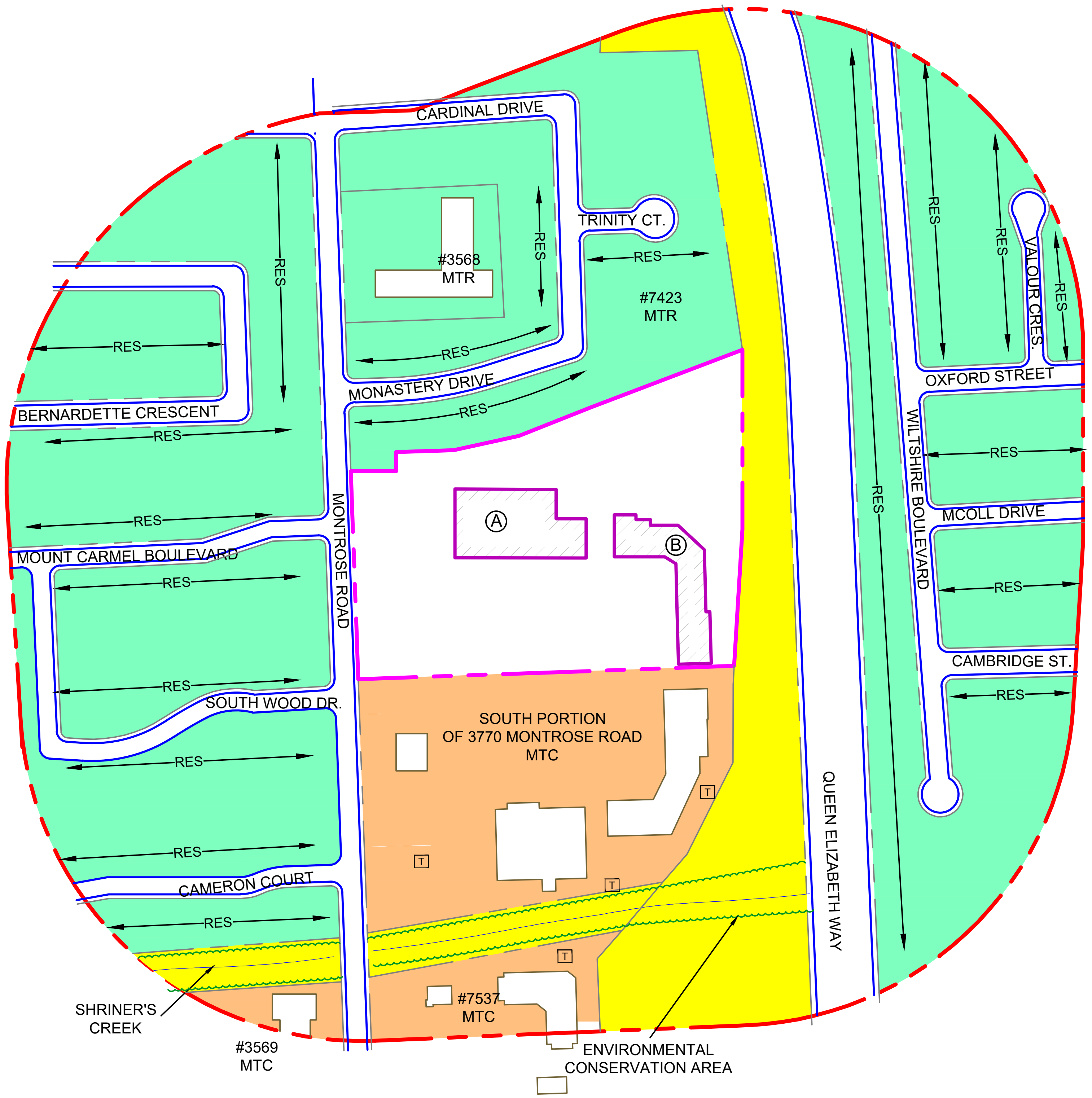
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PHASE TWO PROPERTY - DETAILED PLAN

FIGURE NO.
2B

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022



LEGEND

RES	RESIDENTIAL
MTC	MULTI-TENANT COMMERCIAL
MTR	MULTI-TENANT RESIDENTIAL
—	PHASE ONE STUDY AREA BOUNDARY
▨	SITE BUILDING
Ⓐ	SITE BUILDING ID
T	PAD MOUNTED TRANSFORMER
Ⓟ	PARKING
🟩	RESIDENTIAL USE
🟧	COMMERCIAL USE
🟨	AGRICULTURAL USE / OTHER USE

0m 200m
SCALE

INFERRED
GROUNDWATER
FLOW DIRECTION

PINCHIN

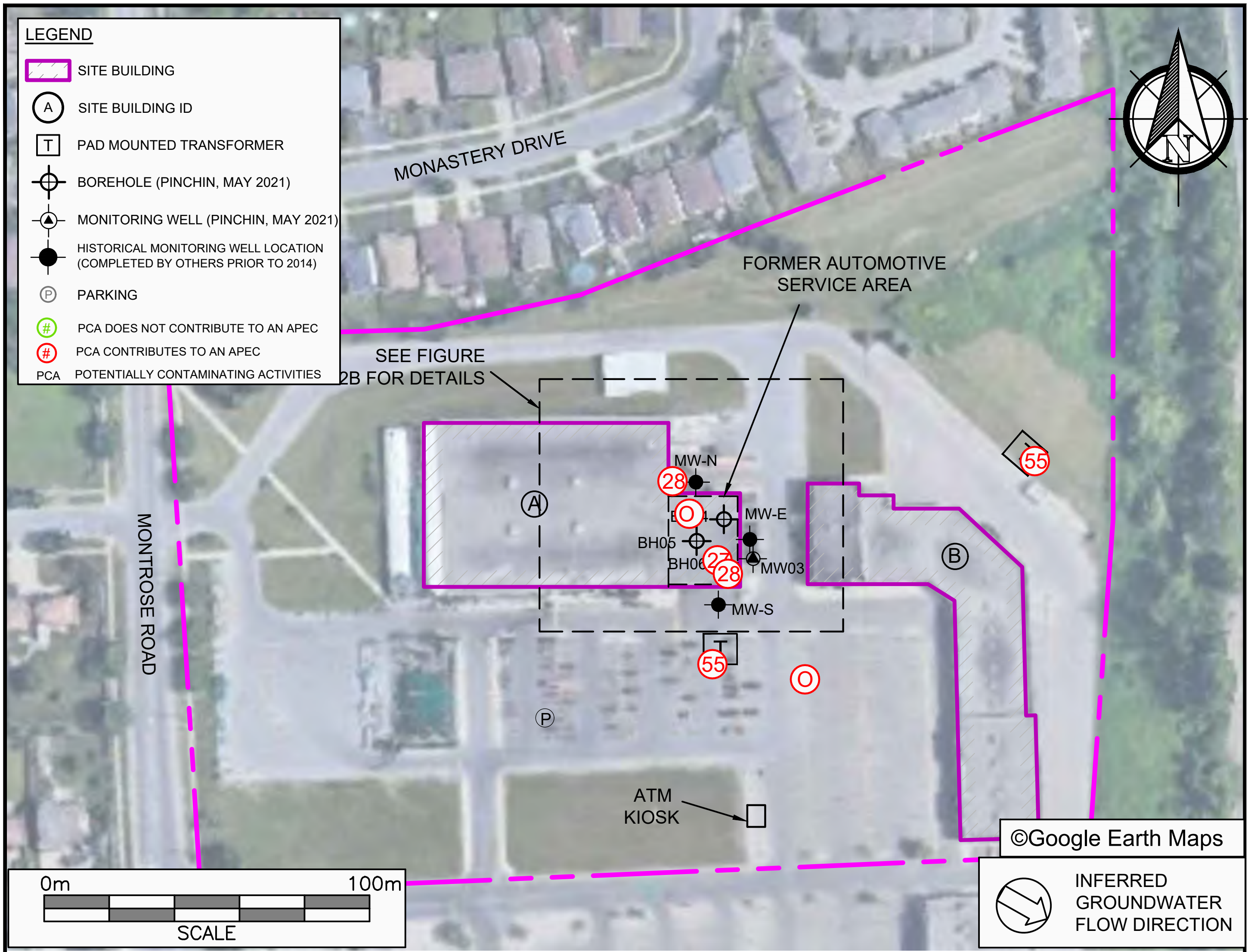
PROJECT NAME
PHASE TWO ENVIRONMENTAL
SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF
3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PHASE ONE STUDY AREA

SCALE	PROJECT NO.
AS SHOWN	296202.001
DATE	FIGURE NO.
MARCH 2022	3



Location of Potentially Contaminating Activity	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contributing to an APEC at the Site (Yes/No)	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
Historical automotive repair/service operations within the east portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	Yes	Soil and Groundwater
Transformer located south of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	Yes	Soil
Transformer located northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	Yes	Soil
Nine hydraulic hoists formerly located within the east portion of Site Building A.	Other - Inground Hydraulic Hoists	On-Site	Yes	Soil and Groundwater
Two new oil ASTs formerly located within the southeast corner of Site Building A.	Item 28 - Gasoline and Associated Products Storage in Fixed Tanks	On-Site	Yes	Soil
Former waste oil and waste antifreeze ASTs located adjacent to the north exterior elevation of Site Building A.	Item 28 - Gasoline and Associated Products Storage in Fixed Tanks	On-Site	Yes	Soil
Exterior, paved portions of the Phase One Property.	Other - Road Salting Activities	On-Site	Yes	Soil and Groundwater

PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

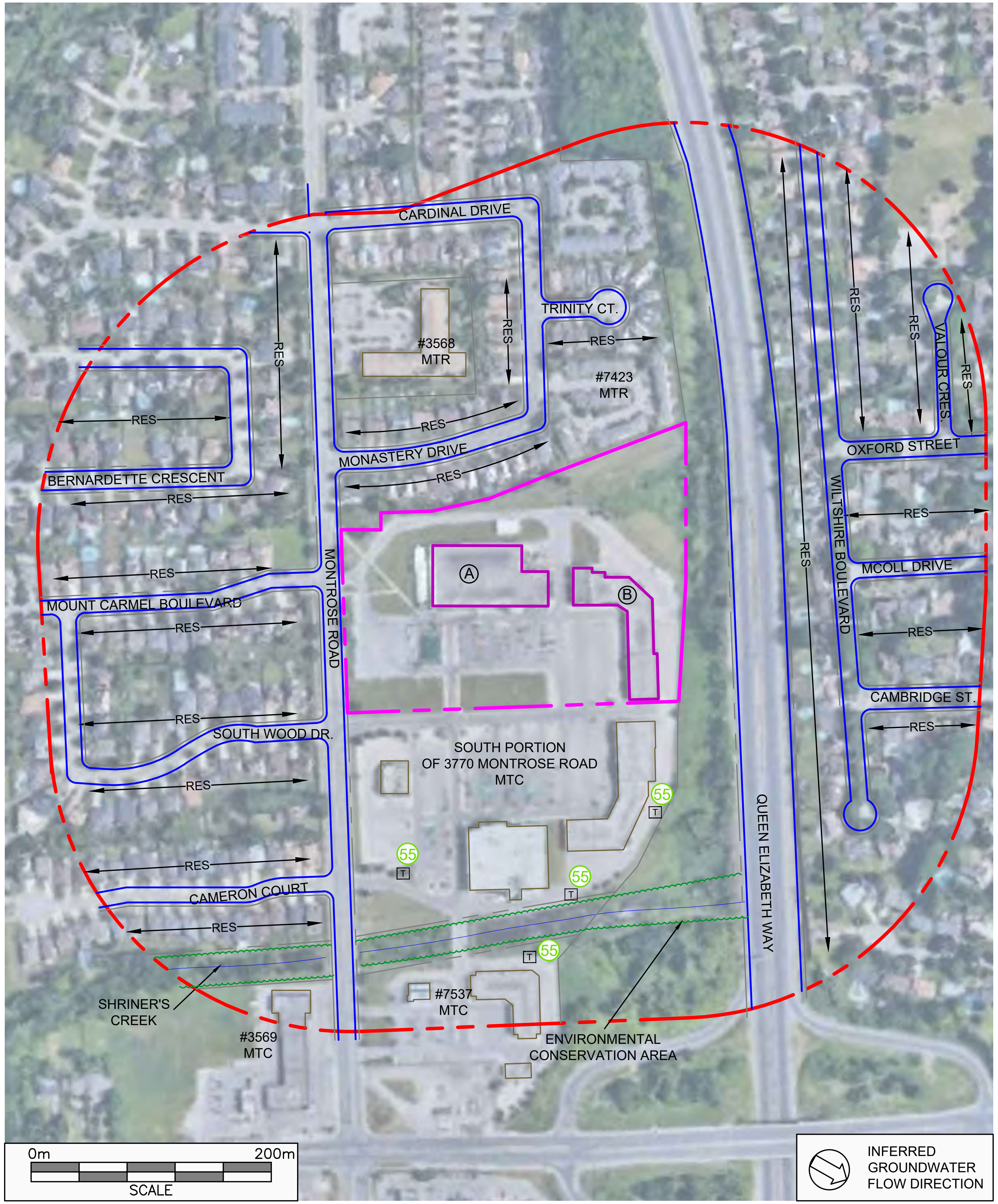
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
POTENTIALLY CONTAMINATING ACTIVITIES
(ON-SITE)

FIGURE NO.
4

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022



Location of Potentially Contaminating Activity	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contributing to an APEC at the Site (Yes/No)	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
Transformer located on the east-central portion of the property adjacent to the south of the Phase One Property (i.e., South Portion of 3770 Montrose Road).	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	No	Not Applicable
Transformer located on the southwest portion of the property adjacent to the south of the Phase One Property (i.e., South Portion of 3770 Montrose Road).	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	No	Not Applicable
Transformer located on the southeast portion of the property adjacent to the south of the Phase One Property (i.e., South Portion of 3770 Montrose Road).	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	No	Not Applicable
Transformer located at 3930 Montrose Road.	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	No	Not Applicable

LEGEND

RES	RESIDENTIAL
MTC	MULTI-TENANT COMMERCIAL
MTR	MULTI-TENANT RESIDENTIAL
—	PHASE ONE STUDY AREA BOUNDARY
▨	SITE BUILDING
Ⓐ	SITE BUILDING ID
T	PAD MOUNTED TRANSFORMER
Ⓟ	PARKING
#	PCA NUMBER CONTRIBUTES TO AN APEC
#	PCA NUMBER DOES NOT CONTRIBUTE TO AN APEC
PCA	POTENTIALLY CONTAMINATING ACTIVITIES

PINCHIN

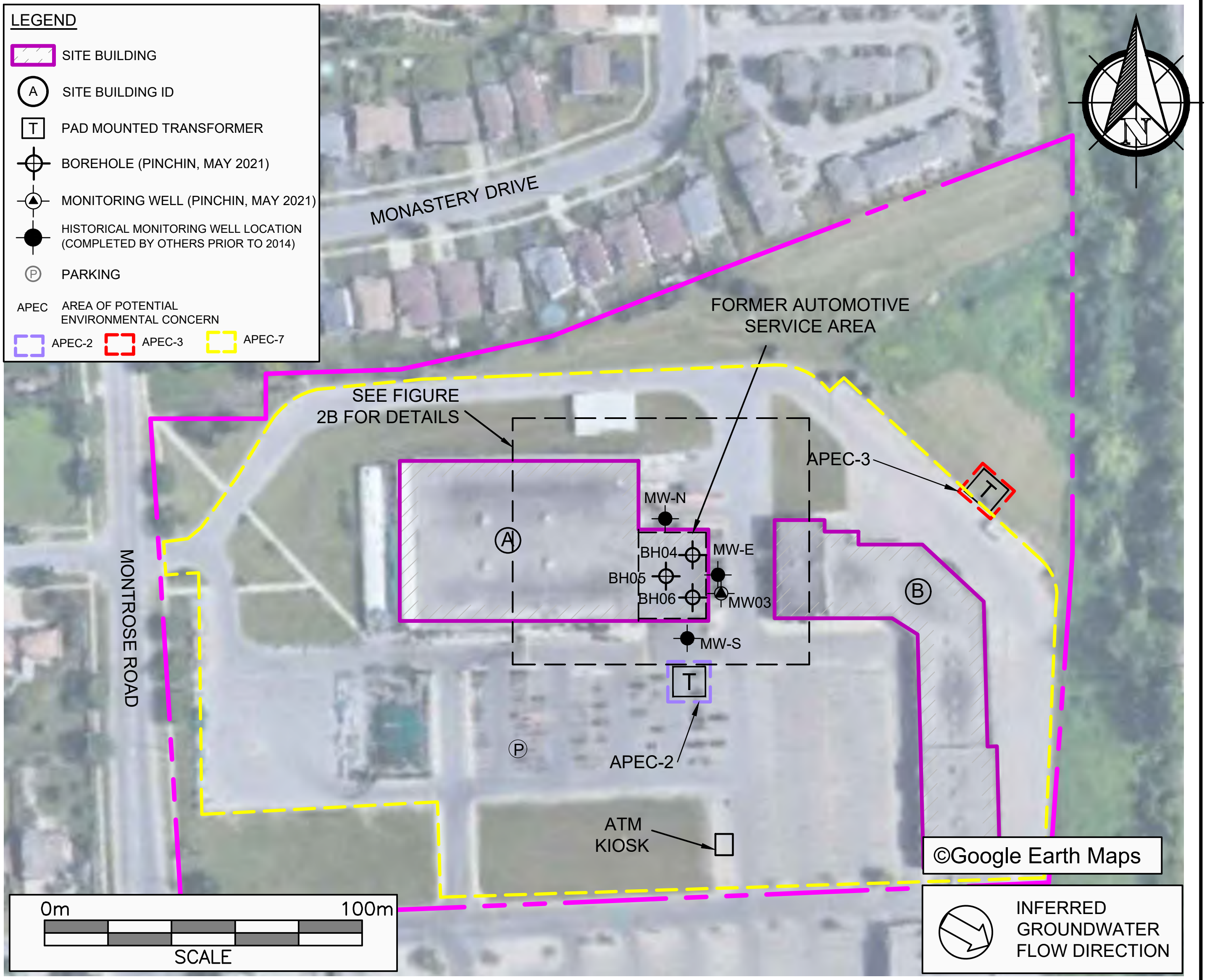
PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF
3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
POTENTIALLY CONTAMINATING ACTIVITIES (OFF-SITE)

SCALE AS SHOWN	PROJECT NO. 296202.001
DATE MARCH 2022	FIGURE NO. 5



Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-2 (Transformer located south of the southeast portion of Site Building A)	South of southeast portion of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-3 (Transformer located northeast of Site Building B)	Northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-7 (Road salting activities)	Exterior, paved portions of Phase One Property.	Other - Road Salting Activities	On-Site	Electrical Conductivity SAR Na Cl-	Soil and Groundwater

PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

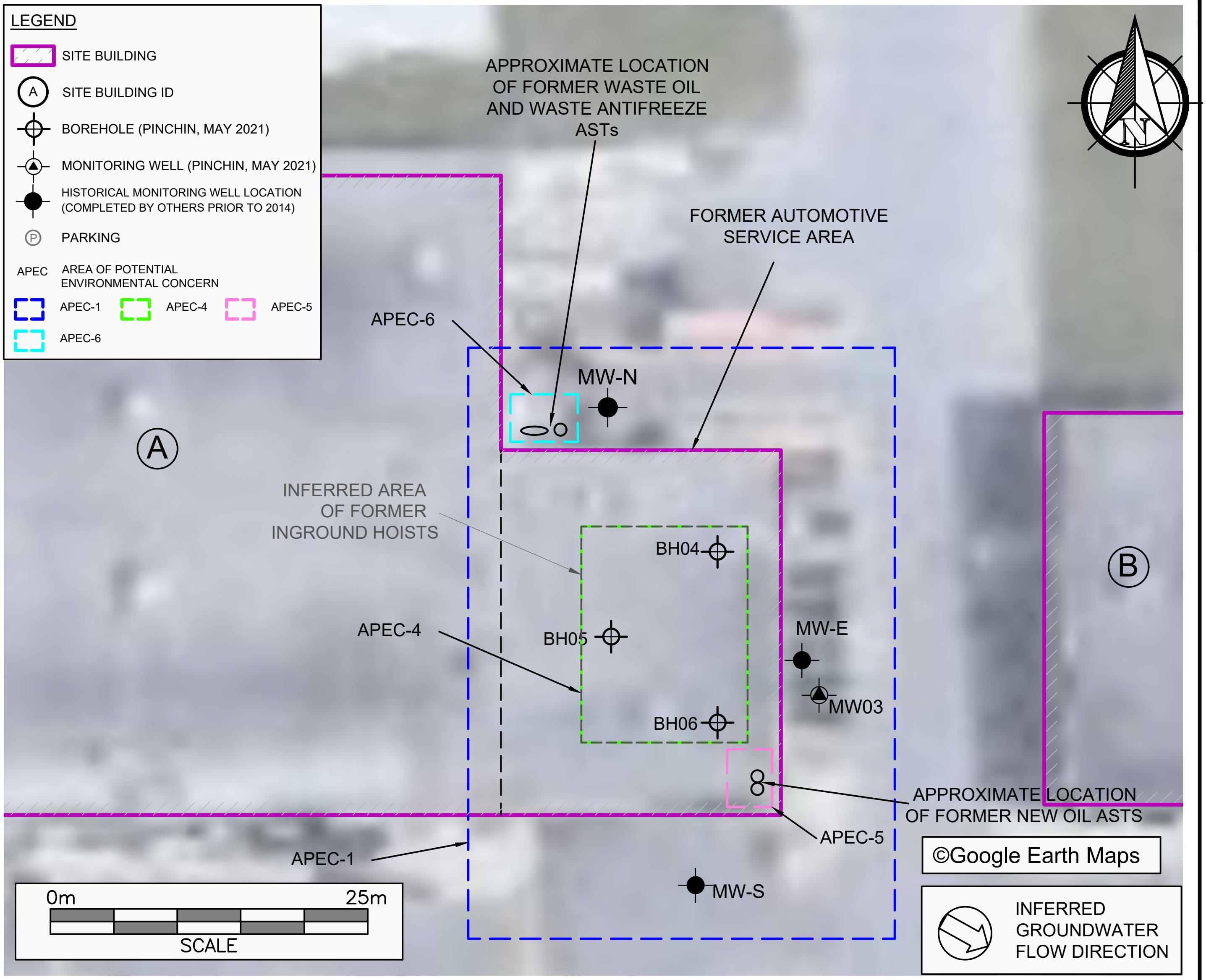
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO

FIGURE NAME
AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

FIGURE NO.
6A

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022



Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-1 (Historical automotive service and repair within east portion of Site Building A)	East portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	PHCs BTEX PAHs VOCs	Soil and Groundwater
APEC-4 (Nine inground hydraulic hoists formerly located within the east portion of Site Building A)	Within the central portion of the former automotive service centre, located within the east potion of Site Building A.	Other - Inground Hydraulic Hoists	On-Site	PHCs BTEX	Soil and Groundwater
APEC-5 (Two new oil ASTs formerly located within the southeast corner of Site Building A)	Southeast corner of Site Building A.	Item 28 - Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs BTEX PAHs	Soil
APEC-6 (Former waste oil AST located adjacent to the north exterior elevation of Site Building A)	Adjacent to the north exterior elevation of Site Building A.	Item 28 - Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs BTEX PAHs	Soil

PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

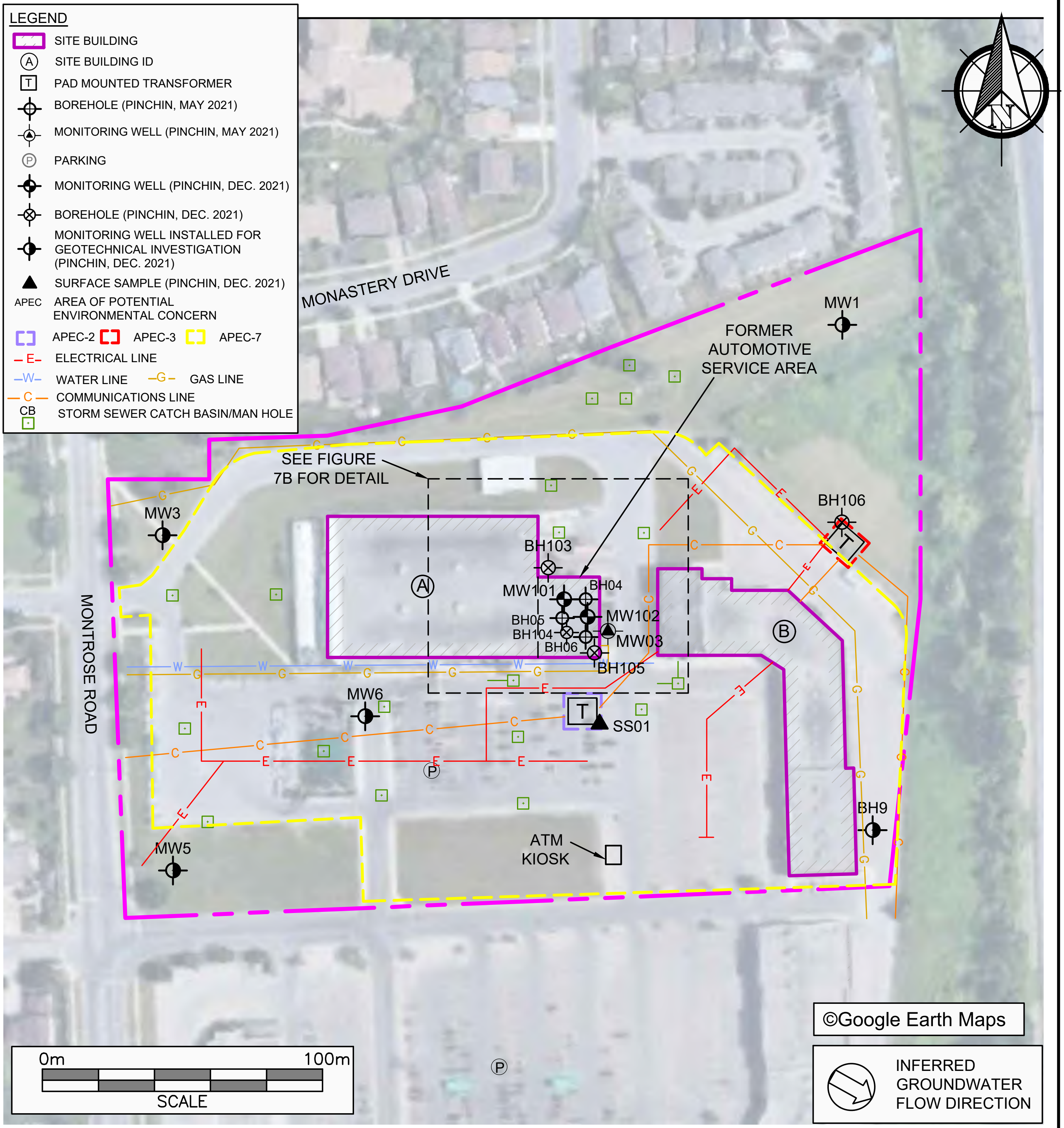
FIGURE NAME
AREAS OF POTENTIAL
ENVIRONMENTAL CONCERN - DETAILED PLAN

FIGURE NO.
6B

SCALE
AS SHOWN

PROJECT NO.
296202.001

DATE
MARCH 2022



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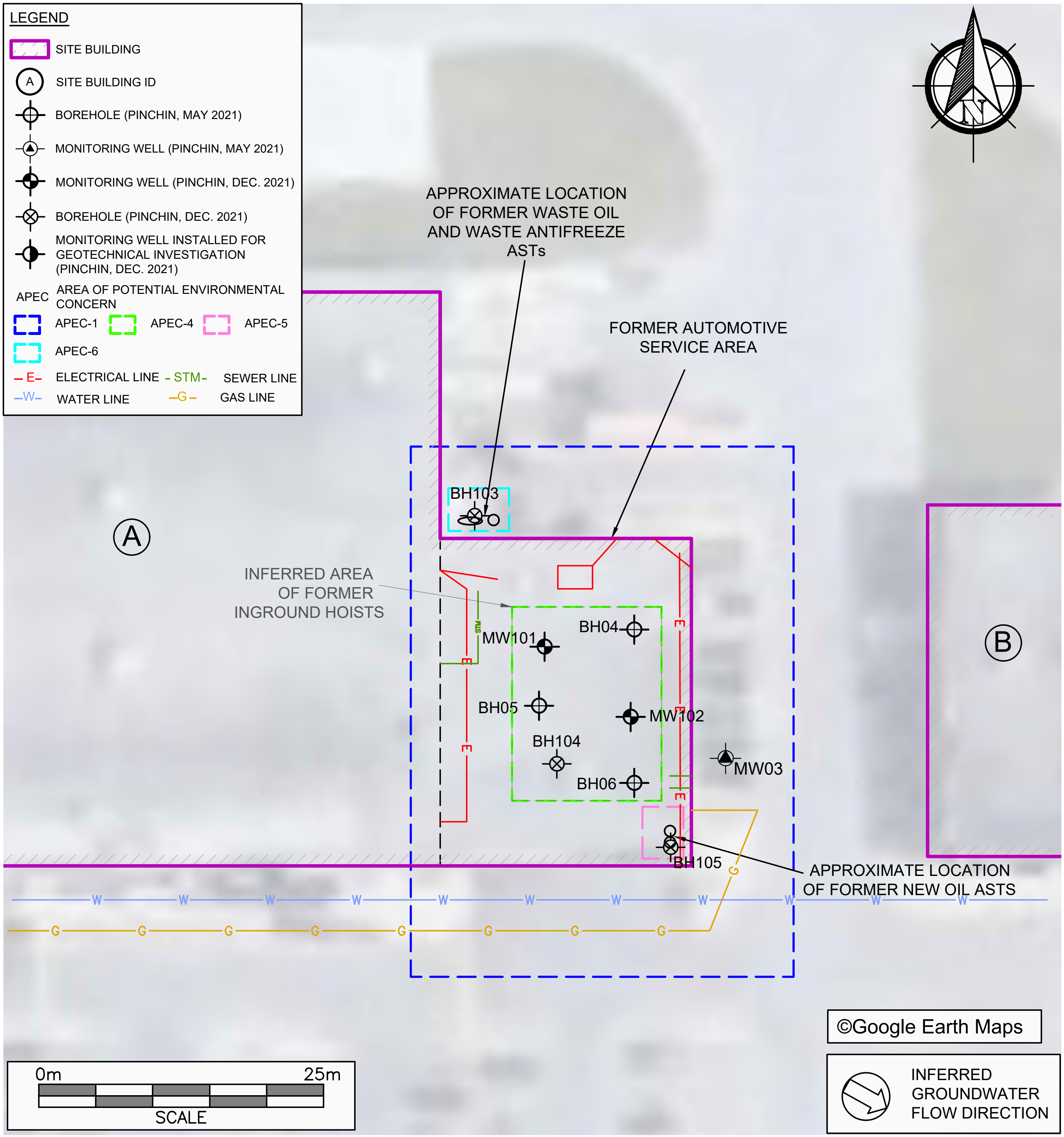
PROJECT NAME PHASE TWO ENVIRONMENTAL SITE ASSESSMENT			
CLIENT NAME FOREST GATE ADVISORS INC.			
PROJECT LOCATION NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO			
FIGURE NAME BOREHOLE AND MONITORING WELL LOCATION PLAN			FIGURE NO. 7A
SCALE AS SHOWN	PROJECT NO. 296202.001	DATE MARCH 2022	



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PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

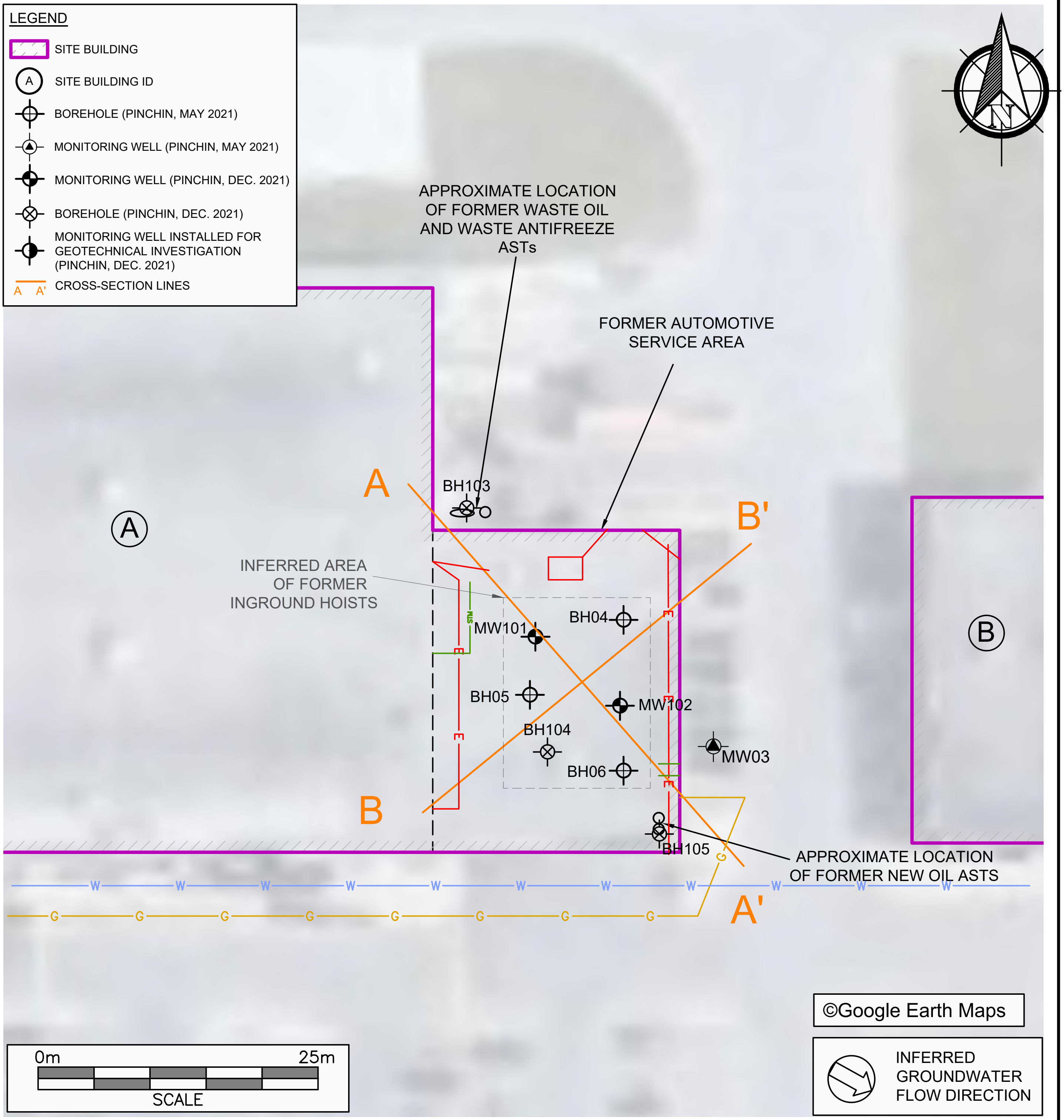
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
BOREHOLE AND MONITORING WELL
LOCATION PLAN - DETAILED PLAN

FIGURE NO.
7B

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022



PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

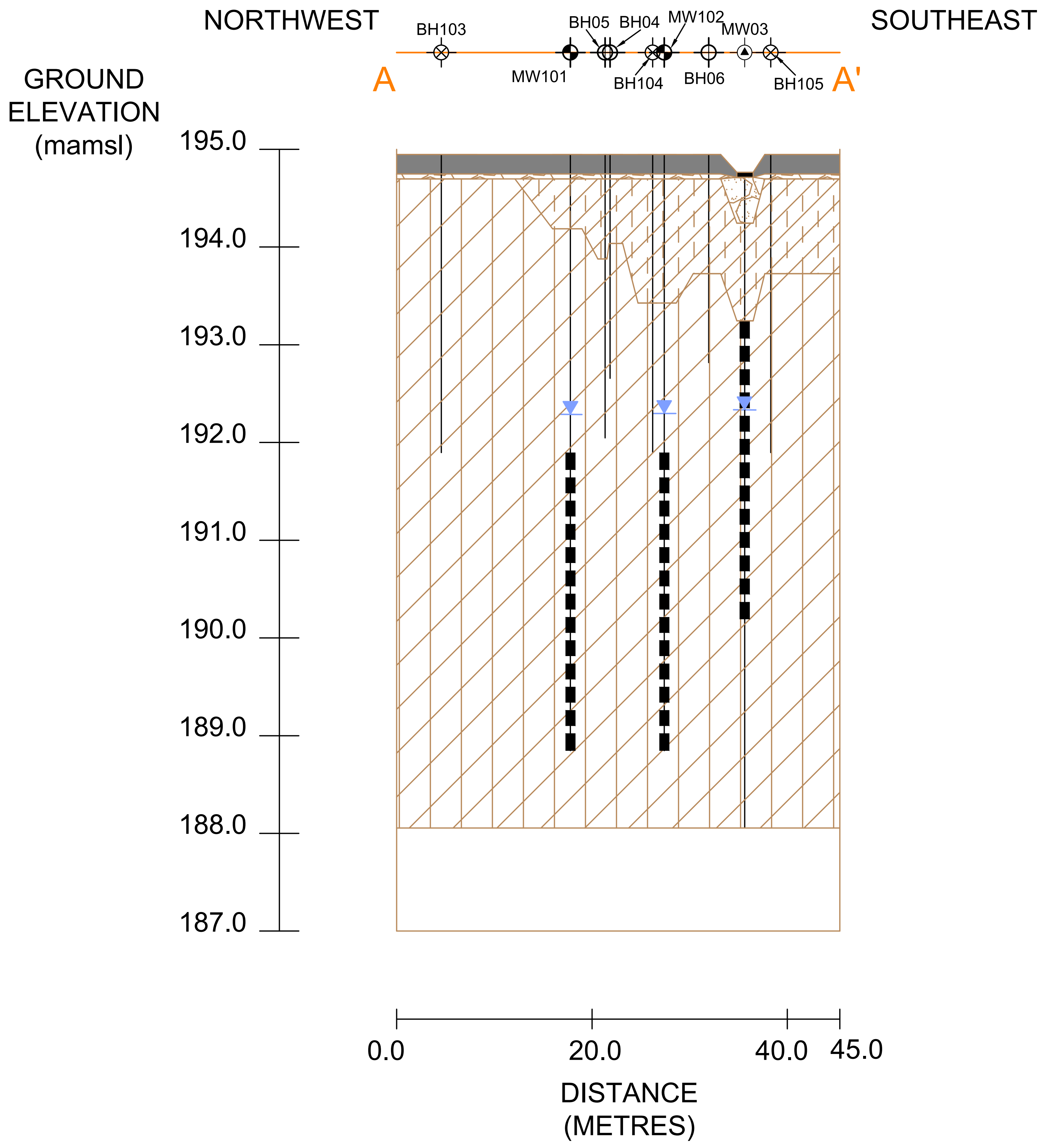
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
CROSS-SECTION LINES

FIGURE NO.
8A

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022



LEGEND

- ⊕ BOREHOLE (PINCHIN, MAY 2021)
- ▲ MONITORING WELL (PINCHIN, MAY 2021)
- ● MONITORING WELL (PINCHIN, DEC. 2021)
- ⊗ BOREHOLE (PINCHIN, DEC. 2021)
- ● MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)
- A A' CROSS-SECTION LINES
- ■ ASPHALT
- ▩ CONCRETE
- ▨ GRANULAR
- ▨ SAND AND GRAVEL
- ▨ SILTY CLAY
- ▨ CLAYEY SILT
- WELL CASING/ BENTONITE
- ▼ MEASURED GROUNDWATER ELEVATION (JAN. 12, 2022)
- ■ WELL SCREEN

PINCHIN

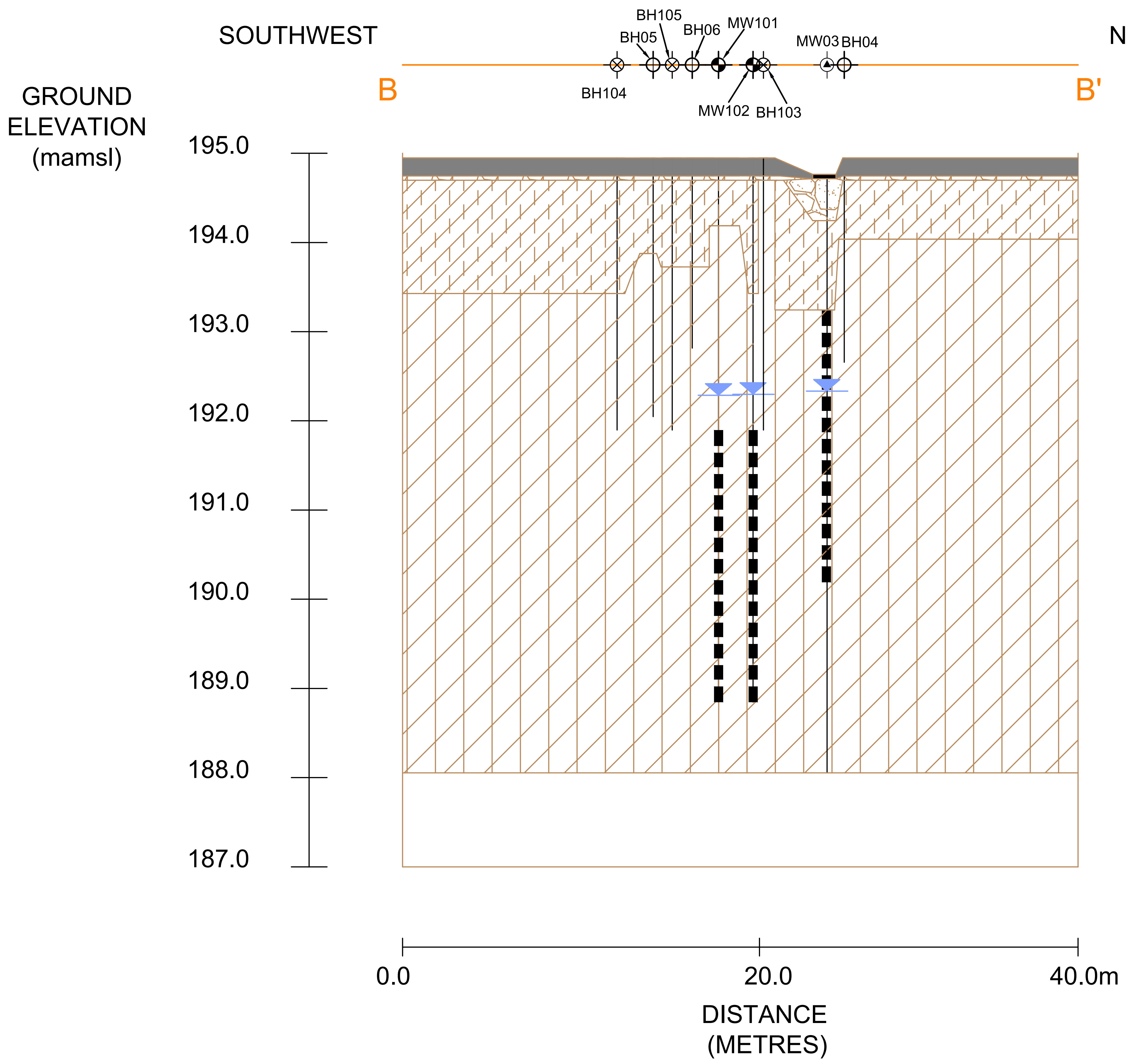
PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF
3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
CROSS-SECTION DETAIL
A-A'

SCALE	PROJECT NO.
AS SHOWN	296202.001
DATE	FIGURE NO.
MARCH 2022	8B



LEGEND

- ⊕ BOREHOLE (PINCHIN, MAY 2021)
- ⊕ MONITORING WELL (PINCHIN, MAY 2021)
- ⊕ MONITORING WELL (PINCHIN, DEC. 2021)
- ⊗ BOREHOLE (PINCHIN, DEC. 2021)
- ⊕ MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)
- A A' CROSS-SECTION LINES
- ■ ASPHALT
- ■ CONCRETE
- ▨ GRANULAR
- ▨ SAND AND GRAVEL
- ▨ SILTY CLAY
- ▨ CLAYEY SILT
- WELL CASING/ BENTONITE
- ▼ MEASURED GROUNDWATER ELEVATION (JAN. 12, 2022)
- ■ WELL SCREEN

PINCHIN

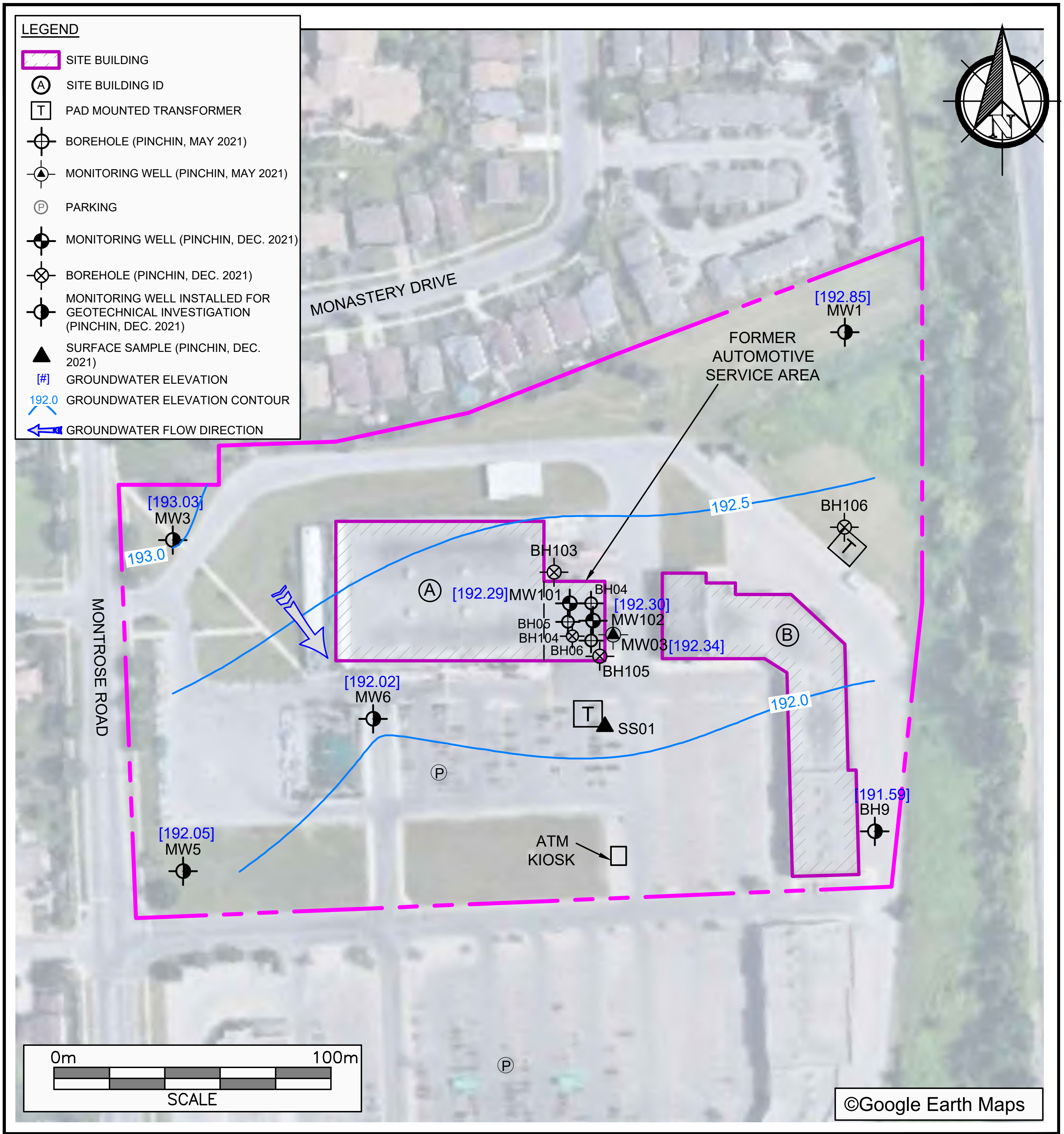
PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF
3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
CROSS-SECTION DETAIL
B-B'

SCALE	PROJECT NO.
AS SHOWN	296202.001
DATE	FIGURE NO.
MARCH 2022	8C



PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO

FIGURE NAME GROUNDWATER ELEVATIONS AND INFERRED FLOW DIRECTION (JANUARY 12, 2022)

SCALE	PROJECT NO.	DATE	FIGURE NO.
AS SHOWN	296202.001	MARCH 2022	9

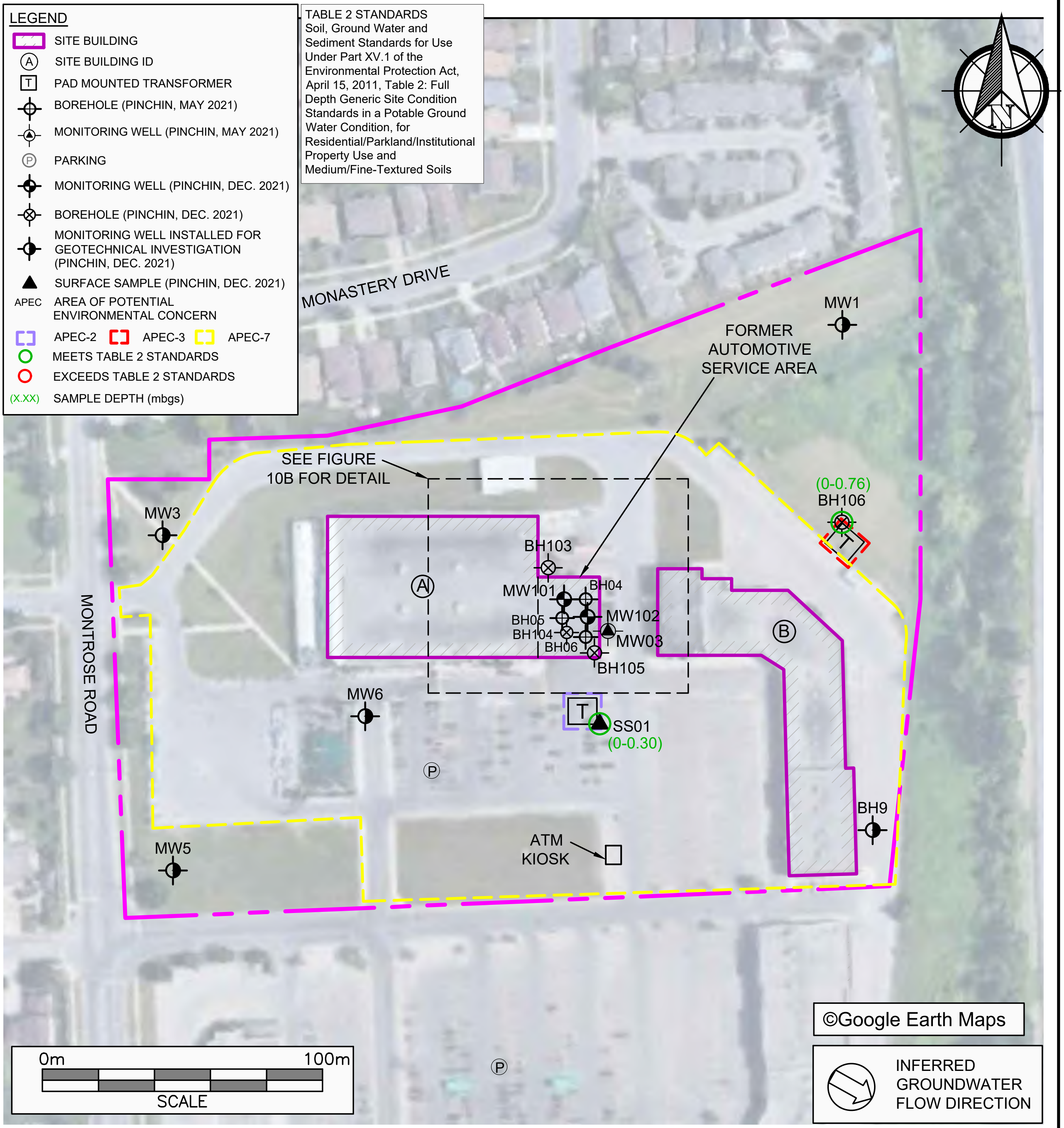


TABLE 2 STANDARDS
Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for Residential/Parkland/Institutional Property Use and Medium/Fine-Textured Soils

PINCHIN

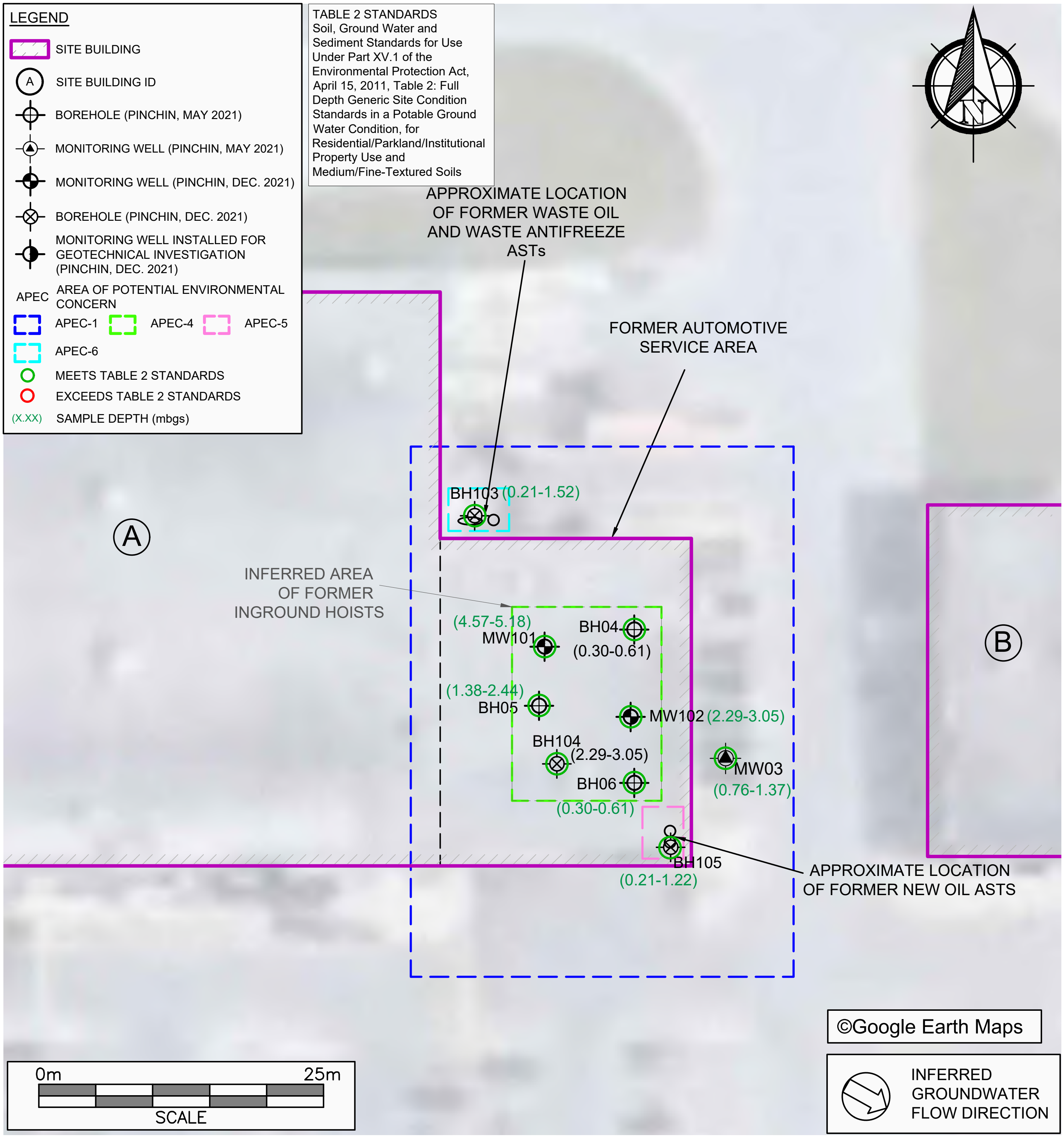
PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PETROLEUM HYDROCARBONS IN SOIL

SCALE	PROJECT NO.	DATE	FIGURE NO.
AS SHOWN	296202.001	MARCH 2022	10A



PINCHIN

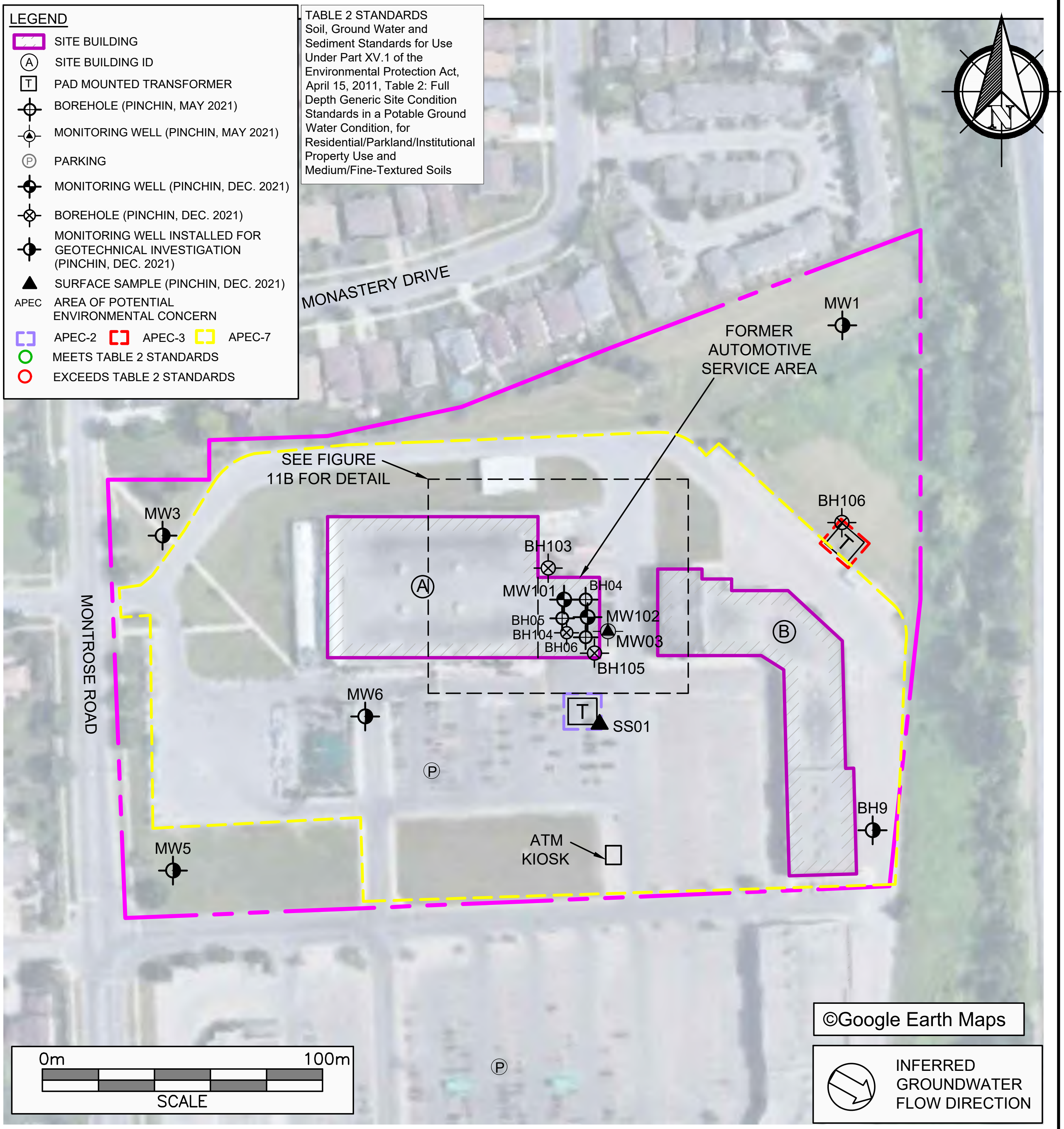
PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PETROLEUM HYDROCARBONS AND BTEX IN SOIL-DETAILED PLAN

SCALE	PROJECT NO.	DATE	FIGURE NO.
AS SHOWN	296202.001	MARCH 2022	10B



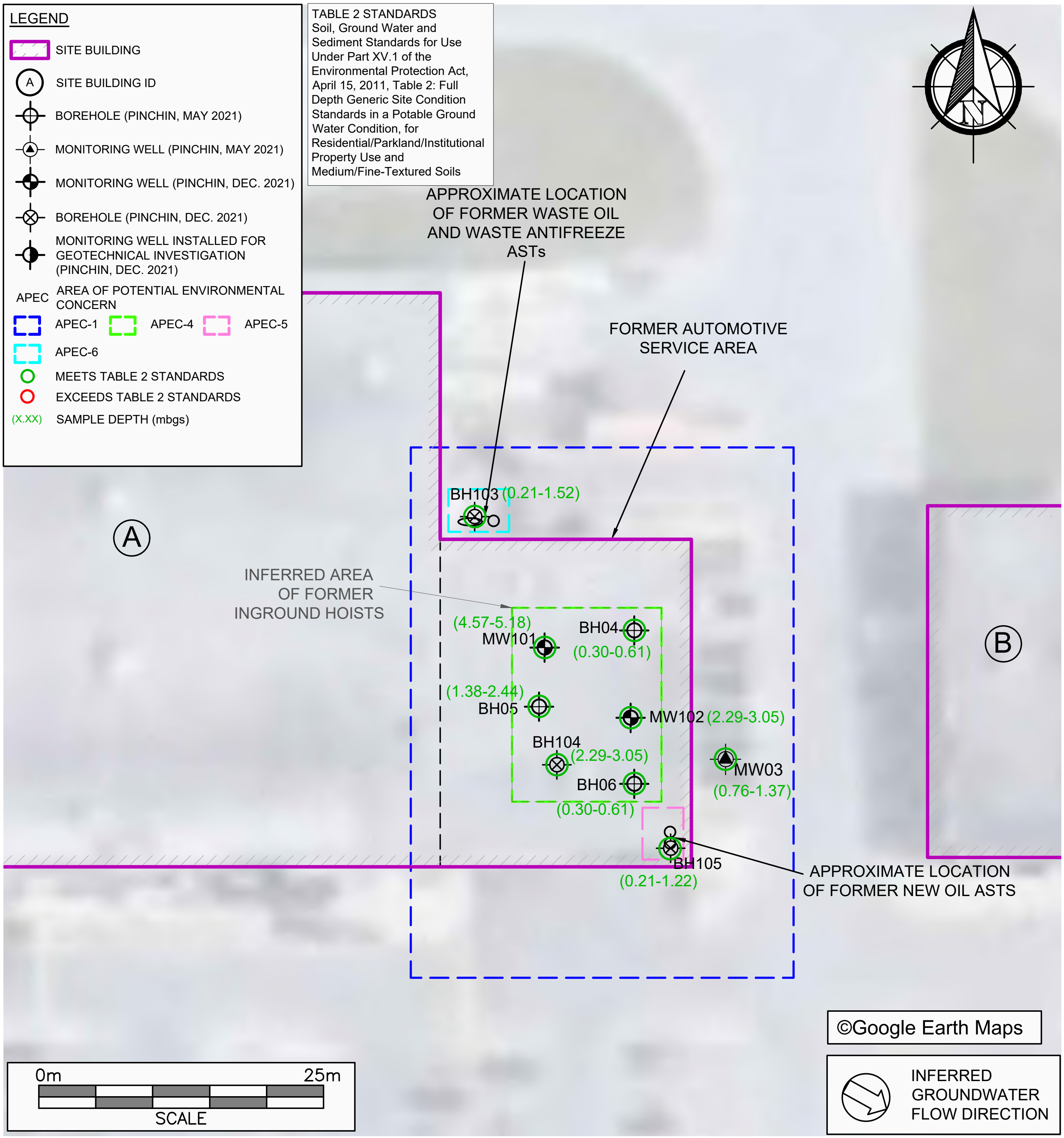
LEGEND

▭	SITE BUILDING
Ⓐ	SITE BUILDING ID
T	PAD MOUNTED TRANSFORMER
⌖	BOREHOLE (PINCHIN, MAY 2021)
⌖	MONITORING WELL (PINCHIN, MAY 2021)
Ⓟ	PARKING
⌖	MONITORING WELL (PINCHIN, DEC. 2021)
⊗	BOREHOLE (PINCHIN, DEC. 2021)
⌖	MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)
▲	SURFACE SAMPLE (PINCHIN, DEC. 2021)
APEC	AREA OF POTENTIAL ENVIRONMENTAL CONCERN
⬚	APEC-2
⬚	APEC-3
⬚	APEC-7
○	MEETS TABLE 2 STANDARDS
○	EXCEEDS TABLE 2 STANDARDS

TABLE 2 STANDARDS
Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for Residential/Parkland/Institutional Property Use and Medium/Fine-Textured Soils

PINCHIN

PROJECT NAME	PHASE TWO ENVIRONMENTAL SITE ASSESSMENT
CLIENT NAME	FOREST GATE ADVISORS INC.
PROJECT LOCATION	NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO
FIGURE NAME	VOLATILE ORGANIC COMPOUNDS IN SOIL
FIGURE NO.	11A
SCALE	AS SHOWN
PROJECT NO.	296202.001
DATE	MARCH 2022



©Google Earth Maps

LEGEND

- ▨ SITE BUILDING
- Ⓐ SITE BUILDING ID
- ⊕ BOREHOLE (PINCHIN, MAY 2021)
- ▲ MONITORING WELL (PINCHIN, MAY 2021)
- ● MONITORING WELL (PINCHIN, DEC. 2021)
- ⊗ BOREHOLE (PINCHIN, DEC. 2021)
- ◐ MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)
- APEC AREA OF POTENTIAL ENVIRONMENTAL CONCERN
- ⬚ APEC-1 ⬚ APEC-4 ⬚ APEC-5
- ⬚ APEC-6
- ○ MEETS TABLE 2 STANDARDS
- ○ EXCEEDS TABLE 2 STANDARDS
- (X.XX) SAMPLE DEPTH (mbgs)

TABLE 2 STANDARDS
Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for Residential/Parkland/Institutional Property Use and Medium/Fine-Textured Soils

PINCHIN

PROJECT NAME	PHASE TWO ENVIRONMENTAL SITE ASSESSMENT
CLIENT NAME	FOREST GATE ADVISORS INC.
PROJECT LOCATION	NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO
FIGURE NAME	VOLATILE ORGANIC COMPOUNDS IN SOIL-DETAILED PLAN
FIGURE NO.	11B

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022

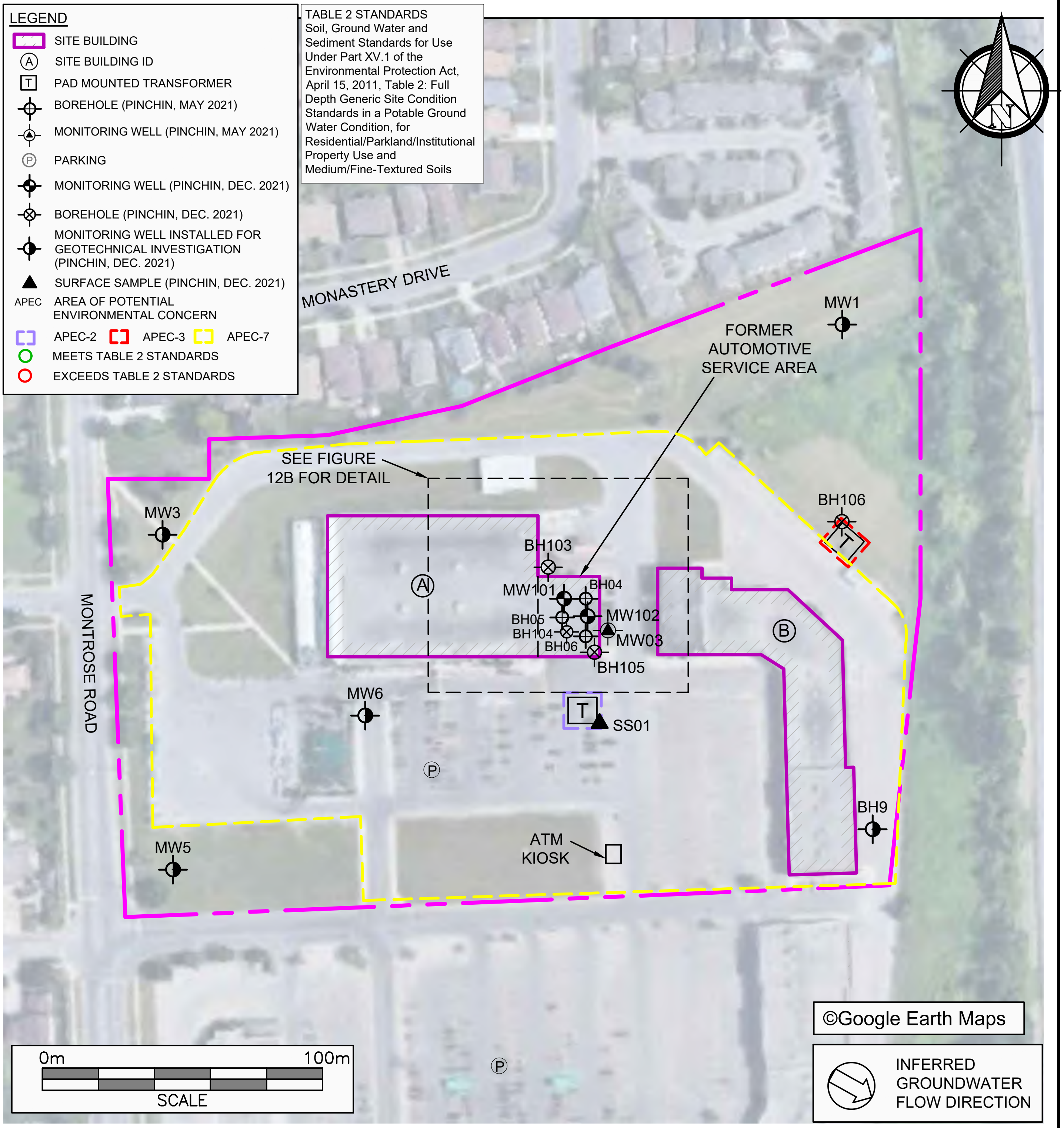
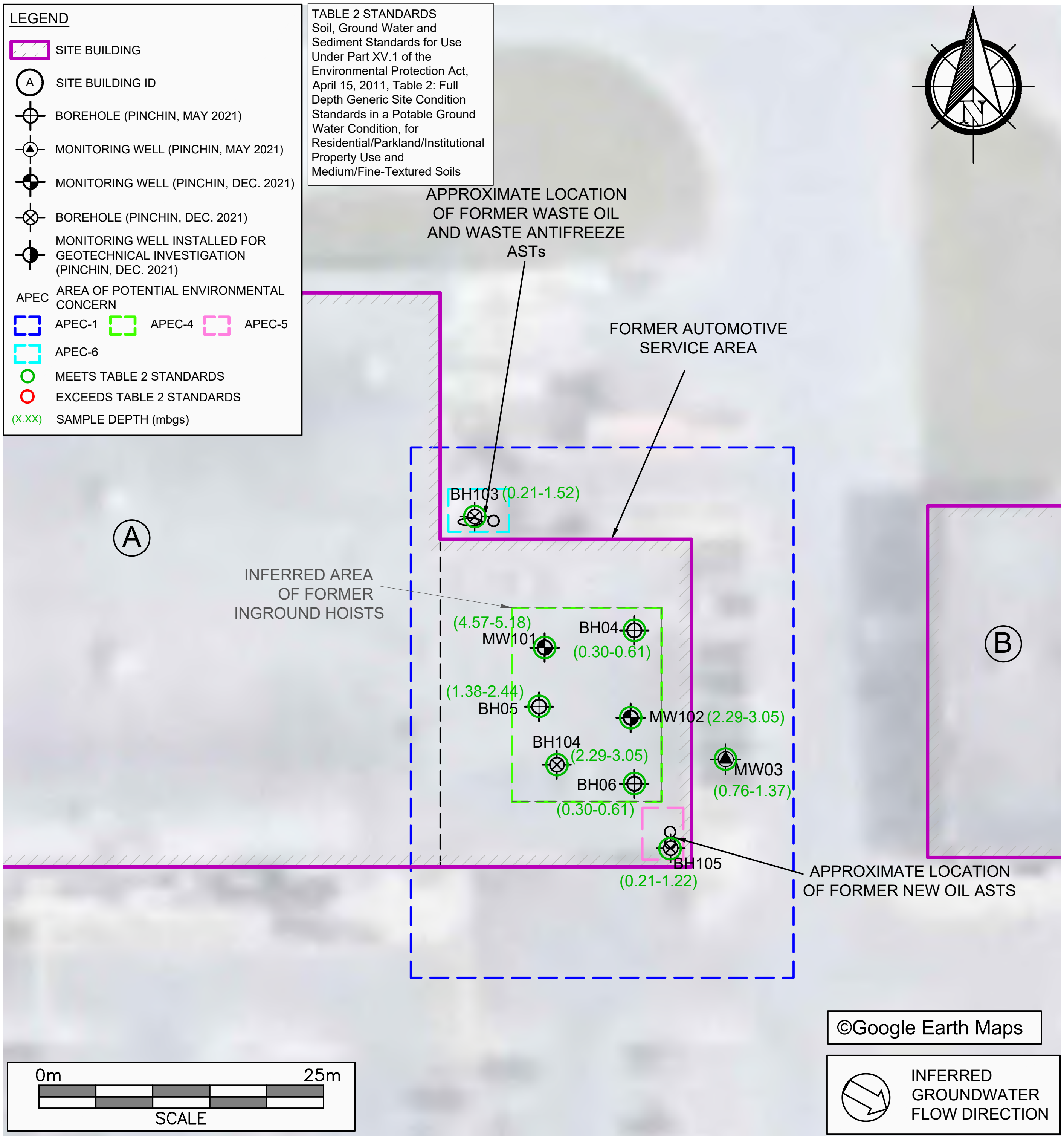


TABLE 2 STANDARDS
Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for Residential/Parkland/Institutional Property Use and Medium/Fine-Textured Soils

PROJECT NAME	PHASE TWO ENVIRONMENTAL SITE ASSESSMENT
CLIENT NAME	FOREST GATE ADVISORS INC.
PROJECT LOCATION	NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO
FIGURE NAME	POLYCYCLIC AROMATIC HYDROCARBONS IN SOIL
FIGURE NO.	12A
SCALE	AS SHOWN
PROJECT NO.	296202.001
DATE	MARCH 2022



PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
POLYCYCLIC AROMATIC HYDROCARBONS
IN SOIL-DETAILED PLAN

FIGURE NO.
12B

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022

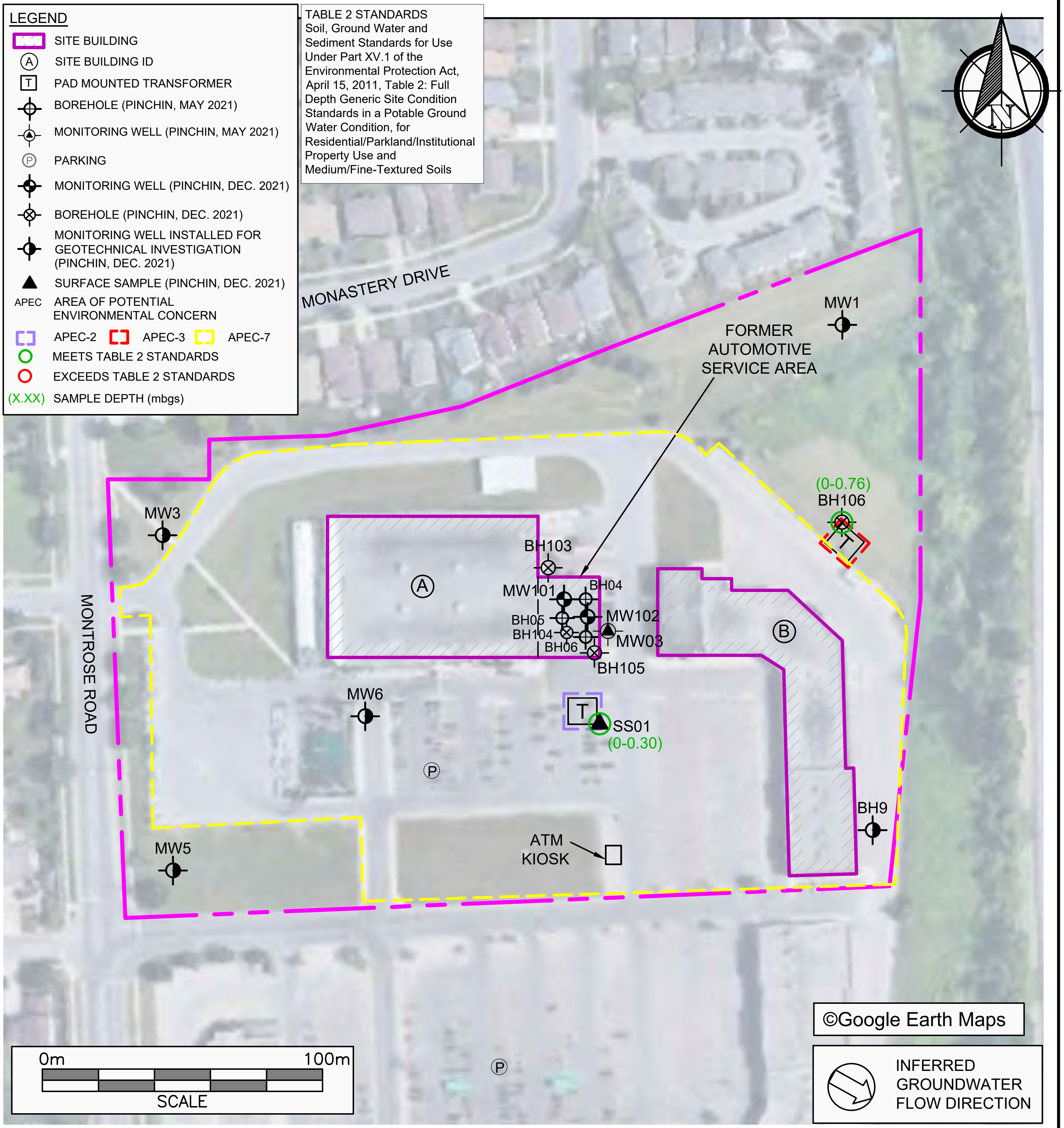
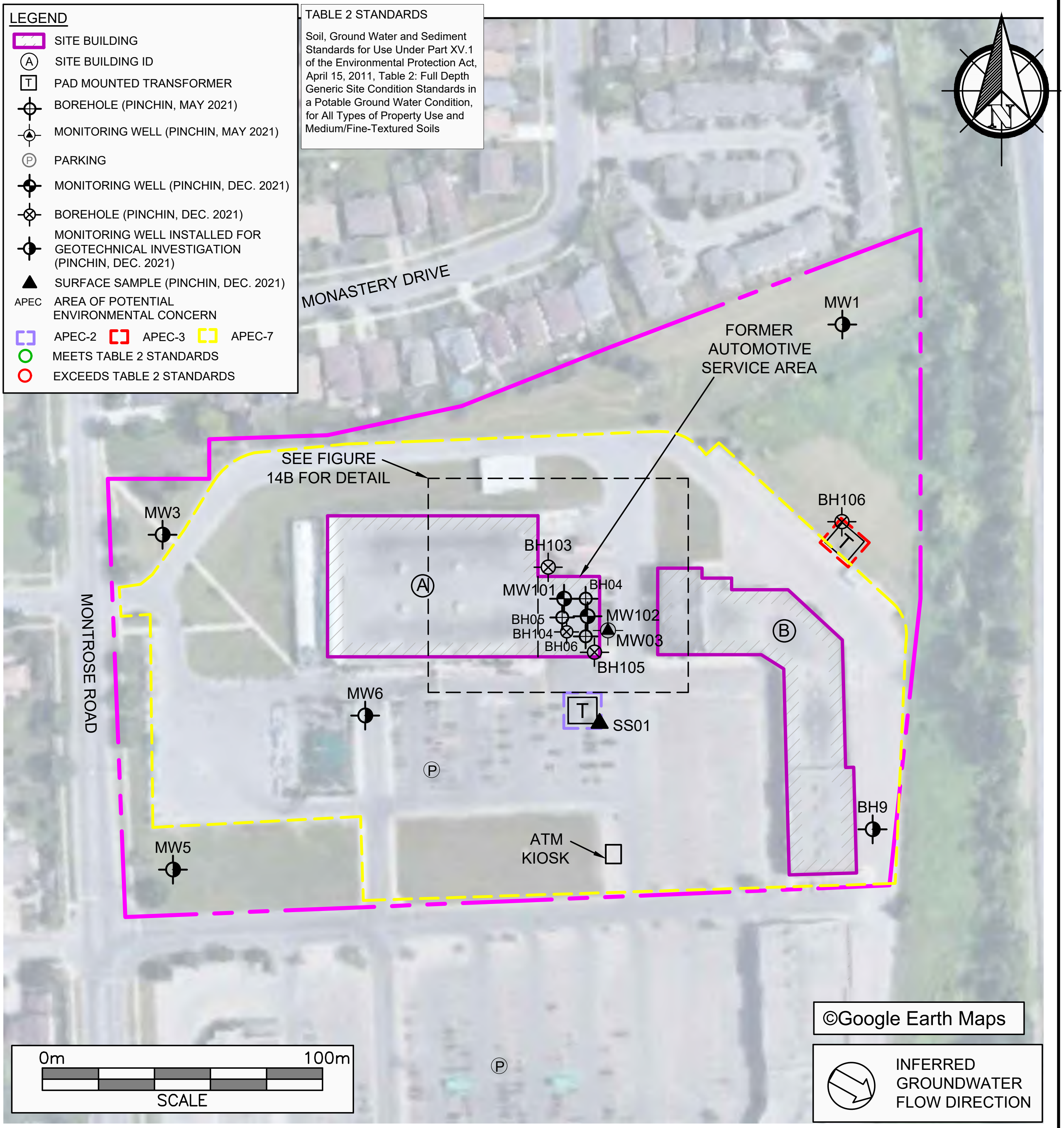


TABLE 2 STANDARDS
Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for Residential/Parkland/Institutional Property Use and Medium/Fine-Textured Soils

PINCHIN

PROJECT NAME	PHASE TWO ENVIRONMENTAL SITE ASSESSMENT
CLIENT NAME	FOREST GATE ADVISORS INC.
PROJECT LOCATION	NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO
FIGURE NAME	POLYCHLORINATED BIPHENYLS IN SOIL
FIGURE NO.	13
SCALE	AS SHOWN
PROJECT NO.	296202.001
DATE	MARCH 2022



LEGEND

▨ SITE BUILDING
Ⓐ SITE BUILDING ID
T PAD MOUNTED TRANSFORMER
⊕ BOREHOLE (PINCHIN, MAY 2021)
⊕ MONITORING WELL (PINCHIN, MAY 2021)
Ⓟ PARKING
⊕ MONITORING WELL (PINCHIN, DEC. 2021)
⊗ BOREHOLE (PINCHIN, DEC. 2021)
⊕ MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)
▲ SURFACE SAMPLE (PINCHIN, DEC. 2021)
APEC AREA OF POTENTIAL ENVIRONMENTAL CONCERN
☐ APEC-2 ☐ APEC-3 ☐ APEC-7
○ MEETS TABLE 2 STANDARDS
○ EXCEEDS TABLE 2 STANDARDS

TABLE 2 STANDARDS

Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for All Types of Property Use and Medium/Fine-Textured Soils

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

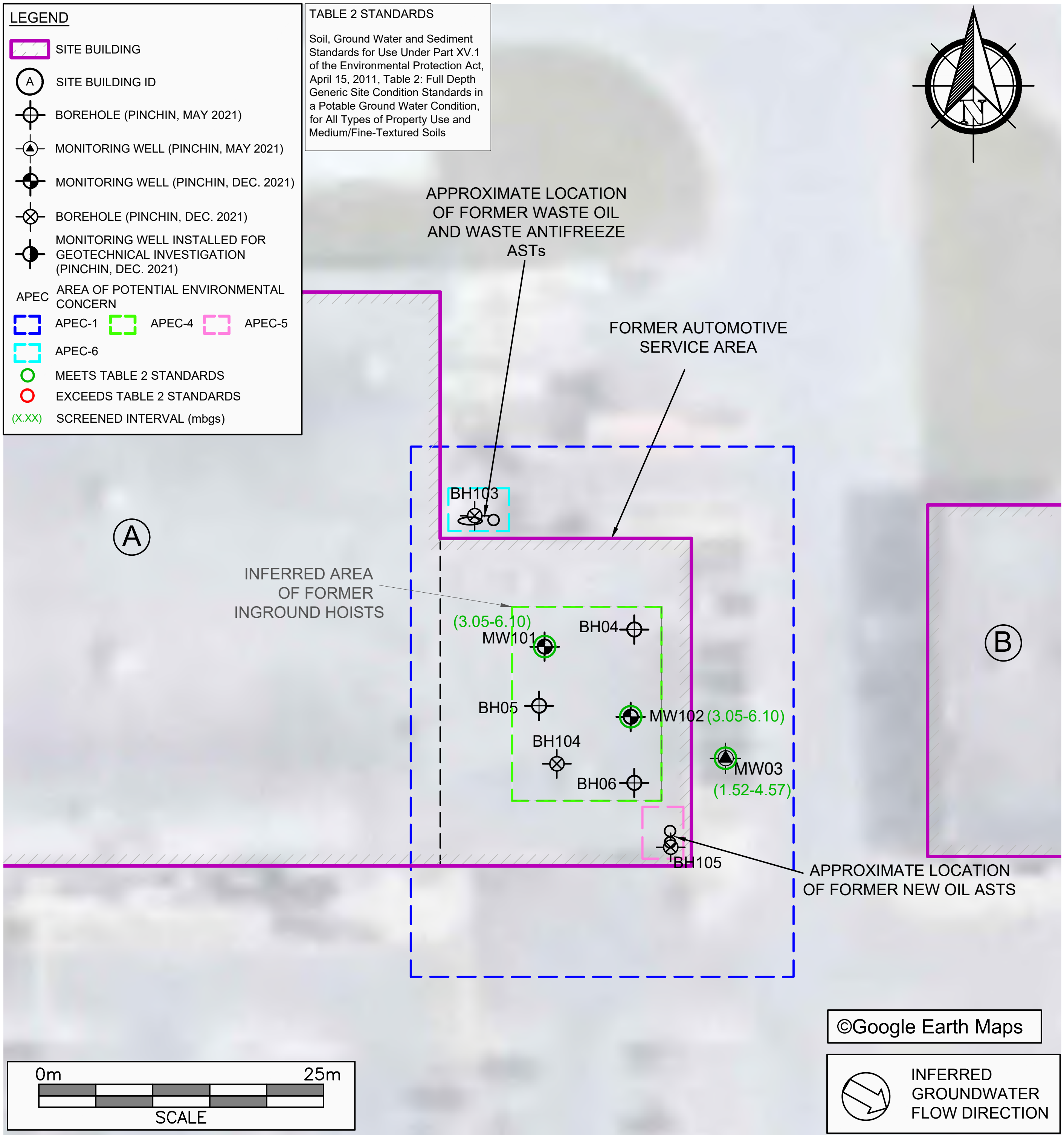
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PETROLEUM HYDROCARBONS
AND BTEX IN GROUNDWATER

FIGURE NO.
14A

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022



PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PETROLEUM HYDROCARBONS AND BTEX
IN GROUNDWATER-DETAILED PLAN

FIGURE NO.
14B

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022

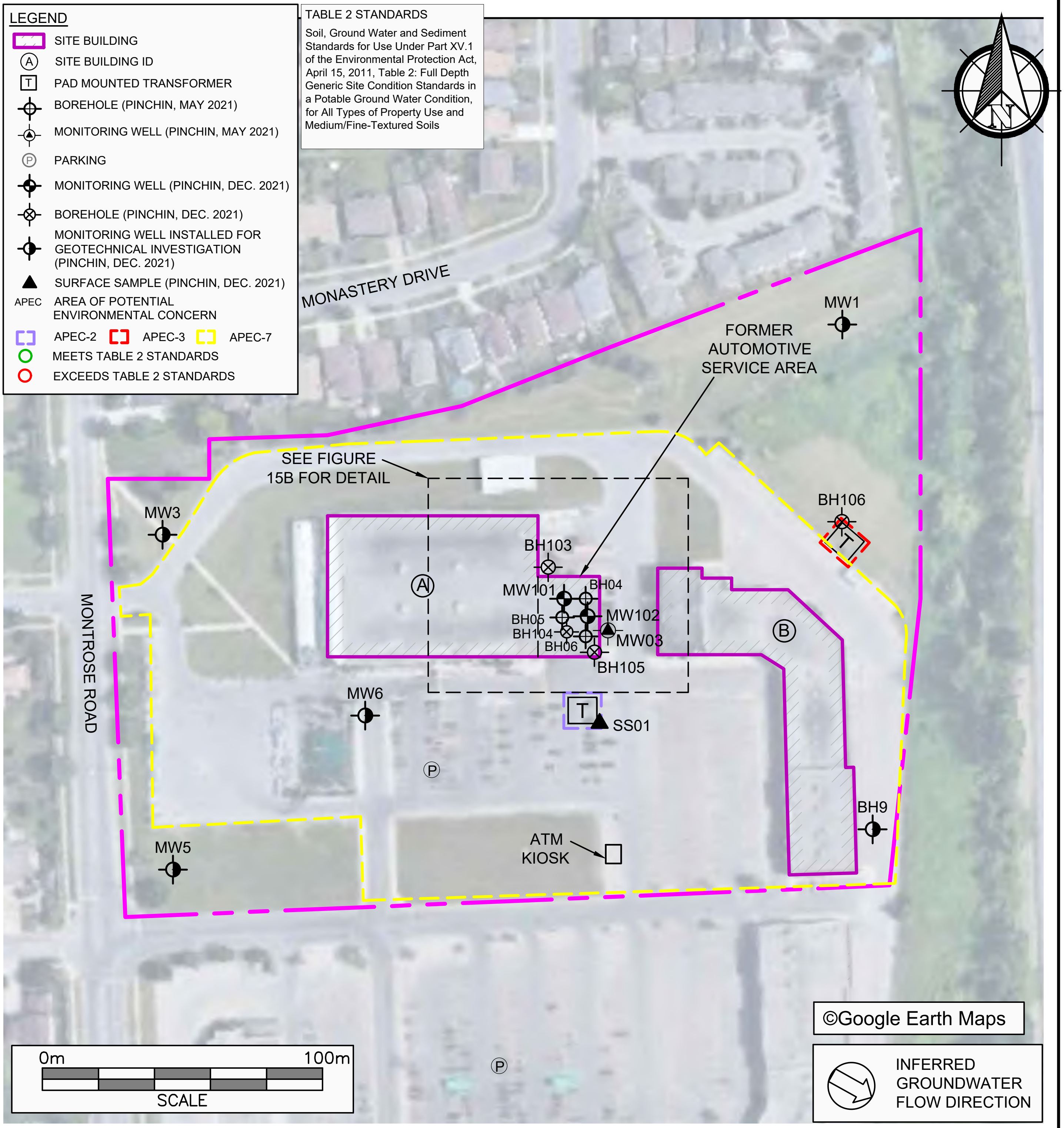


TABLE 2 STANDARDS

Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for All Types of Property Use and Medium/Fine-Textured Soils

PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

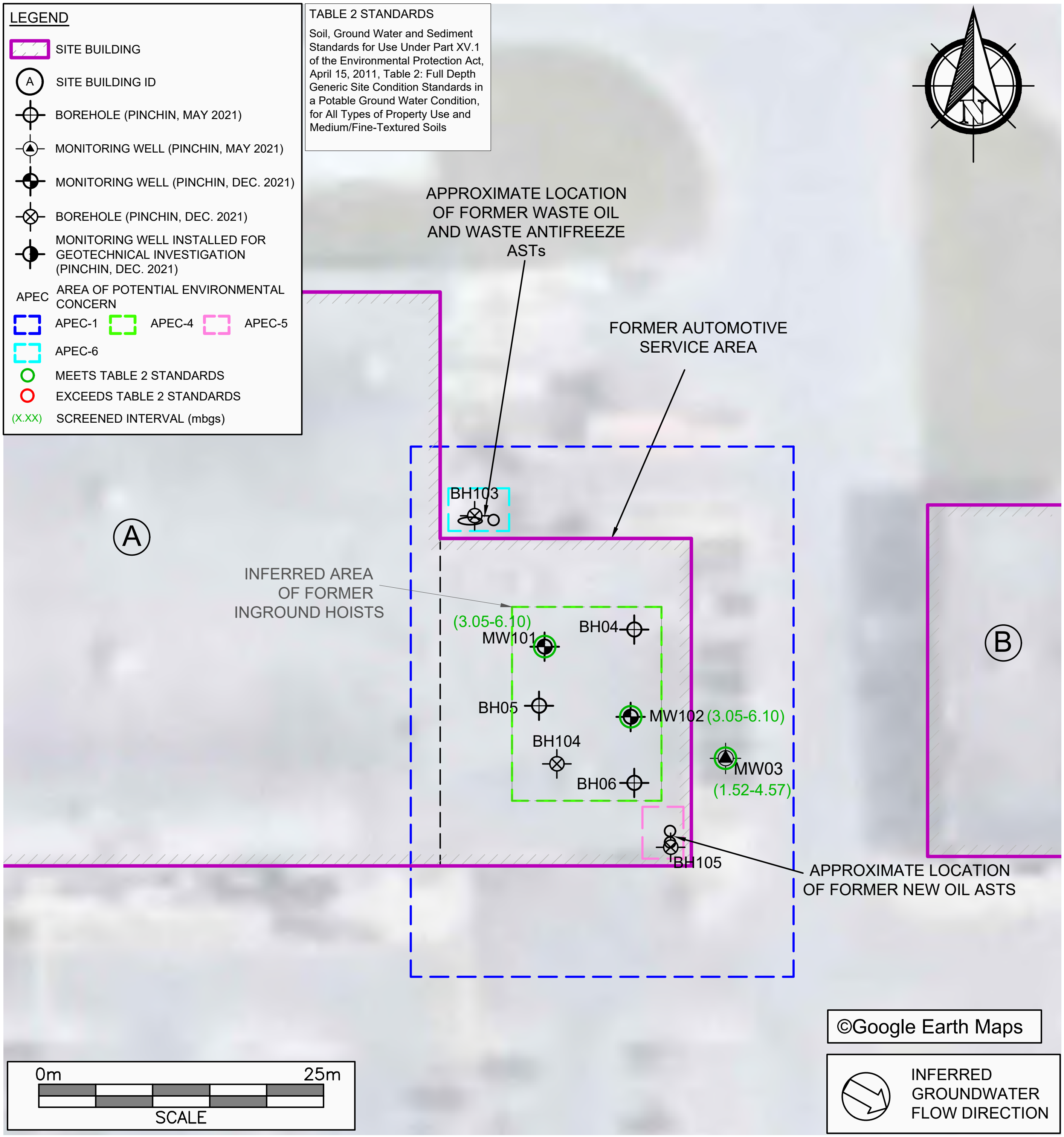
FIGURE NAME
VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER

FIGURE NO.
15A

SCALE
AS SHOWN

PROJECT NO.
296202.001

DATE
MARCH 2022



LEGEND

▨ SITE BUILDING

Ⓐ SITE BUILDING ID

⌖ BOREHOLE (PINCHIN, MAY 2021)

⌖ MONITORING WELL (PINCHIN, MAY 2021)

⌖ MONITORING WELL (PINCHIN, DEC. 2021)

⊗ BOREHOLE (PINCHIN, DEC. 2021)

⌖ MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)

APEC AREA OF POTENTIAL ENVIRONMENTAL CONCERN

⬚ APEC-1 ⬚ APEC-4 ⬚ APEC-5

⬚ APEC-6

○ MEETS TABLE 2 STANDARDS

○ EXCEEDS TABLE 2 STANDARDS

(X.XX) SCREENED INTERVAL (mbgs)

TABLE 2 STANDARDS

Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for All Types of Property Use and Medium/Fine-Textured Soils

PINCHIN

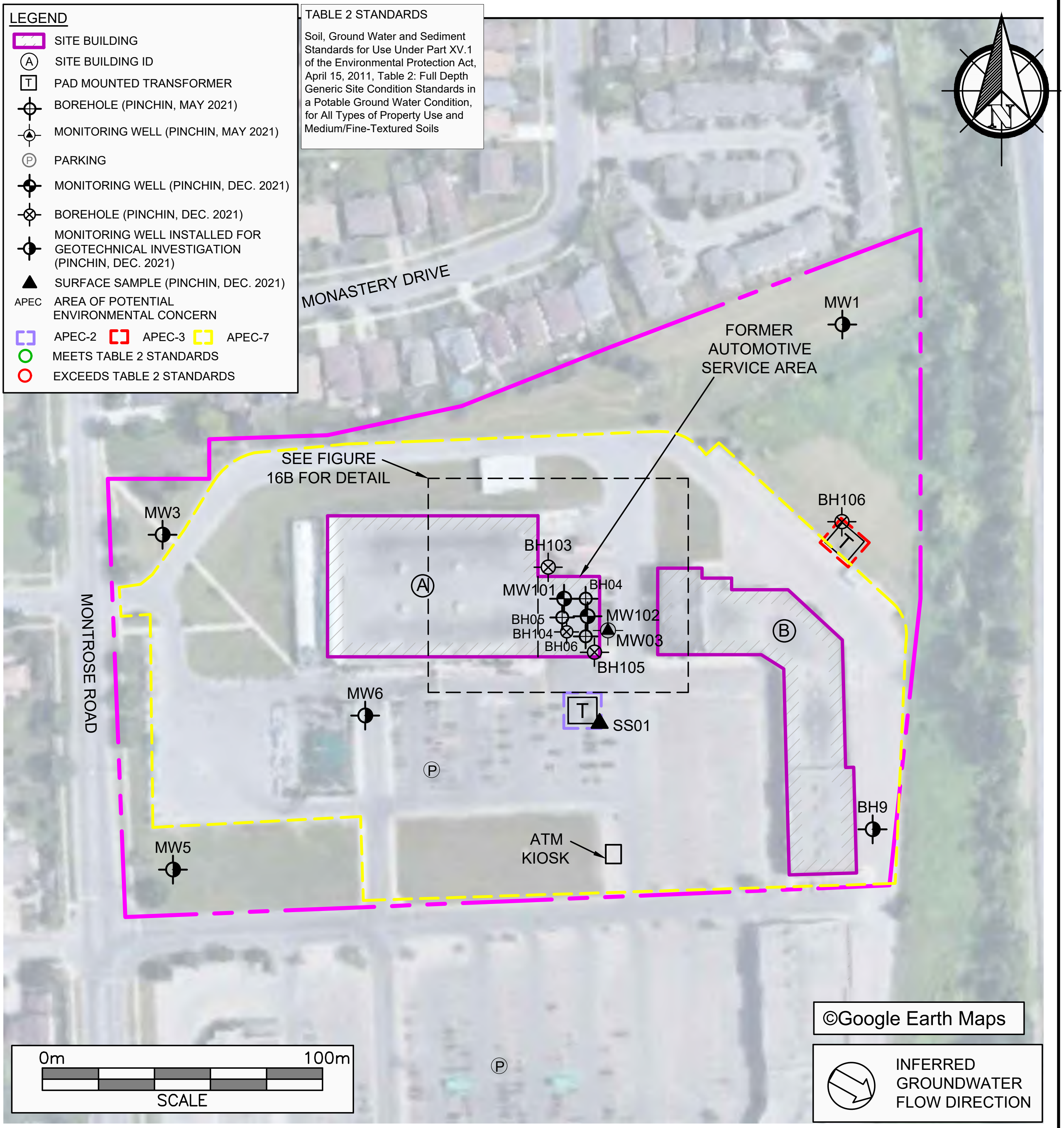
PROJECT NAME	PHASE TWO ENVIRONMENTAL SITE ASSESSMENT
CLIENT NAME	FOREST GATE ADVISORS INC.
PROJECT LOCATION	NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO
FIGURE NAME	VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER-DETAILED PLAN
FIGURE NO.	15B
SCALE	AS SHOWN
PROJECT NO.	296202.001
DATE	MARCH 2022

LEGEND

- ▨ SITE BUILDING
- Ⓐ SITE BUILDING ID
- T PAD MOUNTED TRANSFORMER
- ⊕ BOREHOLE (PINCHIN, MAY 2021)
- ⊕ MONITORING WELL (PINCHIN, MAY 2021)
- Ⓟ PARKING
- ⊕ MONITORING WELL (PINCHIN, DEC. 2021)
- ⊗ BOREHOLE (PINCHIN, DEC. 2021)
- ⊕ MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)
- ▲ SURFACE SAMPLE (PINCHIN, DEC. 2021)
- APEC AREA OF POTENTIAL ENVIRONMENTAL CONCERN
- ⬚ APEC-2 ⬚ APEC-3 ⬚ APEC-7
- ○ MEETS TABLE 2 STANDARDS
- ○ EXCEEDS TABLE 2 STANDARDS

TABLE 2 STANDARDS

Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for All Types of Property Use and Medium/Fine-Textured Soils



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INFERRED GROUNDWATER FLOW DIRECTION

PINCHIN

PROJECT NAME
PHASE TWO ENVIRONMENTAL SITE ASSESSMENT

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
POLYCYCLIC AROMATIC HYDROCARBONS
IN GROUNDWATER

FIGURE NO.
16A

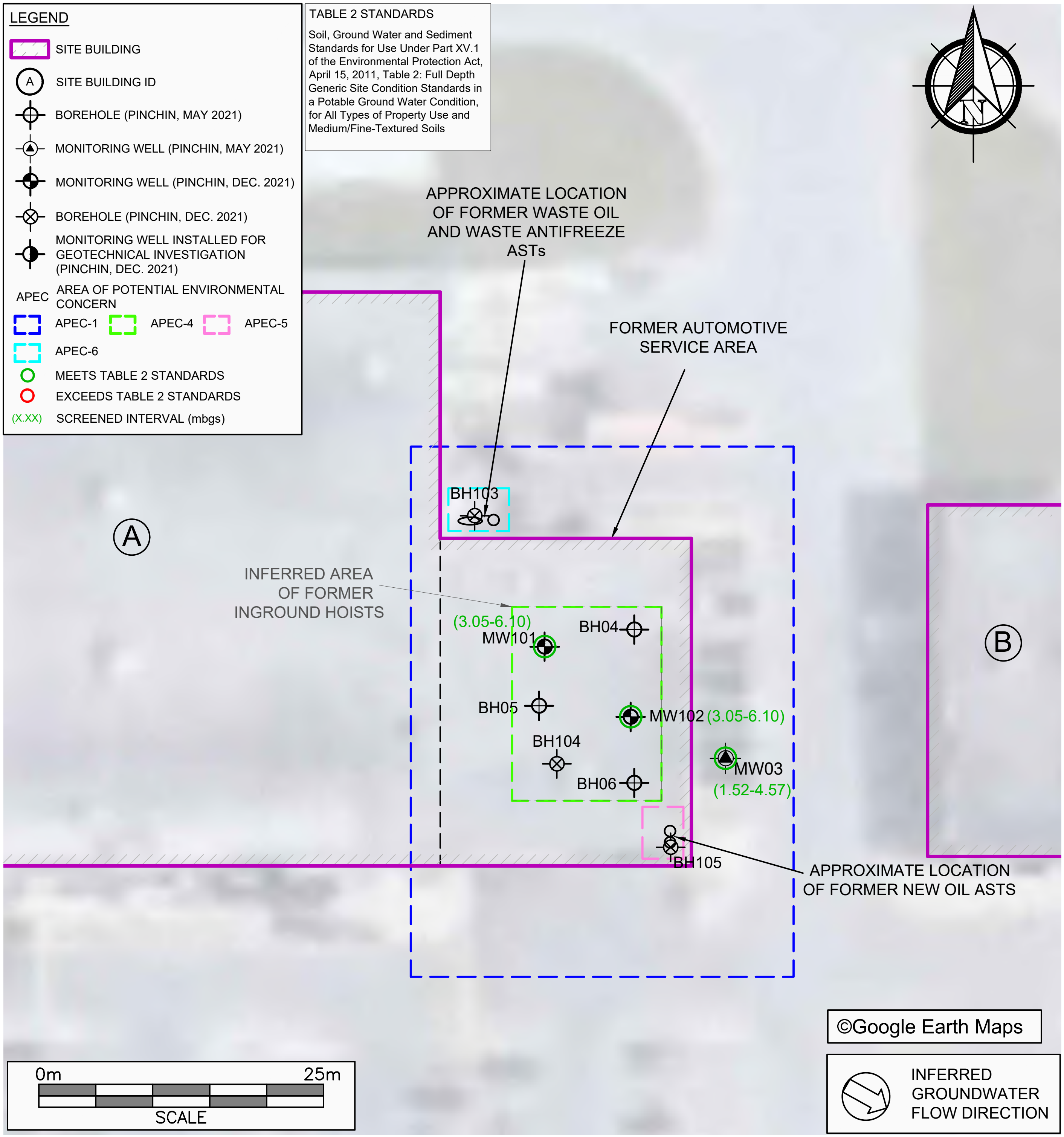
SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022

LEGEND

▨ SITE BUILDING
Ⓐ SITE BUILDING ID
⌖ BOREHOLE (PINCHIN, MAY 2021)
▲ MONITORING WELL (PINCHIN, MAY 2021)
◐ MONITORING WELL (PINCHIN, DEC. 2021)
⊗ BOREHOLE (PINCHIN, DEC. 2021)
● MONITORING WELL INSTALLED FOR GEOTECHNICAL INVESTIGATION (PINCHIN, DEC. 2021)
APEC AREA OF POTENTIAL ENVIRONMENTAL CONCERN
▭ APEC-1 ▭ APEC-4 ▭ APEC-5
▭ APEC-6
○ MEETS TABLE 2 STANDARDS
○ EXCEEDS TABLE 2 STANDARDS
(X.XX) SCREENED INTERVAL (mbgs)

TABLE 2 STANDARDS

Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for All Types of Property Use and Medium/Fine-Textured Soils



PROJECT NAME	PHASE TWO ENVIRONMENTAL SITE ASSESSMENT
CLIENT NAME	FOREST GATE ADVISORS INC.
PROJECT LOCATION	NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO
FIGURE NAME	POLYCYCLIC AROMATIC HYDROCARBONS IN GROUNDWATER-DETAILED PLAN
FIGURE NO.	16B

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	MARCH 2022

Table 1 - Table of Areas of Potential Environmental Concern

Area of Potential Environmental Concern[1]	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity[2]	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern[3]	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-1 (Historical automotive service and repair within east portion of Site Building A)	East portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	PHCs BTEX PAHs VOCs	Soil and Groundwater
APEC-2 (Transformer located south of the southeast portion of Site Building A)	South of southeast portion of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-3 (Transformer located northeast of Site Building B)	Northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-4 (Nine inground hydraulic hoists formerly located within the east portion of Site Building A)	Within the central portion of the automotive service centre, located within the east portion of Site Building A.	Other – Inground hydraulic hoists	On-Site	PHCs BTEX	Soil and Groundwater
APEC-5 (Two new oil ASTs formerly located within the southeast corner of Site Building A)	Southeast corner of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs BTEX PAHs	Soil
APEC-6 (Former waste oil and waste antifreeze ASTs located adjacent to the north exterior elevation of Site Building A)	Adjacent to the north exterior elevation of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs BTEX PAHs	Soil
APEC-7 (Road salting activities)	Paved, exterior portions of the Phase One property	Other – Road Salting Activities	On-Site	Electrical Conductivity SAR Na Cl-	Soil and Groundwater

Notes:

1 - Areas of potential environmental concern means the area on, in or under a phase one property where one or more contaminants are potentially present, as determined through the phase one environmental site assessment, including through,

(a) identification of past or present uses on, in or under the phase one property, and

(b) identification of potentially contaminating activity.

2 - Potentially contaminating activity means a use or activity set out in Column A of Table 2 of Schedule D that is occurring or has occurred in a phase one study area

3 - When completing this column, identify all contaminants of potential concern using the Method Groups as identified in the Protocol for in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, March 9, 2004, amended as of July 1, 2011, as specified below:

List of Method Groups:

ABNs	PCBs	Metals	Electrical Conductivity
CPs	PAHs	As, Sb, Se	Cr (VI)
1,4-Dioxane	THMs	Na	Hg
Dioxins/Furans, PCDDs/PCDFs	VOCs	B-HWS	Methyl Mercury
OCs	BTEX	Cl-	Low or high pH,
PHCs	Ca, Mg	CN-	SAR

4 - When submitting a record of site condition for filing, a copy of this table must be attached

Table 2 - Table of Potentially Contaminating Activities

PCA Designation	Location of Potentially Contaminating Activity	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Distance from Phase One Property (metres)	Location Relative to Inferred Groundwater Flow Direction[1]	Contributing to an APEC at the Site (Yes/No)	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
PCA-1	Historical automotive repair/service garage within the east portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	NA – On-Site PCA	NA - On-Site PCA	Yes	Soil and Groundwater
PCA-2	Transformer located south of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	NA – On-Site PCA	NA - On-Site PCA	Yes	Soil
PCA-3	Transformer located northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	NA – On-Site PCA	NA - On-Site PCA	Yes	Soil
PCA-4	Nine inground hydraulic hoists formerly located within the east portion of Site Building A.	Other – Inground hydraulic hoists.	On-Site	NA – On-Site PCA	NA – On-Site PCA	Yes	Soil and Groundwater
PCA-5	Two new oil ASTs formerly located within the southeast corner of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	NA – On-Site PCA	NA – On-Site PCA	Yes	Soil
PCA-6	Former waste oil and waste antifreeze ASTs located adjacent to the north exterior elevation of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	NA – On-Site PCA	NA – On-Site PCA	Yes	Soil
PCA-7	Road salting activities on exterior, paved portions of Phase One Property.	Other - Road Salting Activities	On-Site	NA – On-Site PCA	NA - On-Site PCA	Yes	Soil and Groundwater
PCA-8	Transformer located on the east-central portion of the property adjacent to the south of the Phase One Property (i.e., South Portion of 3770 Montrose Road).	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	85	Transgradient	No	Not Applicable
PCA-9	Transformer located on the southwest portion of the property adjacent to the south of the Phase One Property (i.e., South Portion of 3770 Montrose Road).	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	115	Transgradient	No	Not Applicable
PCA-10	Transformer located on the southeast portion of the property adjacent to the south of the Phase One Property (i.e., South Portion of 3770 Montrose Road).	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	150	Transgradient	No	Not Applicable

PCA-11	Transformer located at 3930 Montrose Road.	Item 55 - Transformer Manufacturing, Processing and Use	Off-Site	195	Transgradient	No	Not Applicable

Notes:

APEC – Area of Potential Environmental Concern

PCA – Potentially Contaminating Activity

1 – Location of PCA relative to the Phase One Property in relation to the inferred groundwater flow direction in the Phase One Study Area

TABLE 3

SOIL ANALYTICAL RESULTS

Forest Gate Advisors Inc.

North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Sample Location	**MECP Table 2 SCS (R/P/I-F)**	MW03	BH04	BH05	BH06	SS01	MW101	MW101	MW102	BH103	BH104	BH104	BH104	BH105	BH106	BH106	BH106	BH106	BH106	TRIP BLANK
Sample Designation		MW03-2	BH04-1	BH05-4	BH06-1	SS01	MW101-7	MW101-7 Lab Dup	MW102-3	BH103-1	BH104-2	BH104-3	DUP09	BH105-1	BH106-1	DUP16	DUP16 Lab Dup	BH106-2	BH106-2 Lab Dup	TRIP BLANK #1
Sample Collection Date (dd/mm/yyyy)		25/05/2021	26/05/2021	26/05/2021	26/05/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021	06/12/2021	07/12/2021	07/12/2021	07/12/2021	07/12/2021	07/12/2021	-
Laboratory Certificate No.		R6660476	R6660476	R6660476	R6660476	R6948411	R6948411	R6948411	R6948411	R6948411	C200820	R6948411	R6948411	R6948411	R6948411	R6948411	R6948411	C200820	C200820	R6948411
Date of Laboratory Analysis (dd/mm/yyyy-dd/mm/yyyy)		28/05/2021-02/06/2021	28/05/2021-02/06/2021	28/05/2021-02/06/2021	28/05/2021-02/06/2021	11/12/2021-14/12/2021	11/12/2021-13/12/2021	11/12/2021-13/12/2021	11/12/2021-14/12/2021	14/12/2021-21/12/2021	10/01/2022	11/12/2021-18/12/2021	11/12/2021-14/12/2021	11/12/2021-14/12/2021	11/12/2021-14/12/2021	11/12/2021-14/12/2021	14/12/2021	10/01/2022	10/01/2022	15/12/2021-30/12/2021
Laboratory Sample No.		PRH815	PRH816	PRH817	PRH818	RHO488	RHO489	RHO489 Dup	RHO490	RHO491	AMT013-01	RHO492	RHO493	RHO494	RHO495	RHO496	RHO496 Dup	AMT014-01	DUP AMT014-01	RHO498
Sample Depth (mbgs)		0.76 - 1.37	0.30 - 0.61	1.83 - 2.44	0.30 - 0.61	0 - 0.30	4.57 - 5.18	4.57 - 5.18	2.29 - 3.05	0.21 - 1.52	1.52 - 2.29	2.29 - 3.05	2.29 - 3.05	0.21 - 1.22	0 - 0.76	0 - 0.76	0 - 0.76	0.76 - 1.52	0.76 - 1.52	-
Miscellaneous Parameters																				
pH (pH Units)	NV	6.42	-	-	-	7.18	7.94	-	-	-	-	7.90	-	-	7.35	-	-	-	-	-
Sieve #200 <0.075 mm (%)	NV	-	-	-	-	-	-	-	-	-	98.1	-	-	-	-	-	-	96.7	96.0	-
Sieve #200 >0.075 mm (%)	NV	-	-	-	-	-	-	-	-	-	1.9	-	-	-	-	-	-	3.3	4.0	-
Soil Texture	NV	-	-	-	-	-	-	-	-	-	FINE	-	-	-	-	-	-	FINE	FINE	-
Petroleum Hydrocarbons (PHCs)													-							
PHCs F1 (C_6 - C_{10})	65	<10	<10	<10	<10	<10	-	<10	<10	<10	-	<10	<20	<10	<10	-	-	-	-	-
PHCs F2 (>C_{10} - C_{16})	150	<10	<10	<10	13	<10	-	-	<10	<10	-	<10	<10	<10	<10	-	-	-	-	-
PHCs F3 (>C_{16} - C_{34})	1300	<50	<50	<50	440	55	-	-	<50	<50	-	<50	<50	<50	<50	-	-	-	-	-
PHCs F4 (>C_{34} - C_{50})	5600	<50	<50	<50	140	<50	-	-	<50	<50	-	<50	<50	<50	<50	-	-	-	-	-
Volatile Organic Compounds																				
Acetone	28	<0.50	<0.50	<0.50	<0.50	-	<0.49	<0.49	<0.49	<0.49	-	<0.49	<0.98	<0.49	-	-	-	-	-	<0.49
Benzene	0.17	<0.020	<0.020	<0.020	<0.020	-	<0.0060	<0.0060	<0.0060	0.0062	-	<0.0060	<0.012	<0.0060	-	-	-	-	-	<0.0060
Bromodichloromethane	1.9	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Bromoform	0.26	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Bromomethane	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	**<0.080**	<0.040	-	-	-	-	-	<0.040
Carbon Tetrachloride	0.12	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Chlorobenzene	2.7	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Chloroform	0.18	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Dibromochloromethane	2.9	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,2-Dichlorobenzene	1.7	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,3-Dichlorobenzene	6	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,4-Dichlorobenzene	0.097	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Dichlorodifluoromethane	25	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,1-Dichloroethane	0.6	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,2-Dichloroethane	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.049	<0.049	<0.049	<0.049	-	<0.049	**<0.080**	<0.049	-	-	-	-	-	<0.049
1,1-Dichloroethylene	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	**<0.080**	<0.040	-	-	-	-	-	<0.040
cis-1,2-Dichloroethylene	2.5	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
trans-1,2-Dichloroethylene	0.75	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,2-Dichloropropane	0.085	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,3-Dichloropropene (Total)	0.081	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	-	<0.050	**<0.10**	<0.050	-	-	-	-	-	<0.050
Ethylbenzene	1.6	<0.020	<0.020	<0.020	<0.020	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.020	<0.010	-	-	-	-	-	<0.010
Ethylene Dibromide	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	**<0.080**	<0.040	-	-	-	-	-	<0.040
Hexane	34	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Methyl Ethyl Ketone	44	<0.50	<0.50	<0.50	<0.50	-	<0.40	<0.40	<0.40	<0.40	-	<0.40	<0.80	<0.40	-	-	-	-	-	<0.40
Methyl Isobutyl Ketone	4.3	<0.50	<0.50	<0.50	<0.50	-	<0.40	<0.40	<0.40	<0.40	-	<0.40	<0.80	<0.40	-	-	-	-	-	<0.40
Methyl t-Butyl Ether (MTBE)	1.4	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Methylene Chloride	0.96	<0.050	<0.050	<0.050	<0.050	-	<0.049	<0.049	<0.049	<0.049	-	<0.049	<0.098	<0.049	-	-	-	-	-	<0.049
Styrene	2.2	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,1,1,2-Tetrachloroethane	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	**<0.080**	<0.040	-	-	-	-	-	<0.040
1,1,2,2-Tetrachloroethane	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	**<0.080**	<0.040	-	-	-	-	-	<0.040
Tetrachloroethylene	2.3	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Toluene	6	<0.050	<0.050	<0.050	<0.050	-	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.040	<0.020	-	-	-	-	-	<0.020
1,1,1-Trichloroethane	3.4	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
1,1,2-Trichloroethane	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	**<0.080**	<0.040	-	-	-	-	-	<0.040
Trichloroethylene	0.52	<0.050	<0.050	<0.050	<0.050	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.020	<0.010	-	-	-	-	-	0.027
Trichlorofluoromethane	5.8	<0.050	<0.050	<0.050	<0.050	-	<0.040	<0.040	<0.040	<0.040	-	<0.040	<0.080	<0.040	-	-	-	-	-	<0.040
Vinyl Chloride	0.022	<0.020	<0.020	<0.020	<0.020	-	<0.019	<0.019	<0.019	<0.019	-	<0.019	**<0.038**	<0.019	-	-	-	-	-	<0.019
Xylenes (Total)	25	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.020	<0.020	<0.020	-	<0.020	<0.040	<0.020	-	-	-	-	-	<0.020
Polycyclic Aromatic Hydrocarbons																				
Acenaphthene	29	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Acenaphthylene	0.17	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Anthracene	0.74	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Benzo(a)anthracene	0.63	<0.0050	<0.0050	<0.0050	0.0073	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Benzo(a)pyrene	0.3	<0.0050	<0.0050	<0.0050	0.0077	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Benzo(b)fluoranthene	0.78	<0.0050	0.0076	<0.0050	0.012	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Benzo(ghi)perylene	7.8	<0.0050	<0.0050	<0.0050	0.0060	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Benzo(k)fluoranthene	0.78	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Chrysene	7.8	<0.0050	<0.0050	<0.0050	0.0080	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Dibenzo(a,h)anthracene	0.1	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Fluoranthene	0.69	<0.0050	0.0087	<0.0050	0.017	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Fluorene	69	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	0.48	<0.0050	<0.0050	<0.0050	0.0052	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
1- & 2-Methylnaphthalene	3.4	<0.0071	<0.0071	<0.0071	<0.0071	-	<0.0071	-	<0.0071	<0.0071	-	<0.0071	<0.0071	<0.0071	-	-	-	-	-	-
Naphthalene	0.75	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Phenanthrene	7.8	<0.0050	0.0052	<0.0050	0.0077	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Pyrene	78	<0.0050	0.0075	<0.0050	0.015	-	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-
Polychlorinated Biphenyls (PCBs)																				
PCBs (Total)	0.35	-	-	-	-	<0.010	-	-	-	-	-	-	-	-	<0.010	0.014	<0.010	-	-	-

Notes:
MECP Table 2 SCS (R/P/I-F):
Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for Residential/Parkland/Institutional Property Use and Medium/Fine-Textured Soils

BOLD	Exceeds SCS
BOLD	Reportable Detection Limit Exceeds SCS
Units	All units in micrograms per gram, unless otherwise noted
mbgs	metres below ground surface
NA	Not Applicable
NV	No Value

TABLE 4

GROUNDWATER MONITORING WELL ELEVATIONS AND CONSTRUCTION DETAILS

Forest Gate Advisors Inc.

North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Monitoring Well	Top of Pipe Elevation (mamsl)	Ground Surface Elevation (mamsl)	Well Construction Details						
			Total Well Depth (mbgs)	Stick-Up Height (metres)	Well Diameter (centimetres)	Screen Slot Size	Monitoring Well Screen Interval (mbgs)	Screen length (metres)	Sealant thickness (metres)
MW101	194.817	194.947	6.10	-0.13	5.08	010	3.05 - 6.10	3.05	2.74
MW102	194.847	194.947	6.10	-0.10	5.08	010	3.05 - 6.10	3.05	2.74
MW03	194.575	194.764	4.57	-0.19	5.08	010	1.52 - 4.57	3.05	1.22
MW1	194.936	194.176	6.10	0.76	5.08	010	3.05 - 6.10	3.05	2.74
MW3	195.516	194.676	6.10	0.84	5.08	010	3.05 - 6.10	3.05	2.74
MW5	194.945	194.065	6.10	0.88	5.08	010	3.05 - 6.10	3.05	2.74
MW6	194.549	194.685	6.10	-0.14	5.08	010	3.05 - 6.10	3.05	2.74
BH9	194.535	194.609	6.10	-0.07	5.08	010	3.05 - 6.10	3.05	2.74

Notes:

mamsl	metres above mean sea level
mbgs	metres below ground surface

TABLE 5
GROUNDWATER MONITORING DATA
Forest Gate Advisors Inc.
North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Monitoring Well	Monitoring Well Screen Interval (mbgs)	Top of Pipe Elevation (mamsl)	Ground Surface Elevation (mamsl)	Stick-Up Height (metres)	Date of Monitoring (dd/mm/yyyy)	Measured Depth to Groundwater from Top of Pipe (mbtop)	Calculated Depth to Groundwater from Surface (mbgs)	Groundwater Elevation (mamsl)	Visual / Olfactory Observations
MW101	3.05 - 6.10	194.817	194.947	-0.13	04/01/2022	2.44	2.57	192.38	No sheen or odours
					05/01/2022	2.45	2.58	192.37	No sheen or odours
					06/01/2022	2.48	2.61	192.34	No sheen or odours
					12/01/2022	2.53	2.66	192.29	No sheen or odours
MW102	3.05 - 6.10	194.847	194.947	-0.10	04/01/2022	2.47	2.57	192.38	No sheen or odours
					05/01/2022	2.46	2.56	192.39	No sheen or odours
					06/01/2022	2.52	2.62	192.33	No sheen or odours
					12/01/2022	2.55	2.65	192.30	No sheen or odours
MW03	1.52 - 4.57	194.575	194.764	-0.19	04/01/2022	2.25	2.44	192.33	No sheen or odours
					12/01/2022	2.24	2.43	192.34	No sheen or odours
MW1	3.05 - 6.10	194.936	194.176	0.76	12/01/2022	2.09	1.33	192.85	No sheen or odours
MW3	3.05 - 6.10	195.516	194.676	0.84	12/01/2022	2.49	1.65	193.03	No sheen or odours
MW5	3.05 - 6.10	194.945	194.065	0.88	12/01/2022	2.90	2.02	192.05	No sheen or odours
MW6	3.05 - 6.10	194.549	194.685	-0.14	12/01/2022	2.53	2.67	192.02	No sheen or odours
BH9	3.05 - 6.10	194.535	194.609	-0.07	12/01/2022	2.95	3.02	191.59	No sheen or odours

Notes:

mamsl	metres above mean sea level
mbgs	metres below ground surface
mbtop	metres below top of pipe
NM	Not Measured

	Calculated Depth to Groundwater from Surface (mbgs)	Groundwater Elevation (mamsl)
Minimum =	1.33	191.59
Maximum =	3.02	193.03

TABLE 6

GROUNDWATER MONITORING - NON-AQUEOUS PHASE LIQUIDS

Forest Gate Advisors Inc.

North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Monitoring Well	Top of Pipe Elevation (mamsl)	Date of Monitoring (dd/mm/yyyy)	LNAPL					DNAPL				
			Measured Depth to Bottom of LNAPL from Top of Pipe (metres)	Measured Depth to Top of LNAPL from Top of Pipe (metres)	LNAPL Thickness (metres)	Top of LNAPL Elevation (mamsl)	Bottom of LNAPL Elevation (mamsl)	Measured Depth to Bottom of DNAPL from Top of Pipe (metres)	Measured Depth to Top of DNAPL from Top of Pipe (metres)	DNAPL Thickness (metres)	Top of DNAPL Elevation (mamsl)	Bottom of DNAPL Elevation (mamsl)
MW101	194.82	04/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		05/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		06/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW102	194.85	04/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		05/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		06/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW03	194.58	04/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW1	194.94	12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW3	195.52	12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW5	194.95	12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW6	194.55	12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BH9	194.54	12/01/2022	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

DNAPL	Dense Non-Aqueous Phase Liquid
LNAPL	Light Non-Aqueous Phase Liquid
mamsl	Metres Above Mean Sea Level
mbgs	Metres Below Ground Surface
ND	Not Detected

TABLE 7
GROUNDWATER ANALYTICAL RESULTS
Forest Gate Advisors Inc.
North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Sample Location	**MECP Table 2 SCS (F)**	MW03	MW03	MW101	MW102	MW102	MW102	TRIP BLANK
Sample Designation		MW03	MW03	MW101	MW102	MW102 Lab Dup	DUP999	TBLK-VOC/F1BTEX-21-3719
Sample Collection Date (dd/mm/yyyy)		04/06/2021	12/01/2022	12/01/2022	12/01/2022	12/01/2022	12/01/2022	-
Laboratory Certificate No.		R6667488	R6969932	R6969932	R6969932	R6969932	R6969932	R6969932
Date of Laboratory Analysis (dd/mm/yyyy)		08/06/2021	18/01/2022-20/01/2022	18/01/2022-20/01/2022	18/01/2022-20/01/2022	18/01/2022	18/01/2022-20/01/2022	19/01/2022-20/01/2022
Laboratory Sample No.		PTP794	RPV429	RPV426	RPV427	RPV427 Dup	RPV428	RPV430
Well Screen Depth Interval (mbgs)		1.52 - 4.57	1.52 - 4.57	3.05 - 6.10	3.05 - 6.10	3.05 - 6.10	3.05 - 6.10	-
Petroleum Hydrocarbons (PHCs)								
PHCs F1 (C_6 - C_{10})	750	<25	<25	<25	<25	<25	<25	-
PHCs F2 (>C_{10} - C_{16})	150	<100	<100	<100	<100	-	<100	-
PHCs F3 (>C_{16} - C_{34})	500	<200	<200	<200	<200	-	<200	-
PHCs F4 (>C_{34} - C_{50})	500	<200	<200	<200	<200	-	<200	-
Volatile Organic Compounds								
Acetone	2700	14	<10	<10	<10	<10	<10	<10
Benzene	5	<0.20	<0.17	<0.17	<0.17	<0.17	<0.17	<0.20
Bromodichloromethane	16	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bromoform	25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	0.89	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Carbon Tetrachloride	5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.19
Chlorobenzene	30	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Chloroform	22	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Dibromochloromethane	25	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	3	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.40
1,3-Dichlorobenzene	59	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.40
1,4-Dichlorobenzene	1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.40
Dichlorodifluoromethane	590	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,2-Dichloroethane	5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.49
1,1-Dichloroethylene	14	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
cis-1,2-Dichloroethylene	17	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethylene	17	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	5	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,3-Dichloropropene (Total)	0.5	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50
Ethylbenzene	2.4	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Ethylene Dibromide	0.2	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.19
Hexane	520	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl Ethyl Ketone	1800	<10	<10	<10	<10	<10	<10	<10
Methyl Isobutyl Ketone	640	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Methyl t-Butyl Ether (MTBE)	15	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene Chloride	50	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Styrene	5.4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.40
1,1,1,2-Tetrachloroethane	1.1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.40
Tetrachloroethylene	17	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	24	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,1-Trichloroethane	200	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,1,2-Trichloroethane	5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.40
Trichloroethylene	5	0.72	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Trichlorofluoromethane	150	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Vinyl Chloride	1.7	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Xylenes (Total)	300	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	4.1	<0.050	<0.050	<0.0050	<0.0050	-	<0.050	-
Acenaphthylene	1	<0.050	<0.050	<0.0050	<0.0050	-	<0.050	-
Anthracene	2.4	<0.050	<0.050	<0.0050	<0.0050	-	<0.050	-
Benzo(a)anthracene	1	<0.050	<0.050	<0.0050	<0.0050	-	<0.050	-
Benzo(a)pyrene	0.01	<0.0090	<0.0090	<0.0090	<0.0090	-	<0.0090	-
Benzo(b)fluoranthene	0.1	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Benzo(ghi)perylene	0.2	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Benzo(k)fluoranthene	0.1	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Chrysene	0.1	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Dibenzo(a,h)anthracene	0.2	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Fluoranthene	0.41	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Fluorene	120	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Indeno(1,2,3-cd)pyrene	0.2	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
1- & 2-Methylnaphthalene	3.2	<0.071	<0.071	<0.071	<0.071	-	<0.071	-
Naphthalene	11	<0.050	0.050	0.064	0.066	-	0.062	-
Phenanthrene	1	0.089	<0.030	<0.030	0.031	-	0.034	-
Pyrene	4.1	<0.050	<0.050	<0.050	<0.050	-	<0.050	-

Notes:

MECP Table 2 SCS (F):

Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act, April 15, 2011, Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition, for All Types of Property Use and Medium/Fine-Textured Soils

BOLD	Exceeds SCS
BOLD	Reportable Detection Limit Exceeds SCS
Units	All units in micrograms per litre, unless otherwise noted
mbgs	metres below ground surface
NA	Not Applicable

TABLE 8

MAXIMUM CONCENTRATIONS IN SOIL

Forest Gate Advisors Inc.

North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Parameter	Maximum Concentration	MECP Table 2 SCS (R/P/I-F)	Sample Designation	Sample Location	Sample Depth (mbgs)
Petroleum Hydrocarbons (PHCs)					
PHCs F1 (C_6 - C_{10})	<20	65	DUP09	BH104	2.29 - 3.05
PHCs F2 ($>C_{10}$ - C_{16})	13	150	BH06-1	BH06	0.30 - 0.61
PHCs F3 ($>C_{16}$ - C_{34})	440	1300	BH06-1	BH06	0.30 - 0.61
PHCs F4 ($>C_{34}$ - C_{50})	140	5600	BH06-1	BH06	0.30 - 0.61
Volatile Organic Compounds					
Acetone	<0.98	28	DUP09	BH104	2.29 - 3.05
Benzene	<0.020	0.17	Multiple Samples	Multiple Samples	Multiple Samples
Bromodichloromethane	<0.080	1.9	DUP09	BH104	2.29 - 3.05
Bromoform	<0.080	0.26	DUP09	BH104	2.29 - 3.05
Bromomethane	<0.080	0.05	DUP09	BH104	2.29 - 3.05
Carbon Tetrachloride	<0.080	0.12	DUP09	BH104	2.29 - 3.05
Chlorobenzene	<0.080	2.7	DUP09	BH104	2.29 - 3.05
Chloroform	<0.080	0.18	DUP09	BH104	2.29 - 3.05
Dibromochloromethane	<0.080	2.9	DUP09	BH104	2.29 - 3.05
1,2-Dichlorobenzene	<0.080	1.7	DUP09	BH104	2.29 - 3.05
1,3-Dichlorobenzene	<0.080	6	DUP09	BH104	2.29 - 3.05
1,4-Dichlorobenzene	<0.080	0.097	DUP09	BH104	2.29 - 3.05
Dichlorodifluoromethane	<0.080	25	DUP09	BH104	2.29 - 3.05
1,1-Dichloroethane	<0.080	0.6	DUP09	BH104	2.29 - 3.05
1,2-Dichloroethane	<0.080	0.05	DUP09	BH104	2.29 - 3.05
1,1-Dichloroethylene	<0.080	0.05	DUP09	BH104	2.29 - 3.05
cis-1,2-Dichloroethylene	<0.080	2.5	DUP09	BH104	2.29 - 3.05
trans-1,2-Dichloroethylene	<0.080	0.75	DUP09	BH104	2.29 - 3.05
1,2-Dichloropropane	<0.080	0.085	DUP09	BH104	2.29 - 3.05
1,3-Dichloropropene (Total)	<0.10	0.081	DUP09	BH104	2.29 - 3.05
Ethylbenzene	<0.020	1.6	Multiple Samples	Multiple Samples	Multiple Samples
Ethylene Dibromide	<0.080	0.05	DUP09	BH104	2.29 - 3.05
Hexane	<0.080	34	DUP09	BH104	2.29 - 3.05
Methyl Ethyl Ketone	<0.80	44	DUP09	BH104	2.29 - 3.05
Methyl Isobutyl Ketone	<0.80	4.3	DUP09	BH104	2.29 - 3.05
Methyl t-Butyl Ether (MTBE)	<0.080	1.4	DUP09	BH104	2.29 - 3.05
Methylene Chloride	<0.098	0.96	DUP09	BH104	2.29 - 3.05
Styrene	<0.080	2.2	DUP09	BH104	2.29 - 3.05
1,1,1,2-Tetrachloroethane	<0.080	0.05	DUP09	BH104	2.29 - 3.05
1,1,2,2-Tetrachloroethane	<0.080	0.05	DUP09	BH104	2.29 - 3.05
Tetrachloroethylene	<0.080	2.3	DUP09	BH104	2.29 - 3.05
Toluene	<0.050	6	Multiple Samples	Multiple Samples	Multiple Samples
1,1,1-Trichloroethane	<0.080	3.4	DUP09	BH104	2.29 - 3.05
1,1,2-Trichloroethane	<0.080	0.05	DUP09	BH104	2.29 - 3.05
Trichloroethylene	<0.050	0.52	Multiple Samples	Multiple Samples	Multiple Samples
Trichlorofluoromethane	<0.080	5.8	DUP09	BH104	2.29 - 3.05
Vinyl Chloride	<0.038	0.022	DUP09	BH104	2.29 - 3.05
Xylenes (Total)	<0.040	25	DUP09	BH104	2.29 - 3.05
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	<0.0050	29	Multiple Samples	Multiple Samples	Multiple Samples
Acenaphthylene	<0.0050	0.17	Multiple Samples	Multiple Samples	Multiple Samples
Anthracene	<0.0050	0.74	Multiple Samples	Multiple Samples	Multiple Samples
Benzo(a)anthracene	0.0073	0.63	BH06-1	BH06	0.30 - 0.61
Benzo(a)pyrene	0.0077	0.3	BH06-1	BH06	0.30 - 0.61
Benzo(b)fluoranthene	0.012	0.78	BH06-1	BH06	0.30 - 0.61
Benzo(ghi)perylene	0.0060	7.8	BH06-1	BH06	0.30 - 0.61
Benzo(k)fluoranthene	<0.0050	0.78	Multiple Samples	Multiple Samples	Multiple Samples
Chrysene	0.0080	7.8	BH06-1	BH06	0.30 - 0.61
Dibenzo(a,h)anthracene	<0.0050	0.1	Multiple Samples	Multiple Samples	Multiple Samples
Fluoranthene	0.017	0.69	BH06-1	BH06	0.30 - 0.61
Fluorene	<0.0050	69	Multiple Samples	Multiple Samples	Multiple Samples
Indeno(1,2,3-cd)pyrene	0.0052	0.48	BH06-1	BH06	0.30 - 0.61
1- & 2-Methylnaphthalene	<0.0071	3.4	Multiple Samples	Multiple Samples	Multiple Samples
Naphthalene	<0.0050	0.75	Multiple Samples	Multiple Samples	Multiple Samples
Phenanthrene	0.0077	7.8	BH06-1	BH06	0.30 - 0.61
Pyrene	0.015	78	BH06-1	BH06	0.30 - 0.61
Polychlorinated Biphenyls (PCBs)					
PCBs (Total)	0.014	0.35	DUP16	BH106	0 - 0.76

Notes:

Units	All units in micrograms per gram, unless otherwise noted
mbgs	metres below ground surface

TABLE 9
MAXIMUM CONCENTRATIONS IN GROUNDWATER
Forest Gate Advisors Inc.
North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Parameter	Maximum Concentration	MECP Table 2 SCS (F)	Sample Designation	Sample Location	Sample Depth (mbgs)
Petroleum Hydrocarbons (PHCs)					
PHCs F1 (C_6 - C_{10})	<25	750	Multiple Samples	Multiple Samples	Multiple Samples
PHCs F2 (>C_{10} - C_{16})	<100	150	Multiple Samples	Multiple Samples	Multiple Samples
PHCs F3 (>C_{16} - C_{34})	<200	500	Multiple Samples	Multiple Samples	Multiple Samples
PHCs F4 (>C_{34} - C_{50})	<200	500	Multiple Samples	Multiple Samples	Multiple Samples
Volatile Organic Compounds					
Acetone	14	2700	MW03	MW03	1.52 - 4.57
Benzene	<0.20	5	Multiple Samples	Multiple Samples	Multiple Samples
Bromodichloromethane	<0.50	16	Multiple Samples	Multiple Samples	Multiple Samples
Bromoform	<1.0	25	Multiple Samples	Multiple Samples	Multiple Samples
Bromomethane	<0.50	0.89	Multiple Samples	Multiple Samples	Multiple Samples
Carbon Tetrachloride	<0.20	5	Multiple Samples	Multiple Samples	Multiple Samples
Chlorobenzene	<0.20	30	Multiple Samples	Multiple Samples	Multiple Samples
Chloroform	<0.20	22	Multiple Samples	Multiple Samples	Multiple Samples
Dibromochloromethane	<0.50	25	Multiple Samples	Multiple Samples	Multiple Samples
1,2-Dichlorobenzene	<0.50	3	Multiple Samples	Multiple Samples	Multiple Samples
1,3-Dichlorobenzene	<0.50	59	Multiple Samples	Multiple Samples	Multiple Samples
1,4-Dichlorobenzene	<0.50	1	Multiple Samples	Multiple Samples	Multiple Samples
Dichlorodifluoromethane	<1.0	590	Multiple Samples	Multiple Samples	Multiple Samples
1,1-Dichloroethane	<0.20	5	Multiple Samples	Multiple Samples	Multiple Samples
1,2-Dichloroethane	<0.50	5	Multiple Samples	Multiple Samples	Multiple Samples
1,1-Dichloroethylene	<0.20	14	Multiple Samples	Multiple Samples	Multiple Samples
cis-1,2-Dichloroethylene	<0.50	17	Multiple Samples	Multiple Samples	Multiple Samples
trans-1,2-Dichloroethylene	<0.50	17	Multiple Samples	Multiple Samples	Multiple Samples
1,2-Dichloropropane	<0.20	5	Multiple Samples	Multiple Samples	Multiple Samples
1,3-Dichloropropene (Total)	<0.50	0.5	Multiple Samples	Multiple Samples	Multiple Samples
Ethylbenzene	<0.20	2.4	Multiple Samples	Multiple Samples	Multiple Samples
Ethylene Dibromide	<0.20	0.2	Multiple Samples	Multiple Samples	Multiple Samples
Hexane	<1.0	520	Multiple Samples	Multiple Samples	Multiple Samples
Methyl Ethyl Ketone	<10	1800	Multiple Samples	Multiple Samples	Multiple Samples
Methyl Isobutyl Ketone	<5.0	640	Multiple Samples	Multiple Samples	Multiple Samples
Methyl t-Butyl Ether (MTBE)	<0.50	15	Multiple Samples	Multiple Samples	Multiple Samples
Methylene Chloride	<2.0	50	Multiple Samples	Multiple Samples	Multiple Samples
Styrene	<0.50	5.4	Multiple Samples	Multiple Samples	Multiple Samples
1,1,1,2-Tetrachloroethane	<0.50	1.1	Multiple Samples	Multiple Samples	Multiple Samples
1,1,2,2-Tetrachloroethane	<0.50	1	Multiple Samples	Multiple Samples	Multiple Samples
Tetrachloroethylene	<0.20	17	Multiple Samples	Multiple Samples	Multiple Samples
Toluene	<0.20	24	Multiple Samples	Multiple Samples	Multiple Samples
1,1,1-Trichloroethane	<0.20	200	Multiple Samples	Multiple Samples	Multiple Samples
1,1,2-Trichloroethane	<0.50	5	Multiple Samples	Multiple Samples	Multiple Samples
Trichloroethylene	0.72	5	MW03	MW03	1.52 - 4.57
Trichlorofluoromethane	<0.50	150	Multiple Samples	Multiple Samples	Multiple Samples
Vinyl Chloride	<0.20	1.7	Multiple Samples	Multiple Samples	Multiple Samples
Xylenes (Total)	<0.20	300	Multiple Samples	Multiple Samples	Multiple Samples
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	<0.050	4.1	Multiple Samples	Multiple Samples	Multiple Samples
Acenaphthylene	<0.050	1	Multiple Samples	Multiple Samples	Multiple Samples
Anthracene	<0.050	2.4	Multiple Samples	Multiple Samples	Multiple Samples
Benzo(a)anthracene	<0.050	1	Multiple Samples	Multiple Samples	Multiple Samples
Benzo(a)pyrene	<0.0090	0.01	Multiple Samples	Multiple Samples	Multiple Samples
Benzo(b)fluoranthene	<0.050	0.1	Multiple Samples	Multiple Samples	Multiple Samples
Benzo(ghi)perylene	<0.050	0.2	Multiple Samples	Multiple Samples	Multiple Samples
Benzo(k)fluoranthene	<0.050	0.1	Multiple Samples	Multiple Samples	Multiple Samples
Chrysene	<0.050	0.1	Multiple Samples	Multiple Samples	Multiple Samples
Dibenzo(a,h)anthracene	<0.050	0.2	Multiple Samples	Multiple Samples	Multiple Samples
Fluoranthene	<0.050	0.41	Multiple Samples	Multiple Samples	Multiple Samples
Fluorene	<0.050	120	Multiple Samples	Multiple Samples	Multiple Samples
Indeno(1,2,3-cd)pyrene	<0.050	0.2	Multiple Samples	Multiple Samples	Multiple Samples
Methylnaphthalene 2-(1-)	<0.071	3.2	Multiple Samples	Multiple Samples	Multiple Samples
Naphthalene	0.066	11	MW102	MW102	3.05 - 6.10
Phenanthrene	0.089	1	MW03	MW03	1.52 - 4.57
Pyrene	<0.050	4.1	Multiple Samples	Multiple Samples	Multiple Samples

Notes:

Units	All units in micrograms per litre, unless otherwise noted
mbgs	metres below ground surface

10.0 APPENDICES

APPENDIX A
Legal Survey

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORPs): UTM ZONE 17, NAD83 (CSRS) (2010.0).

COORDINATES TO URBAN ACCURACY PER SECTION 14 (2) OF O.REG 216/10.

POINT ID	EASTING	NORTHING
ORP Ⓐ	652 551.60	4 775 772.98
ORP Ⓑ	652 843.7	4 775 868.84

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

THE RESULTANT TIE BETWEEN ORP Ⓐ AND ORP Ⓑ IS 307.48 (GROUND), N71°49'55"E

NOTES

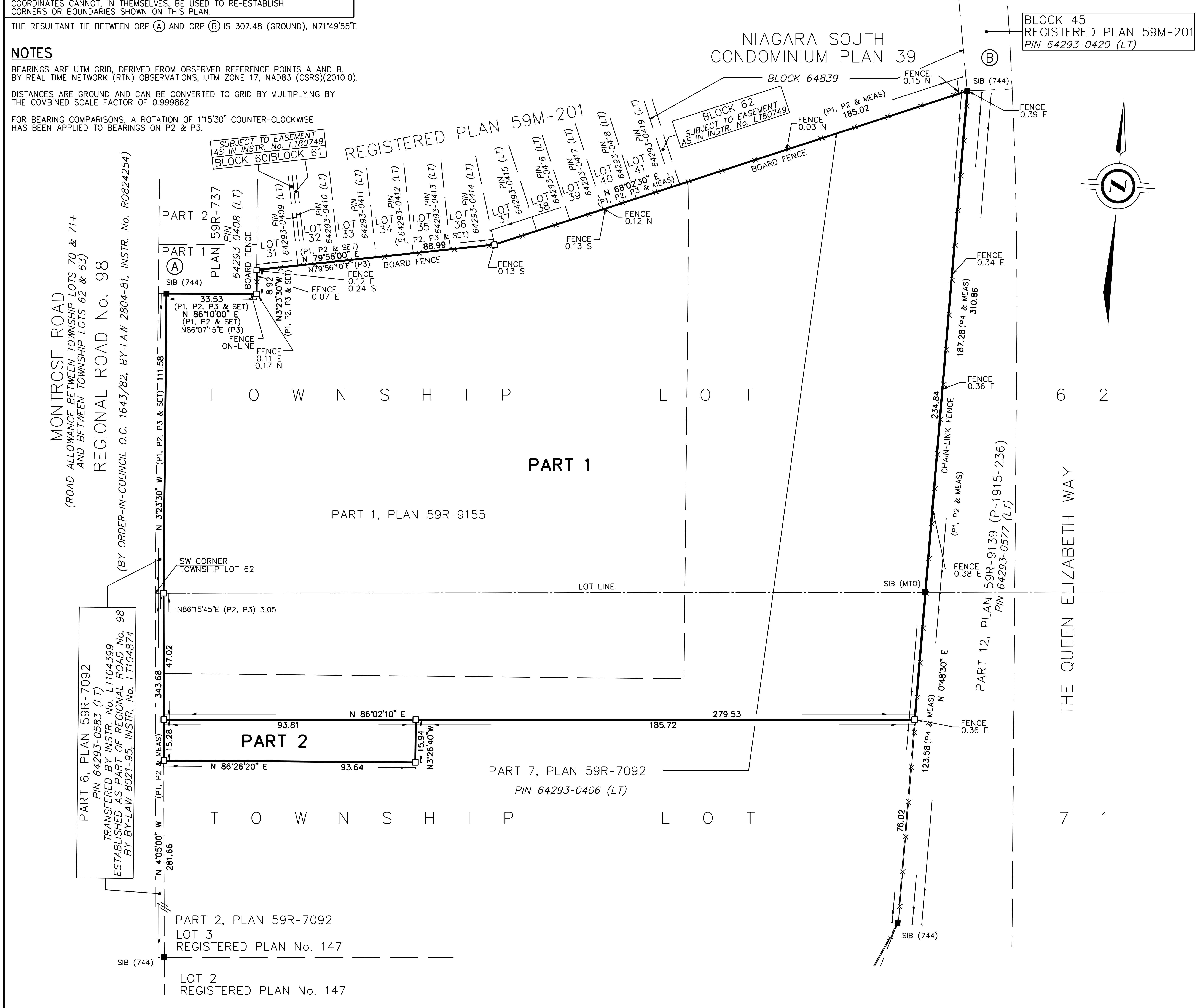
BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS A AND B, BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS)(2010.0).

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999862

FOR BEARING COMPARISONS, A ROTATION OF 1°15'30" COUNTER-CLOCKWISE HAS BEEN APPLIED TO BEARINGS ON P2 & P3.

SCHEDULE

PART	LOT	TOWNSHIP	PIN	AREA
1	PART OF 62 & 71	STAMFORD	PART OF 64293-0406 (LT)	5.454 HA
2	PART OF 71			1463 sq.m



PLAN OF SURVEY OF

PART OF TOWNSHIP LOTS 62 & 71

GEOGRAPHIC TOWNSHIP OF STAMFORD

NOW IN THE

CITY OF NIAGARA FALLS

REGIONAL MUNICIPALITY OF NIAGARA

SCALE 1 : 1000

20 0 20 40 60 metres

THE INTENDED PLOT SIZE OF THIS PLAN IS 610mm IN WIDTH BY 457mm IN HEIGHT WHEN PLOTTED AT A SCALE OF 1:1000

J. D. BARNES LIMITED

METRIC DISTANCES AND/OR COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

LEGEND

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
IB	DENOTES	IRON BAR
WIT	DENOTES	WITNESS
MEAS	DENOTES	MEASURED
744	DENOTES	MATTHEWS, CAMERON, HEYWOOD-KERRY T. HOWE SURVEYING LTD.
MTO	DENOTES	MINSTRY OF TRANSPORTATION, ONTARIO
P1	DENOTES	PLAN OF SURVEY BY J.D. BARNES LIMITED DATED JUNE 8, 2021, FILE 21-16-135-00
P2	DENOTES	PLAN 59R-7092
P3	DENOTES	PLAN 59R-9155
P4	DENOTES	PLAN 59R-9139 (P-1915-236)

N=NORTH / S=SOUTH / E=EAST / W=WEST

ALL SET SSIB MONUMENTS WERE USED DUE TO LACK OF OVERBURDEN AND/OR PROXIMITY OF UNDERGROUND UTILITIES IN ACCORDANCE WITH SECTION 11 (4) OF O.REG. 525/91.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON

DATE

ALLAN J. HEYWOOD
ONTARIO LAND SURVEYOR

THIS PLAN OF SURVEY RELATES TO AOLS PLAN SUBMISSION FORM NUMBER

J.D.BARNES
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PLOTTED: 5/5/2022

APPENDIX B

Sampling and Analysis Plan

Sampling and Analysis Plan for Phase Two Environmental Site Assessment

North Portion of 3770 Montrose Road
Niagara Falls, Ontario

Prepared for:

Forest Gate Advisors Inc.
100 Tesma Way, Suite 6
Vaughan, ON L4K 0J9

Attn: Dan Marinovic

December 1, 2021

Pinchin File: 296202

Issued To:	**Forest Gate Advisors Inc.**
Contact:	**Dan Marinovic**
Issued On:	**December 1, 2021**
Pinchin File:	**296202**
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APPENDICES

FIGURES

TABLES

1.0 INTRODUCTION

Pinchin Ltd. (Pinchin) has prepared this Sampling and Analysis Plan (SAP) for the Phase Two Environmental Site Assessment (ESA) to be performed at the property located at North Portion of 3770 Montrose Road in Niagara Falls, Ontario (hereafter referred to as the Site or Phase Two Property). The Phase Two Property is presently developed with a commercial building formerly occupied by Canadian Tire and a multi-tenant commercial building (collectively referred to as "the Site Buildings"). A Key Map showing the Phase Two Property location is provided on Figure 1 (all Figures are located in Appendix I).

The Phase Two ESA will be conducted at the request of Forest Gate Advisors Inc. (Client) in relation to the future redevelopment of the Phase Two Property from commercial to residential land use. A Record of Site Condition (RSC) submittal to the Ontario Ministry of the Environment, Conservation and Parks (MECP) is a mandatory requirement when a land use changes to a more sensitive land use and as such, to support the RSC submission, the Phase Two ESA will be conducted in accordance with the Province of Ontario's *Ontario Regulation 153/04: Records of Site Condition – Part XV.1 of the Act*, which was last amended by Ontario Regulation 214/21 on March 19, 2021 (O. Reg. 153/04).

This SAP provides the scope of work and procedures for completing the field investigation for the Phase Two ESA. The Phase Two ESA will be performed in accordance with the scope of work, and terms and conditions described in the proposal entitled *"Proposal for Phase One and Two Environmental Site Assessments, Geotechnical Investigation and Record of Site Condition Filing, North Portion of 3770 Montrose Road, Niagara Falls, Ontario"*, prepared for the Client, dated September 3, 2021.

2.0 AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

The objectives of the Phase Two ESA will be to assess soil and groundwater quality at the Phase Two Property in relation to three areas of potential environmental concern (APECs) and related potentially contaminating activities (PCAs) and contaminants of potential concern (COPCs) identified in a Phase One ESA completed by Pinchin in accordance with O. Reg. 153/04, the findings of which are provided in the draft report entitled "*Phase One Environmental Site Assessment Report, North Portion of 3770 Montrose Road, Niagara Falls, Ontario",* prepared for the Client. The APECs and corresponding PCAs and COPCs are summarized in Table 1 (all Tables are located in Appendix II) and shown on Figures 2 to 4B.

3.0 SCOPE OF WORK

The information obtained from the Phase One ESA, in particular the Phase One Conceptual Site Model, was used to determine the environmental media requiring investigation during the Phase Two ESA (i.e., soil and groundwater), the locations and depths for sample collection, and the parameters to be analyzed for the samples submitted from each APEC. The Phase Two ESA scope of work will include the advancement of four boreholes, two of which will be completed as groundwater monitoring wells. The proposed borehole and groundwater monitoring well locations are provided on Figures 4A and 4B.

Table 2 in Appendix II provides a detailed summary of the proposed Phase Two ESA scope of work, including:

- Boreholes and/or groundwater monitoring wells to be completed within each APEC and the COPCs to be analyzed for samples collected in each APEC.
- Media to be sampled at each sampling location, the sampling system (see Section 7.0), the soil sampling depth intervals, monitoring well screen intervals and the sampling frequency.
- Number of samples per borehole or groundwater monitoring well to be collected and submitted for laboratory analysis.

Note that the soil sampling depth intervals (i.e., borehole depths), monitoring well screen intervals and sampling frequency are based on Pinchin's current knowledge of subsurface conditions and may be revised based on the actual subsurface conditions encountered.

Additional scope of work items include the following:

- Elevation surveying of the ground surface elevations of all monitoring well locations, and the top of pipe elevations for all groundwater monitoring wells.
- Depth to water measurements of all newly-installed and existing groundwater monitoring wells, including assessment for non-aqueous phase liquid. Depth to water measurements will be made during well development and groundwater sampling.
- Completion of groundwater sampling using low-flow purging and sampling methods as per SOP-EDR023 (see Section 6.0), unless well yields are too low to permit this method to be used. For well(s) where low flow sampling cannot be employed, groundwater sampling will be conducted using the well volume method described in SOP-EDR008.

4.0 DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) for the Phase Two ESA will be to obtain unbiased analytical data that are representative of actual soil and groundwater conditions at the Phase Two Property. This will be accomplished by implementing a quality assurance/quality control (QA/QC) program, as described in Section 5.0, and by completing the field work in accordance with Pinchin's standard operating procedures (SOPs), as described in Section 6.0. Pinchin's SOPs are based in part on the MECP's *"Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario"*, dated December 1996 and the Association of Professional Geoscientists of Ontario document entitled *"Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended)"*, dated April 2011.

The DQOs are intended to minimize uncertainty in the analytical data set such that the data are considered reliable enough to not affect the conclusions and recommendations of the Phase Two ESA and to meet the overall objective of the Phase Two ESA, which is to assess the environmental quality of the Phase Two Property in relation to the identified APECs.

5.0 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

5.1 Non-Dedicated Sampling and Monitoring Equipment Cleaning

Based on the proposed scope of work, the following non-dedicated sampling and monitoring equipment will be used during completion of the Phase Two ESA:

- Interface probe.
- Water level tape.
- Spatula for soil sampling.
- Hollow-stem augers.
- Split-spoon samplers.
- Flow-through cell for groundwater sampling.

All of the above-listed equipment will be cleaned prior to initial use and between samples or sampling locations, as appropriate, following the equipment cleaning procedures described in SOP-EDR009. Any non-dedicated sampling or monitoring equipment not listed above that is used during the Phase Two ESA will also be cleaned in accordance with SOP-EDR009.

5.2 Trip Blanks

A trip blank is a set of VOC sample vials filled by the analytical laboratory with VOC-free distilled water and shipped with the groundwater sample containers. Trip blanks will be stored with the sample containers provided by the analytical laboratory during travel to the Phase Two Property, while on the Phase Two Property, and during travel from the Phase Two Property back to the analytical laboratory. The sample containers comprising a trip blank will not be opened in the field.

One trip blank will accompany each submission to the laboratory. Each trip blank will be submitted for analysis of VOCs. Based on the scope of work and anticipated field work schedule for the Phase Two ESA, it is estimated that analysis of one trip blank will be required. Additional trip blanks will be submitted if there are additional laboratory submissions.

5.3 Field Duplicate Samples

Field duplicate soil and groundwater samples will be collected for laboratory analysis in accordance with SOP-EDR025 at a frequency of one sample for every ten samples submitted for laboratory analysis, with a minimum of one sample per media sampled per COPC.

5.4 Calibration Checks on Field Instruments

5.4.1 Field Screening Instruments

The photoionization detector (PID) and combustible gas indicator (CGI) used for the field screening of soil samples will be calibrated in accordance with the procedures described in SOP-EDR003. Calibration checks will also be made at the frequency specified in SOP-EDR003.

Records of the calibration and calibration checks of the PID and CGI, including any calibration sheets provided by the equipment supplier, will be retained in Pinchin's project file.

5.4.2 Water Quality Measurement Instruments

Water quality instruments used to measure field parameters during groundwater sampling will be calibrated in accordance with the procedures described in SOP-EDR016. Calibration checks will also be made at the frequency specified in SOP-EDR016.

Records of the calibration and calibration checks of the probes/instruments used for water quality parameter measurements, including any calibration sheets provided by the equipment supplier, will be retained in Pinchin's project file.

6.0 STANDARD OPERATING PROCEDURES

The proposed field investigation for the Phase Two ESA will require the following SOPs to be followed:

- Borehole drilling (SOP-EDR006).
- Soil sampling (SOP-EDR013 and SOP-EDR019).
- Field screening (SOP-EDR003).
- Monitoring well installation (SOP-EDR007).
- Monitoring well development (SOP-EDR017).
- Field measurement of water quality indicators (SOP-EDR016).
- Groundwater sampling (SOP-EDR008 and/or SOP-EDR023).
- QA/QC sampling (SOP-EDR025).
- Non-dedicated field equipment decontamination (SOP-EDR009).

- Vertical elevation surveying (SOP-EDR026).

The above-referenced SOPs are provided in Appendix III. Each SOP includes a section describing the specific requirements for Phase Two ESAs completed to support the filing of an RSC in accordance with O. Reg. 153/04.

Any deviations from the SOPs will be summarized in the Phase Two ESA report.

7.0 SAMPLING SYSTEM

The borehole and monitoring well locations in all APECs will be selected following a judgemental sampling system. Boreholes and monitoring wells will be placed at locations where the potential for COPCs to be present is considered the highest (i.e., “worst case”), as per the following:

- Two monitoring wells and one borehole will be completed within the former automotive service centre and area of hydraulic hoists in the east portion of Site Building A (APECs #1 and #4).
- One borehole will be completed within the former automotive service centre and area of an AST in southeast corner of Site Building A (APECs #1 and #5).
- One borehole will be completed immediately north of the former automotive service centre and area of an exterior AST north of Site Building A (APECs #1 and #6).
- A borehole will be completed adjacent to the transformer located south of the southeast portion of Site Building A (APEC #2).
- A borehole will be completed adjacent to the transformer located northeast of Site Building B (APEC #3).

In addition, the field screening results for soil samples collected from each borehole will be used to select “worst case” samples for laboratory analysis.

The sampling system that will be used for each APEC is summarized in Table 2.

8.0 PHYSICAL IMPEDIMENTS

Pinchin does not anticipate any physical impediments that will limit access to the Phase Two Property during completion of the Phase Two ESA.

9.0 TERMS AND LIMITATIONS

This Sampling and Analysis Plan (SAP) has been prepared to summarize the general scope of work and field procedures to be followed for the Phase Two ESA that will be performed for Forest Gate Financial Corp. (Client) in order to investigate potential environmental impacts at the North Portion of 3770

Montrose Road in Niagara Falls, Ontario (Site). The term recognized environmental condition means the presence or likely presence of any hazardous substance on a property under conditions that indicate an existing release, past release, or a material threat of a release of a hazardous substance into structures on the property or into the ground, groundwater, or surface water of the property. The Phase Two ESA will not quantify the extent of the current and/or recognized environmental condition or the cost of any remediation.

Conclusions derived from the Phase Two ESA will be specific to the immediate area of study and cannot be extrapolated extensively away from sample locations. Samples will be analyzed for a limited number of contaminants that are expected to be present at the Site, and the absence of information relating to a specific contaminant does not indicate that it is not present.

No environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions on a property. Performance of the Phase Two ESA to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions on the Site, and recognizes reasonable limits on time and cost.

The Phase Two ESA will be performed in general compliance with currently acceptable practices for environmental site investigations, and specific Client requests, as applicable to this Site.

This SAP was prepared for the exclusive use of the Client, subject to the terms, conditions and limitations contained within the duly authorized work plan for this project. Any use which a third party makes of this SAP, or any reliance on or decisions to be made based on it, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted.

If additional parties require reliance on this SAP, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this SAP should not be construed as legal advice. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law.

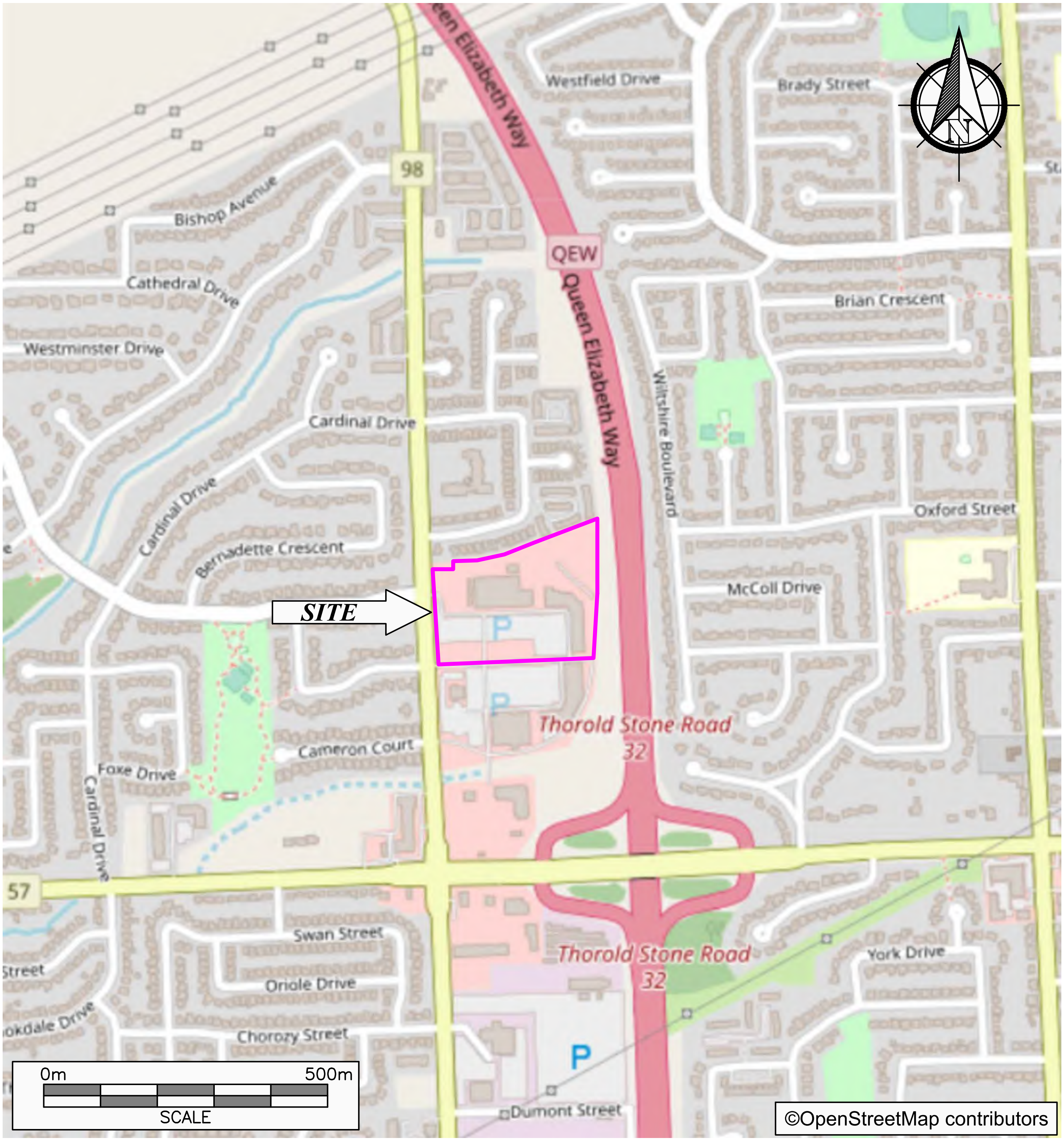
Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this SAP, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time.

\\pinchin.com\ham\Job\296000s\0296202.000 ForestGate,3770Montrose,Falls,EDR,RSC\Deliverables\Sampling and Analysis Plan\296202 - Phase Two ESA Sampling and Analysis Plan, 3770 Montrose Road, Niagara Falls.docx

Template: RSC Sampling and Analysis Plan, EDR, January 17, 2020

APPENDIX I

Figures



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PROJECT NAME
SMAPLING AND ANALYSIS PLAN

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

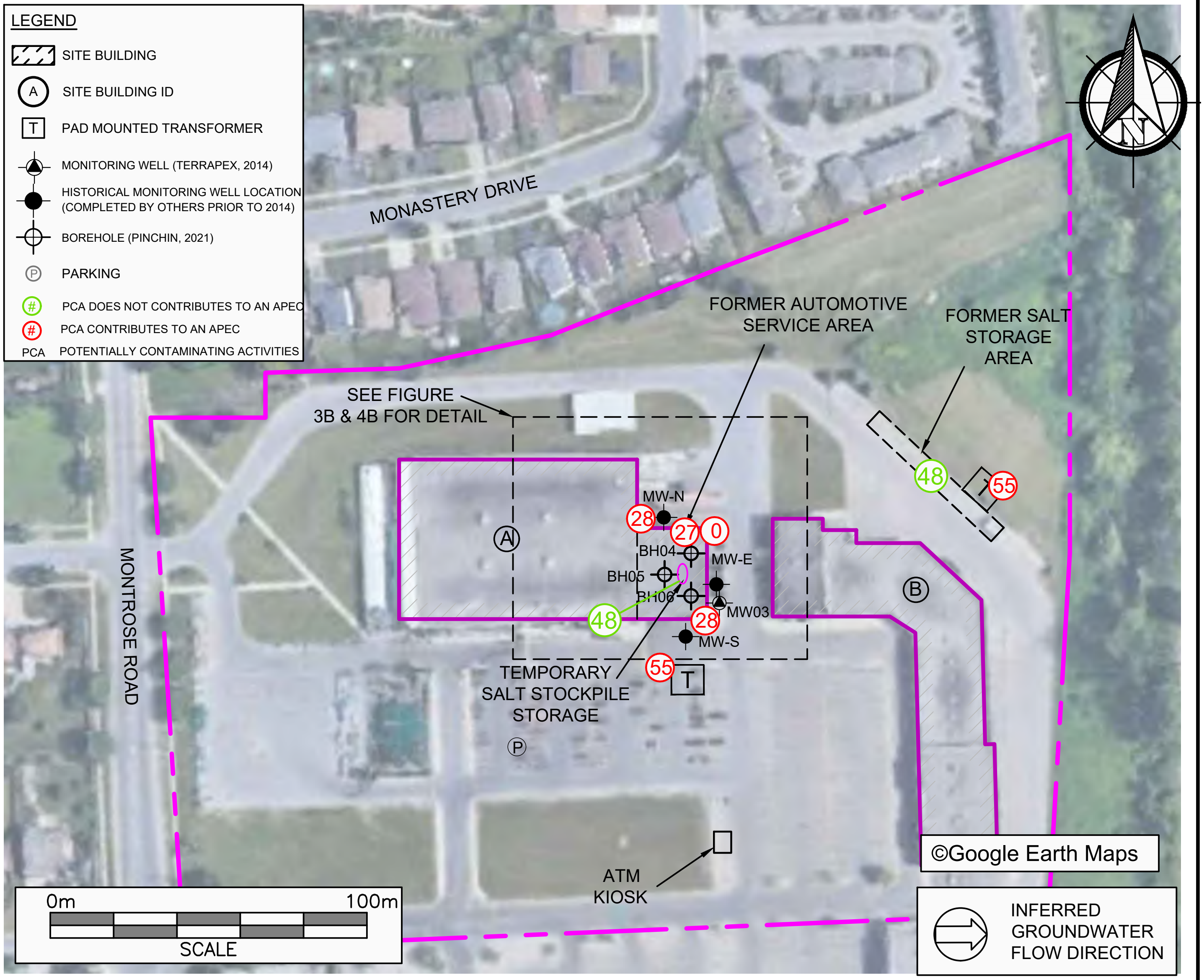
FIGURE NAME
KEY MAP

FIGURE NO.
1

SCALE
AS SHOWN

PROJECT NO.
296202.001

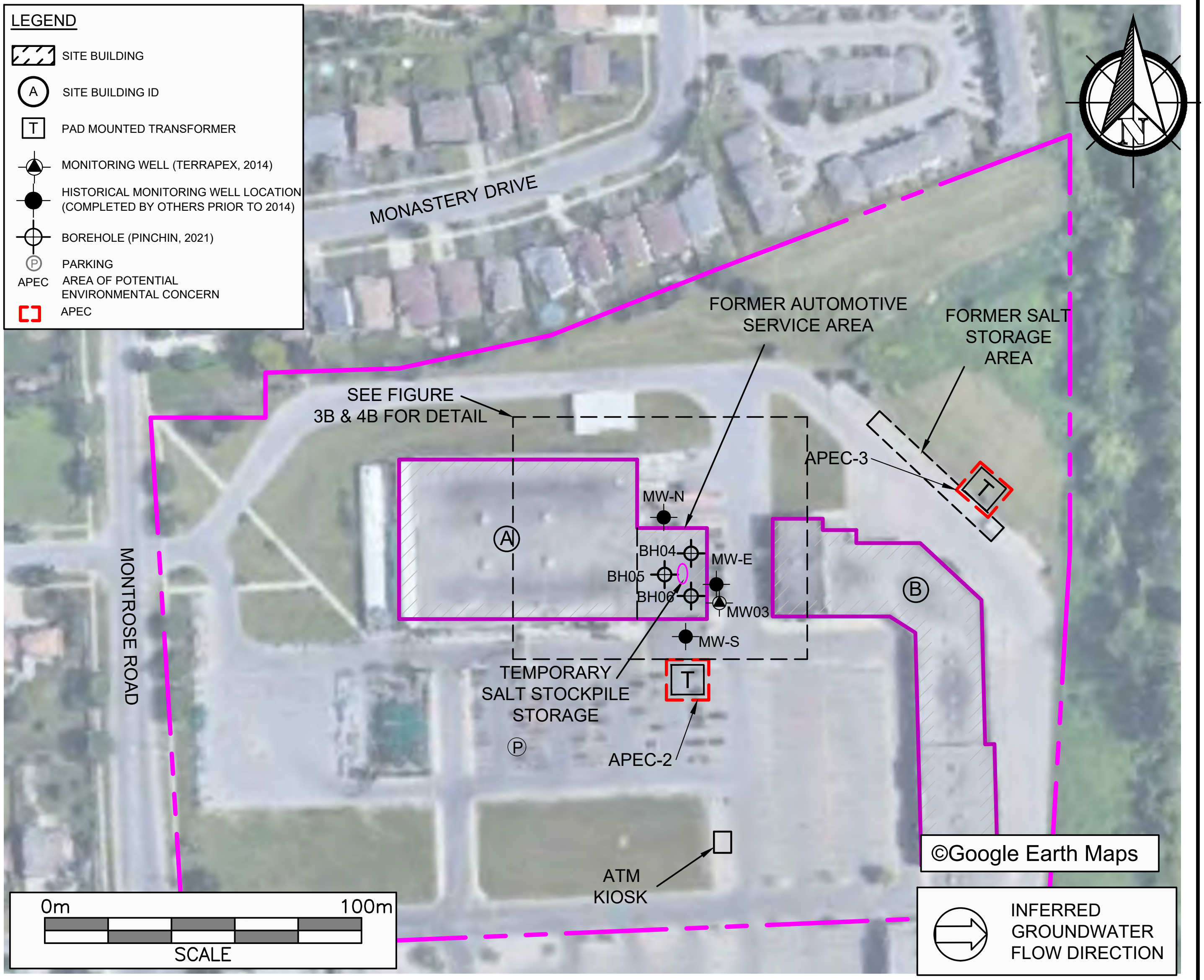
DATE
DEC. 2021



Area of Potential Environmental Concern[1]	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity[2]	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern[3]	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-1 (Historical automotive service and repair within east portion of Site Building A)	East portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	PHCs BTEX PAHs VOCs	Soil and Groundwater
APEC-2 (Transformer located south of the southeast portion of Site Building A)	South of southeast portion of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-3 (Transformer located northeast of Site Building B)	Northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-4 (Nine inground hydraulic hoists located within the east portion of Site Building A)	Within the central portion of the automotive service centre, located within the east portion of Site Building A.	Other – Inground hydraulic hoists	On-Site	PHCs	Soil and Groundwater
APEC-5 (Two new oil ASTs located within the southeast corner of Site Building A)	Southeast corner of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs BTEX PAHs	Soil
APEC-6 (One waste oil AST and one antifreeze AST located adjacent to the north exterior elevation of Site Building A)	Adjacent to the north exterior elevation of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs BTEX PAHs VOCs	Soil

PINCHIN

PROJECT NAME	SMAPLING AND ANALYSIS PLAN
CLIENT NAME	FOREST GATE ADVISORS INC.
PROJECT LOCATION	NORTH PORTION OF 3770 MONTROSE ROAD, NIAGARA FALLS, ONTARIO
FIGURE NAME	POTENTIALLY CONTAMINATING ACTIVITIES (ON-SITE)
FIGURE NO.	2
SCALE	AS SHOWN
PROJECT NO.	296202.001
DATE	DEC. 2021



Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-2 (Transformer located south of the southeast portion of Site Building A)	South of southeast portion of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-3 (Transformer located northeast of Site Building B)	Northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil

PINCHIN

PROJECT NAME
SMAPLING AND ANALYSIS PLAN

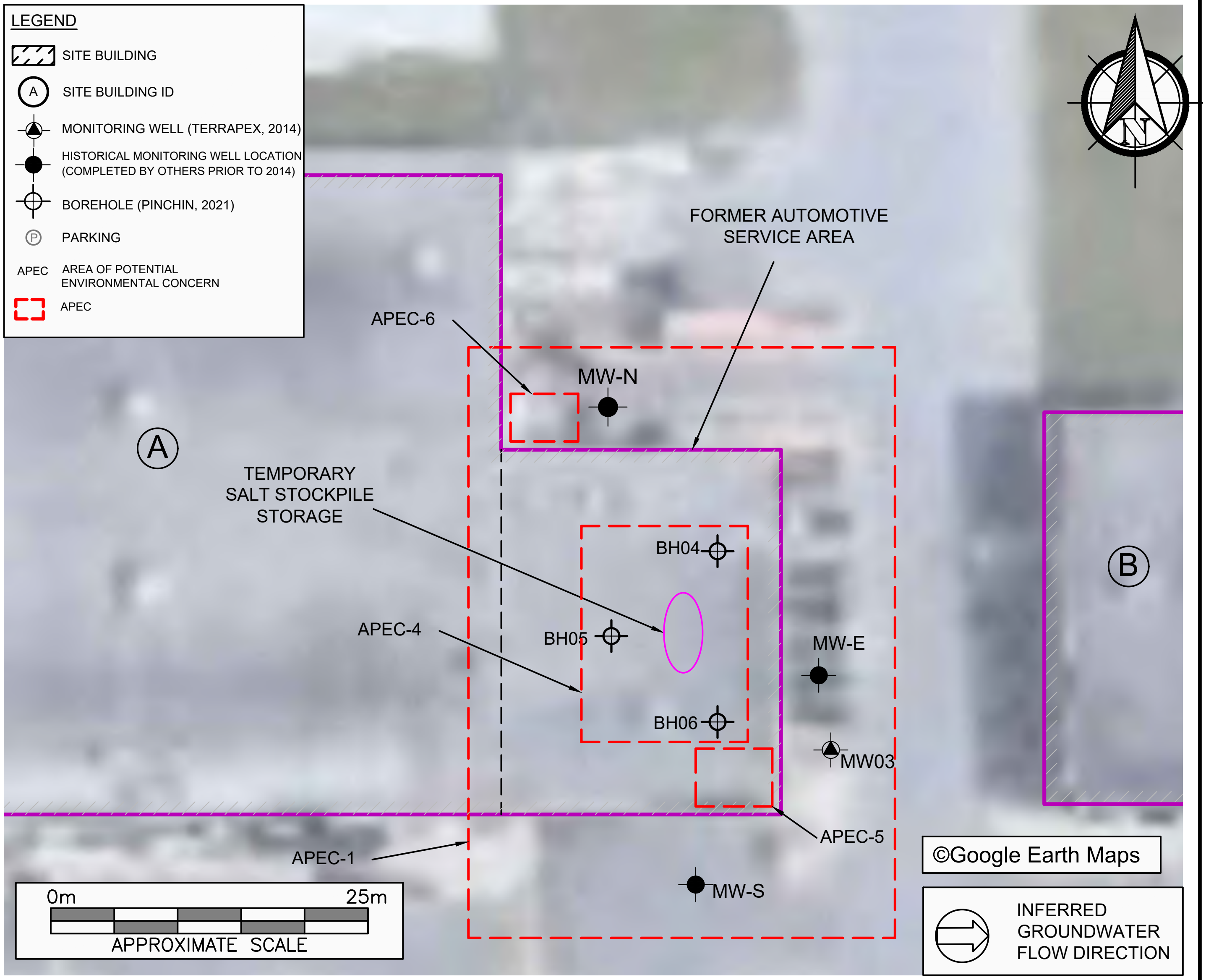
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
AREAS OF POTENTIAL ENVIRONMENTAL CONCERN

FIGURE NO.
3A

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	DEC. 2021



Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-1 (Historical automotive service and repair within east portion of Site Building A)	East portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	PHCs BTEX PAHs VOCs	Soil and Groundwater
APEC-4 (Nine inground hydraulic hoists located within the east portion of Site Building A)	Within the central portion of the automotive service centre, located within the east portion of Site Building A.	Other – Inground hydraulic hoists	On-Site	PHCs	Soil and Groundwater
APEC-5 (Two new oil ASTs located within the southeast corner of Site Building A)	Southeast corner of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs PAHs	Soil
APEC-6 (One waste oil AST located adjacent to the north exterior elevation of Site Building A)	Adjacent to the north exterior elevation of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs PAHs	Soil

PINCHIN

PROJECT NAME
SMAPLING AND ANALYSIS PLAN

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

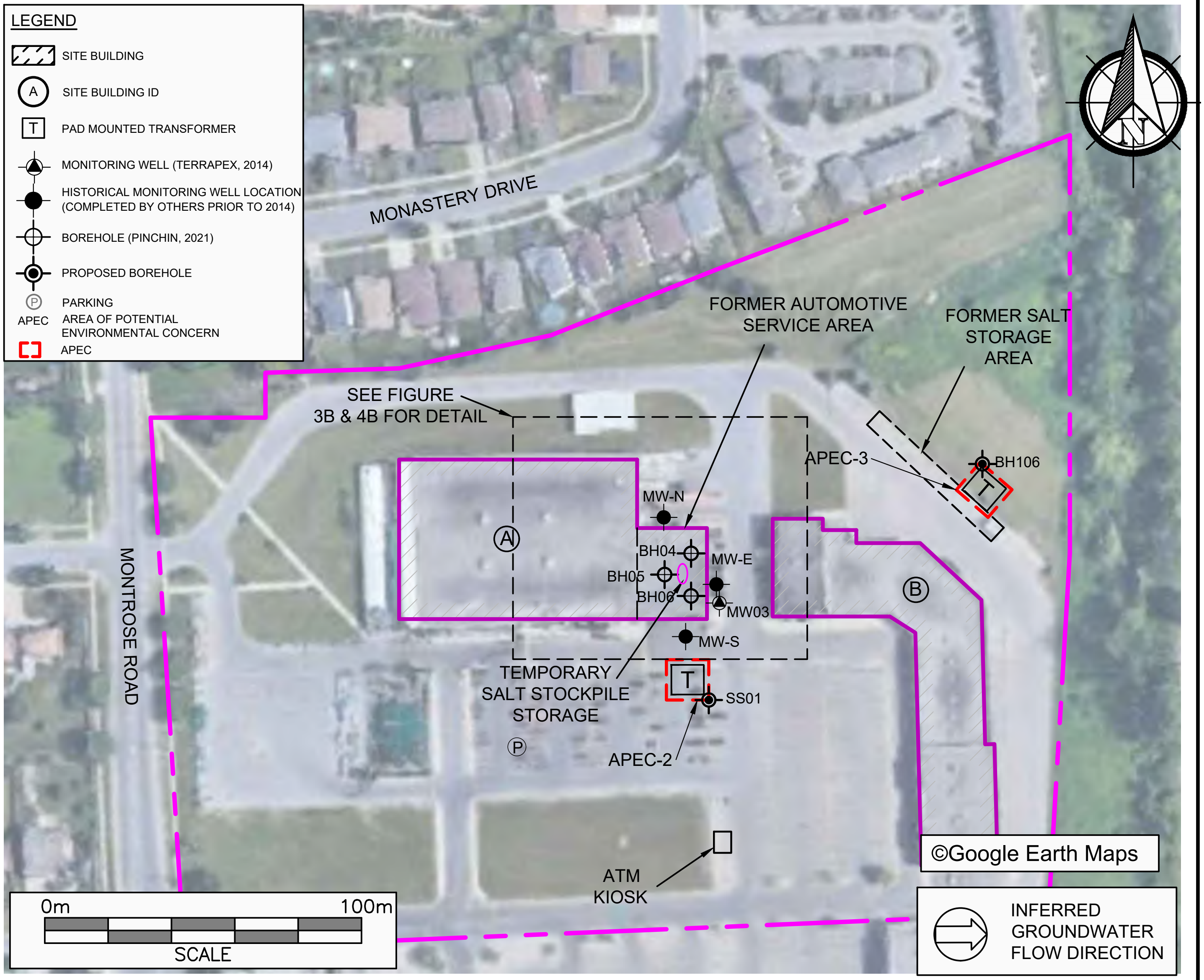
FIGURE NAME
DETAILED AREAS OF POTENTIAL
ENVIRONMENTAL CONCERN

FIGURE NO.
3B

SCALE
AS SHOWN

PROJECT NO.
296202.001

DATE
DEC. 2021



Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-2 (Transformer located south of the southeast portion of Site Building A)	South of southeast portion of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-3 (Transformer located northeast of Site Building B)	Northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil

PINCHIN

PROJECT NAME
SMAPLING AND ANALYSIS PLAN

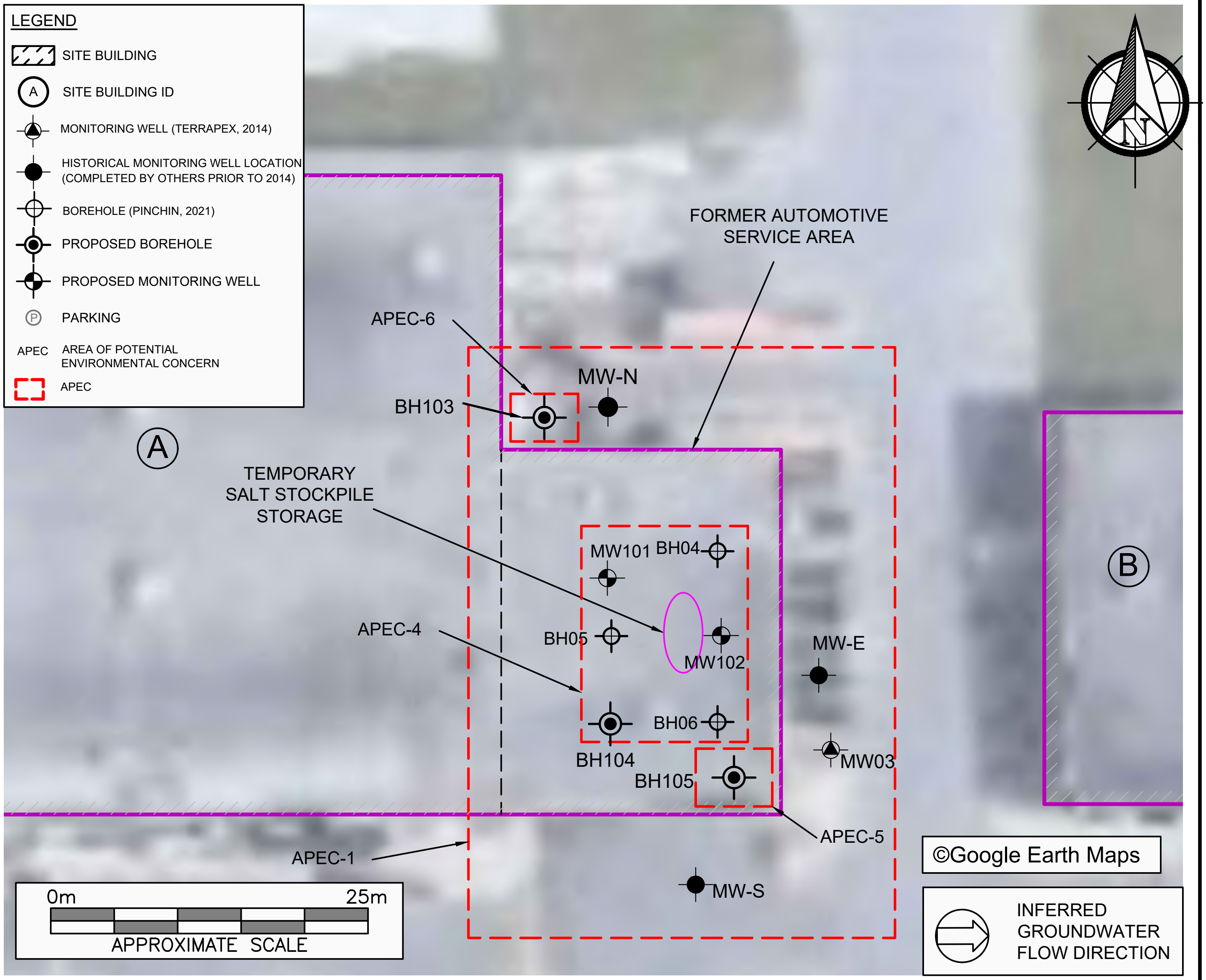
CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PROPOSED BOREHOLE AND
MONITORING WELL LOCATION PLAN

FIGURE NO.
4A

SCALE	PROJECT NO.	DATE
AS SHOWN	296202.001	DEC. 2021



Area of Potential Environmental Concern	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-1 (Historical automotive service and repair within east portion of Site Building A)	East portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	PHCs BTEX PAHs VOCs	Soil and Groundwater
APEC-4 (Nine inground hydraulic hoists located within the east portion of Site Building A)	Within the central portion of the automotive service centre, located within the east portion of Site Building A.	Other – Inground hydraulic hoists	On-Site	PHCs	Soil and Groundwater
APEC-5 (Two new oil ASTs located within the southeast corner of Site Building A)	Southeast corner of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs PAHs	Soil
APEC-6 (One waste oil AST located adjacent to the north exterior elevation of Site Building A)	Adjacent to the north exterior elevation of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs PAHs	Soil

PINCHIN

PROJECT NAME
SMAPLING AND ANALYSIS PLAN

CLIENT NAME
FOREST GATE ADVISORS INC.

PROJECT LOCATION
NORTH PORTION OF 3770 MONTROSE ROAD,
NIAGARA FALLS, ONTARIO

FIGURE NAME
PROPOSED BOREHOLE AND
MONITORING WELL LOCATION PLAN

FIGURE NO.
4B

SCALE
AS SHOWN

PROJECT NO.
296202.001

DATE
DEC. 2021

APPENDIX II

Tables

Table 1 - Table of Areas of Potential Environmental Concern

Area of Potential Environmental Concern[1]	Location of Area of Potential Environmental Concern on Phase One Property	Potentially Contaminating Activity[2]	Location of PCA (On-Site or Off-Site)	Contaminants of Potential Concern[3]	Media Potentially Impacted (Ground Water, Soil and/or Sediment)
APEC-1 (Historical automotive service and repair within east portion of Site Building A)	East portion of Site Building A.	Item 27 - Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles	On-Site	PHCs BTEX PAHs VOCs	Soil and Groundwater
APEC-2 (Transformer located south of the southeast portion of Site Building A)	South of southeast portion of Site Building A.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-3 (Transformer located northeast of Site Building B)	Northeast of Site Building B.	Item 55 - Transformer Manufacturing, Processing and Use	On-Site	PHCs PCBs	Soil
APEC-4 (Nine inground hydraulic hoists located within the east portion of Site Building A)	Within the central portion of the automotive service centre, located within the east portion of Site Building A.	Other – Inground hydraulic hoists	On-Site	PHCs	Soil and Groundwater
APEC-5 (Two new oil ASTs located within the southeast corner of Site Building A)	Southeast corner of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs PAHs	Soil
APEC-6 (One waste oil AST located adjacent to the north exterior elevation of Site Building A)	Adjacent to the north exterior elevation of Site Building A.	Item 28 – Gasoline and Associated Products Storage in Fixed Tanks	On-Site	PHCs PAHs	Soil

Notes:

1 - Areas of potential environmental concern means the area on, in or under a phase one property where one or more contaminants are potentially present, as determined through the phase one environmental site assessment, including through,

(a) identification of past or present uses on, in or under the phase one property, and

(b) identification of potentially contaminating activity.

2 - Potentially contaminating activity means a use or activity set out in Column A of Table 2 of Schedule D that is occurring or has occurred in a phase one study area

3 - When completing this column, identify all contaminants of potential concern using the Method Groups as identified in the Protocol for in the Assessment of Properties under Part XV.1 of the Environmental Protection Act, March 9, 2004, amended as of July 1, 2011, as specified below:

List of Method Groups:

ABNs	PCBs	Metals	Electrical Conductivity
CPs	PAHs	As, Sb, Se	Cr (VI)
1,4-Dioxane	THMs	Na	Hg
Dioxins/Furans, PCDDs/PCDFs	VOCs	B-HWS	Methyl Mercury
OCs	BTEX	Cl-	Low or high pH,
PHCs	Ca, Mg	CN-	SAR

4 - When submitting a record of site condition for filing, a copy of this table must be attached

Table 2 - Phase Two Scope of Work Summary

Sampling Location	APEC	Media Sampled	COPCs					Number of Samples Submitted for Analysis	Soil Sampling Depth Interval (mbgs)	Screen Interval (mbgs)	Sampling Frequency	Sampling System	Rationale/Notes
			PHCs	BTEX	VOCs	PAHs	PCBs						
MW03	1	Groundwater	●	●	●	●		1	NA	1.5 - 4.5	NA	Judgemental	Assess groundwater quality downgradient of the former on-Site automotive service centre (APEC #1).
MW101	1 & 4	Soil	●	●	●	●		1	0 - 6.1	NA	Continous/Soil cores every 1.5 m	Judgemental	Assess soil and groundwater quality within the area of the former on-Site automotive service centre (APEC #1) and hydraulic hoists (APEC #4).
	1 & 4	Groundwater	●	●	●	●		1	NA	1.5 - 4.5	NA	Judgemental	
MW102	1 & 4	Soil	●	●	●	●		1	0 - 6.1	NA	Continous/Soil cores every 1.5 m	Judgemental	
	1 & 4	Groundwater	●	●	●	●		1	NA	1.5 - 4.5	NA	Judgemental	
BH103	1 & 6	Soil	●	●	●	●		1	0 - 3.05	NA	Continous/Soil cores every 1.5 m	Judgemental	Assess soil quality north of the former on-Site automotive service centre (APEC #1) and within the area of a former on-Site AST (APEC #6).
BH104	1 & 4	Soil	●	●	●	●		1	0 - 3.05	NA	Continous/Soil cores every 1.5 m	Judgemental	Assess soil quality within the area of the former on-Site automotive service centre (APEC #1) and within the area of former hydraulic hoists (APEC #4).
BH105	1 & 5	Soil	●	●	●	●		1	0 - 3.05	NA	Continous/Soil cores every 1.5 m	Judgemental	Assess soil quality within the area of the former on-Site automotive service centre (APEC #1) and within the area of a former on-Site AST (APEC #5).
BH106	3	Soil	●				●	1	0 - 1.5	NA	Continous/Soil cores every 1.5 m	Judgemental	Assess soil quality adjacent to the current transformer located northeast of Site Building B (APEC #3).
SS01	2	Soil	●				●	1	0 - 1.5	NA	Surface soil sample to 0.3 m	Judgemental	Assess soil quality adjacent to the current transformer south of the southeast corner of Site Building A (APEC #2).

PHCs	Petroleum Hydrocarbons (Fraction 1	APEC	Area of Potential Environmental Concern
BTEX	Benzene, Toluene, Ethylbenzene an	COPCs	Contaminants of Potential Concern
VOCs	Volatile Organic Compounds	m	Metres
PAHs	Polycyclic Aromatic Hydrocarbons	mbgs	Metres Below Ground Surface
PCBs	Polychlorinated Biphenyls	NA	Not Applicable

APPENDIX III

Pinchin Standard Operating Procedures

SOP – EDR003 – REV005 – FIELD SCREENING OF SOIL SAMPLES

Title:	Field Screening of Soil Samples
Practice:	EDR
First Effective Date:	June 16, 2009
Version:	005
Version Date:	January 20, 2020
Author:	Robert MacKenzie
Authorized by:	Terry Duffy

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	June 16, 2009	N/A	MEM
001	November 26, 2010	Update approval signature	FG
002	September 25, 2013	Revised SOP to reflect current practices/Added section on O.Reg. 153/04 compliance	RLM
003	April 29, 2016	Updated Section 4.0/Modified time between readings to 1 hour	RLM
004	April 28, 2017	Removed reference to Pinchin West/In Section 5.2, clarified that soil vapour measurements do not need to be made within one hour of sampling during winter conditions	RLM
004	January 3, 2018	Reviewed and confirmed current	RLM
005	January 20, 2020	Remove PG Logo and Pinchin LeBlanc Reference	TD

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) presents the quantitative and qualitative methods to be used by Pinchin field personnel for field screening soil samples for potential impacts during field investigations.

The quantitative part of field screening consists of the measurement of vapour concentrations in soil sample headspace in order to assess the potential for volatile constituents to be present in the soil. The soil vapour readings obtained from these measurements are then used to assist in selecting potential “worst case” soil samples for submission to the laboratory for analysis. There are no regulatory standards for comparison with soil headspace vapour readings and we are using the general principle that the sample with the highest soil headspace vapour concentration from a group of samples is often the most likely to be impacted by volatile constituents.

The qualitative part of field screening includes assessing the soil for visual or olfactory indicators of potential contamination and is used in conjunction with the soil headspace vapour readings to select “worst case” soil samples to be submitted for laboratory analysis.

Note that soil vapour measurements have limited value when selecting “worst case” soil samples for laboratory analysis of non-volatile parameters such as metals. Visual observations of the presence of staining and debris (e.g., brick fragments and other building materials, coal ash, etc.), along with sample depth and likely migration pathways are to be factored into selecting the samples. The sample with the highest soil headspace vapour reading is not automatically selected under these circumstances.

Soil samples collected for soil vapour measurement must not be submitted for laboratory analysis except for analysis of non-volatile parameters (i.e., metals and inorganics) or grain size analysis.

This SOP also applies to the field screening of sediment samples but for simplicity, only soil samples are referred to below.

3.0 OVERVIEW

Not applicable.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier for distribution as appropriate.

5.0 PROCEDURE

5.1 Equipment and Supplies

- Resealable plastic bags (e.g., Ziploc®);

  (Note that small capacity bags (e.g., 500 millilitre capacity) are preferred over larger sized bags. When conducting headspace screening of a set of soil samples, the size of bag used should be consistent throughout in order to maintain the same approximate headspace volume in each bag);
- Combustible gas indicator (CGI) capable of operating in methane-elimination and/or photo-ionization detector (PID);

  (The Project Manager will be responsible for selecting the appropriate instrument(s) for each project. CGIs (e.g., RKI Eagle or Gastechtor) are acceptable for screening of petroleum hydrocarbons (PHCs) and related compounds, whereas PIDs (e.g., MiniRAE) are acceptable for screening for volatile organic compounds (VOCs), including chlorinated solvents, but can also be used when screening for PHCs. For many projects, it will be appropriate to employ both a CGI and a PID); and
- Calibration equipment (e.g., calibration gas, regulators, tubing, calibration bags, etc. as provided by the equipment supplier).

5.2 Soil Headspace Vapour Measurement Procedure

The procedure for conducting soil headspace vapour measurements for soil sample headspace is as follows:

1. Unless pre-calibrated by the equipment supplier, calibrate the CGI/PID as per the instrument manufacturer's instructions before commencing soil vapour measurements. Record the date and time of calibration, and type and concentration of the calibration gas used in the field logbook or field forms;
2. Label the plastic bag with the sample number;
3. Create a split soil sample by splitting the sample core vertically (i.e., along the longitudinal axis) with one half used for soil headspace vapour measurement and the other half used to fill sample jars for laboratory analysis of volatile parameters (e.g., VOCs and PHCs (F1 fraction)). In other words, the depth interval of the soil subjected to soil headspace vapour measurements should be the same as the depth interval from which samples for volatile parameters are collected. This procedure doesn't apply to grab samples but is to be completed when soil cores are obtained, such as sampling with dual tube samplers, split-spoon samplers and hand augers. For grab samples, soil used for laboratory analysis and soil headspace vapour measurements should be collected from proximal locations;
4. Place the soil into the plastic bag until the bag is approximately one-quarter full as soon as possible after the sampling device is retrieved/opened;
5. Seal the bag and break apart the soil by manually kneading the soil in the sealed bag;
6. Allow the soil sample to equilibrate at ambient temperature for a minimum of 5 minutes but no longer than one hour before taking a soil headspace vapour measurement. The exception to this is that during winter conditions, the soil samples should be placed in a heated environment (e.g., building interior) to warm up for a minimum of 15 minutes before taking soil vapour measurements. In this case, the soil vapour measurements do not need to be completed within one hour of sample collection;
7. Do not store the bagged soil samples in direct sunlight prior to taking soil headspace vapour measurements;
8. When conducting soil headspace vapour measurements with a CGI, make sure it is switched to methane elimination mode;
9. When completing soil headspace vapour measurements of a soil sample using both a PID and CGI, the vapour measurement using the PID should be made first;

10. Immediately before taking a soil headspace vapour measurement, gently agitate the bag and then create a small opening in the top of the bag. Insert the tip of the CGI/PID into the headspace of the bag and quickly reseal the bag around the tip to minimize leakage. If there is any water inside the bag, ensure that the tip does not contact the water;
11. Record the maximum vapour concentration measured within the first 10 seconds after inserting the tip of the CGI/PID into the bag. Note any anomalies that occur during the taking of the measurement (e.g., if the readings displayed by the instrument progressively increase and do not reach an obvious peak);
12. Remove the tip of the CGI/PID from the bag and reseal the bag immediately in case additional soil headspace vapour measurements are needed. If the soil headspace vapour is measured for a sample using a PID and an additional measurement with a CGI is required, wait a minimum of five minutes after the bag is resealed before taking the measurement with the CGI;
13. Before completing the next soil headspace vapour measurement, allow the CGI/PID to reach “zero” or “baseline”. If the CGI/PID does not return to “zero” or “baseline” it should be recalibrated before further soil headspace vapour measurements are made;
14. At the discretion of the Project Manager, a calibration check of the CGI/PID should be completed at least once per day or at a frequency of once per 100 soil headspace vapour measurements (for projects where numerous soil headspace vapour measurements are made on a daily basis such as a large remediation project); and
15. A calibration check is made by measuring the concentration of a sample of the calibration gas with the CGI/PID without making any adjustments to the instrument beforehand and comparing the measured concentration with the known concentration. The comparison of the measured concentration versus the actual concentration of the calibration gas indicates how much the instrument’s calibration may have been altered during soil headspace vapour measurements, which is known as “instrument drift”. Should the calibration check show instrument drift of more than 10%, the CGI/PID needs to be recalibrated before completing further soil headspace vapour measurements. Record all pertinent information for the calibration check (e.g., date and time, initial measured concentration, calibration gas type and concentration) in the field logbook or field forms.

5.3 Visual Screening

Visual screening consists of examining the soil sample for potential indicators of contamination as per the following:

1. Visually examine the soil sample, including breaking apart a portion of the sample;

2. Note any indications of a mottled appearance, dark discolouration or staining, free-phase product or unusual colour;
3. Note any indications of non-soil constituents, such as brick, asphalt, wood or concrete fragments, coal fragments, coal ash, etc.; and
4. Record the findings of the visual screening in the field logbook or field forms. If there is no visual evidence of impacts this should be noted.

5.4 Olfactory Screening

Record in the field logbook or field forms the presence of any odours noted during sample collection and visual screening. Field staff are not expected to directly smell soil samples to assess the presence/absence of odours.

If it is possible to identify the likely type of odour (e.g., PHC-like, solvent-like, etc.) then this information should be recorded along with a comment on the severity of the odour (e.g., slight, strong, etc.). If the odour cannot be readily identified, it should be described in the field notes as “unidentified odour”.

If no odours are observed, this information should also be recorded in the field logbook or field forms.

5.5 Additional Considerations for Ontario Regulation 153/04 Phase Two ESA Compliance

When completing a Phase Two Environmental Assessment (ESA) in accordance with Ontario Regulation 153/04, the following additional procedures must be undertaken:

- Calibration of the CGI/PID must be completed at the beginning of each field day and calibration checks must be made either at the end of each field day or after every 100 soil vapour readings (whichever occurs first); and
- Thorough records of the CGI/PID calibration and calibration checks must be kept, including any calibration sheets provided by the equipment supplier. The Quality Assurance/Quality Control section of the Phase Two ESA report requires a discussion of field screening instrument calibration, and equipment calibration records must be appended to the Phase Two ESA report.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Association of Professional Geoscientists of Ontario, *Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended),* April 2011.

Ontario Ministry of the Environment, *Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario*, December 1996.

9.0 APPENDICES

None.

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Template: Master SOP Template – February 2014

SOP – EDR006 – REV005 – BOREHOLE DRILLING

Title:	Borehole Drilling
Practice:	EDR
First Effective Date:	November 25, 2010
Version:	004
Version Date:	November 19, 2020
Author:	Francesco Gagliardi and Robert MacKenzie
Authorized by:	Terry Duffy

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	November 25, 2010	N/A	FG
001	November 22, 2013	Streamlined text to reflect most common current practices/Removed sections covered by other SOPs	RM
002	April 29, 2016	Updated Section 4.0	RM
003	April 28, 2017	Removed reference to Pinchin West	RM
004	January 30, 2020	Annual Review	TJD
005	November 19, 2020	Formatting updates	RM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) presents a description of the methods employed for the completion of boreholes and the collection of subsurface soil samples.

Boreholes are typically completed to determine geologic conditions for hydrogeological evaluation, to allow the installation of monitoring wells, and to allow for the collection of subsurface soil samples for laboratory analysis.

Several methods are available for the collection of shallow subsurface soil samples using hand-held equipment (e.g., hand augers, post-hole augers). However, the use of a drill rig, equipped with direct-push tooling, solid-stem augers and/or hollow-stem augers, is the most common method used by Pinchin to advance boreholes and will be the focus of this SOP.

A detailed discussion of all the various drilling rigs and drilling methods (e.g., direct push, augering, sonic drilling, air/water/mud rotary drilling, etc.) is beyond the scope of this SOP. The Project Manager will be responsible for determining the appropriate drill rig and drilling method for the site investigation.

The majority of the site investigations completed by Pinchin involve relatively straightforward drilling within the overburden within a one aquifer system. In some situations, such as when multiple aquifers are spanned by a borehole, when drilling into bedrock or when there are known impacts in the shallow subsurface, drilling using telescoped casing methods may be appropriate. Telescoped casing and bedrock drilling methods are beyond the scope of this SOP. In these situations, the Project Manager, in consultation with the drilling contractor, will be required to confirm the drilling requirements and procedures.

3.0 OVERVIEW

Not applicable.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

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- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier for distribution as appropriate.

5.0 PROCEDURE

5.1 General

The overall borehole drilling program is to be managed in accordance with SOP-EDR005. In particular, utility locates must be completed in accordance with SOP-EDR021 before any drilling activities commence.

All non-dedicated drilling and sample collection equipment must be decontaminated in accordance with SOP-EDR009.

5.2 Prior Planning and Preparation

The planning requirements for borehole drilling programs are covered in detail in SOP-EDR005.

As noted above, the type of drilling rig and drilling method will be determined by the Project Manager when scoping out the site investigation. In some cases, a switch in drilling rig and/or drilling method may be required depending on site conditions. For example, if competent bedrock is encountered in the subsurface at a depth above the water table, bedrock coring would be required to advance the borehole deep enough to install a monitoring well.

5.3 Borehole Drilling Procedures

Once the final location for a proposed boring has been selected and utility clearances are complete, one last visual check of the immediate area should be performed before drilling proceeds. This last visual check should confirm the locations of any adjacent utilities (subsurface or overhead) and verification of adequate clearance.

In some instances, in particular where there is uncertainty regarding the location of buried utilities or the borehole is being completed near a buried utility, the use of a hydro-excavating (hydro-vac) unit will be required to advance the borehole to a depth below the bottom of the utility. The hydro-vac uses a combination of high-pressure water and high-suction vacuum (in the form of a vacuum truck) to excavate soil. This is also known as “daylighting”. The need to use a hydro-vac will be determined by the Project Manager.

If it is necessary to relocate any proposed borehole due to terrain, utilities, access, etc., the Project Manager must be notified, and an alternate location will be selected.

5.4 Borehole Nomenclature

If a borehole is advanced strictly for the purpose of soil sampling and no monitoring well is installed, the borehole should be identified as “BHxx”. If a monitoring well is installed in a borehole, the borehole should be identified as “MWxx”.

To avoid confusion, for site investigations involving both boreholes and monitoring wells, the numerical identifiers are to be sequential (e.g., there should not be a BH01 and MW01 for the same project).

When completing supplemental drilling programs, the borehole number should start at either the next sequential number after the last borehole number used in the first stage, or label them as ‘100 series’, ‘200 series’, etc. as appropriate (e.g., BH101, MW102, etc. for the first series of additional boreholes).

It is also acceptable to add the 2 digit year either before or after the borehole or monitoring well name (e.g., 17-MW101 or MW101-17).

5.5 Borehole Advancement

Each borehole will be advanced incrementally to permit intermittent or continuous sampling as specified by the Project Manager. Typically, the sampling frequency is one sample for every 2.5 or 5 feet (0.75 or 1.5 metres) the borehole is advanced. At the discretion of the Project Manager, soil samples may be collected at a lower frequency in homogeneous soil or at a higher frequency if changes in stratigraphy or other visual observations warrant it.

5.6 Direct-Push Drilling

This method is most commonly used at Pinchin to obtain representative samples of the subsurface soil material at a site. Direct-push drilling is achieved by driving a steel sampler into the subsurface at 1.5 metre intervals until the desired depth is achieved. The samplers are advanced by the drilling rig by means of a hydraulic hammer. For each soil sample run, a dedicated PVC sample liner is placed within the steel sampler which collects the soil as the sampler is advanced. After each sample run, a new sampler is assembled, and it is advanced deeper down the open borehole.

There are generally two methods of direct-push drilling which are used:

- Dual-tube sampling; and
- Macro-core sampling.

A dual-tube sampler consists of an 8.25 centimetre (cm) inner diameter steel tooling (outer tube), equipped with a steel cutting-shoe affixed to the advancing end. A smaller diameter steel tooling, consisting of a 5.75 cm inner diameter (inner tube), fits within the outer tube and contains a PVC sample liner within. These two tubes form the completed dual-tube sampler. The completed dual-tube sampler has a length of 1.5 metres.

A macro-core sampler consists of the smaller inner tube (mentioned above) used independently. The macro-core sampler measures approximately 1.5 metres in length.

The difference in drilling methods used is typically determined by soil conditions. Where soil conditions consist of tight or dense soil types (e.g., silts or clays), the macro-core sampling method may be used as this method provides less resistance to advancing the sampler. In soil types that are less resistive (e.g., loose sands), the dual-tube sampler may be used.

5.7 Auger Drilling (Split-Spoon)

The auger drilling method for borehole advancement and sampling involves using an auger drill rig to advance the borehole to the desired sampling depth and sampling with a split-spoon sampler. Borehole advancement with hollow stem augers is the preferred drilling method when sampling with split-spoon samplers as it minimizes the potential from sloughed material to reach the bottom of a borehole and possibly cross-contaminate samples when the split-spoon is driven beyond the bottom of the borehole. Solid stem augers can be used when drilling at sites with cohesive soils (e.g., silty clay), provided that the borehole remains open after the augers are removed from the ground prior to driving the split-spoon sampler.

The split-spoon sampler consists of an 18- or 24-inch (0.45 or 0.60 metres) long, 2-inch (5.1 cm) outside diameter tube, which comes apart lengthwise into two halves.

Once the borehole is advanced to the target depth, the sampler is driven continuously for either 18 or 24 inches (0.45 or 0.60 metres) by a 140-pound (63.5 kilogram) hammer. The hammer may be lifted and dropped by either the cathead and rope method, or by using an automatic or semi-automatic drop system.

The number of blows applied in each 6-inch (0.15 metre) increment is counted until one of the following occurs:

- A total of 50 blows have been applied during any one of the 6-inch (0.15 metre) increments described above;
- A total of 100 blows have been applied;

- There is no advancement of the sampler during the application of ten successive blows of the hammer (i.e., the spoon is "bouncing" on a cobble or bedrock); or
- The sampler has advanced the complete 18 or 24 inches (0.45 or 0.60 metre) without the limiting blow counts occurring as described above.

On the field form, record the number of blows required to drive each 6-inch (0.15 metre) increment of penetration. The first 6 inches is considered to be a seating drive.

The sum of the number of blows required for the second and third 6 inches (0.15 metres) of penetration is termed the "standard penetration resistance" or the "N-value". This information is typically provided on the borehole logs included in our site investigation reports.

The drill rods are then removed from the borehole and the split-spoon sampler unthreaded from the drill rods.

Caution must be used when drilling with augers below the groundwater table, particularly in sandy or silty soils. These soils tend to heave or "blow back" up the borehole due to the difference in hydraulic pressure between the inside of the borehole and the undisturbed formation soil. If blowback occurs, the drilling contractor will introduce water or drilling mud into the borehole or inside of the hollow-stem augers (if used) to equalize the hydraulic pressure and permit drilling deeper to proceed.

Heaving conditions and the use of water or drilling mud must be noted on the field logs, including the approximate volume of water or drilling mud used.

5.8 Auger Drilling (Direct Sampling)

In some jurisdictions (e.g., BC, Manitoba) it may be acceptable to collect soil samples directly from auger flights when using solid stem augers.

When sampling directly from auger flights, care must be exercised not to collect soils that were in direct contact with the auger or that were smeared along the edge of the borehole.

5.9 Borehole Advancement in Bedrock

It is sometimes possible to advance augers through weathered bedrock but borehole advancement through competent bedrock requires alternate drilling procedures. Bedrock drilling can be accomplished by advancing core barrels or tri-cone bits using air rotary or water rotary drilling methods. A description of the various bedrock drilling procedures is beyond the scope of this SOP.

The bedrock drilling method selected will depend in part on the type of bedrock, the borehole depth required, whether bedrock core logging is required, whether telescoped casing is required, etc. The Project Manager, in consultation with the drilling contractor, will determine the best method for advancing boreholes in competent bedrock.

5.10 Borehole Soil Sample Logging and Collection

The following describes the methods for logging and collection of samples from a split-spoon or direct-push sampler but can be adapted for sample collection from augers:

1. After the driller opens the split-spoon sampler or PVC liner, measure the length of the soil core retained in the sampler in inches or centimetres. Be sure to be consistent in the use of metric or imperial units, and that the units used are clearly noted in the field notes. The percentage of soil retained versus the length of the sampler is known as “sample recovery” and this information is presented on the borehole logs within our Phase II ESA reports;
2. Dedicated, disposable nitrile gloves are to be worn during soil logging and sampling;
3. When using a dual-tube or macro-core sampler with direct-push drilling, there is usually sufficient sample recovery to permit the collection of two soil samples from each sample run. In this case, if the sample recovery is greater than 2.5 feet (0.75 metres), divide the recovered soil into two depth intervals and log/collect a sample from each interval. Split-spoon samplers typically are not long enough nor provide enough sample to divide a sample run into two. However, if a recovered sample contains distinct stratigraphic units (e.g., fill material and native material, obviously impacted soil and non-impacted soil), the distinct units are to be sampled separately. It is especially important that potentially impacted soil (e.g., fill material, obviously impacted soil) is not mixed with potentially unimpacted soil (e.g., native soil, soil without obvious impacts) to form one sample;
4. Discard the top several centimetres in each core as this material is the most likely to have sloughed off the borehole wall and may not be representative of the soil from the intended depth interval;
5. To minimize the potential for cross-contamination, scrape the exterior of the soil core with a clean, stainless-steel putty knife, trowel or similar device to remove any smeared soil. Note that is not practical and can be skipped if the soil is non-cohesive (e.g., loose sand);
6. Split the soil core longitudinally along the length of the sampler and to the extent practical, collect the soil samples for laboratory analysis from the centre of the core (i.e., soil that has not contacted the sampler walls). When sampling directly from augers, soils in direct contact with the auger or soils retained on the augers that may have been in contact with the edge of the borehole should not be collected;

   Collect soil samples for potential volatile parameter analysis and field screening (in that order) as soon as possible after the core is opened. The length of time between opening the sampler and sample collection for these parameters should not exceed 2 minutes. It is important to follow this as it minimizes the potential for volatile constituents in the soil to be lost. See SOP-EDR003 for additional details regarding the collection of soil samples for field screening;

7. Drillers are not to open the split-spoon sampler or PVC liner until instructed to do so. If drilling and sample retrieval is occurring at a rate faster than Pinchin staff are able to sample and log the soil cores, the drillers are to be instructed to slow down or stop until further notice. This will prevent a back log of soil cores from accumulating and minimize the exposure of the soil cores to ambient conditions. This is particularly important when sampling for VOCs;
8. Collect soil samples for the remaining parameters to be analyzed;
9. Soil samples are to be labelled and handled in accordance with SOP-EDR013;
10. Record the parameters sampled for, the type(s) and number of sample containers, and the time and date of sample collection in the field notes;
11. Determine the soil texture in accordance with SOP-EDR019 and record this information in the field notes;
12. Soil samples collected for soil headspace vapour measurement must not be submitted for laboratory analysis except for analysis of non-volatile parameters (i.e., metals and inorganics) or grain size analysis;
13. Immediately following collection, place each sample container in a cooler containing ice bags or ice packs; and
14. After the maximum borehole drilling depth is reached, measure the borehole depth with a weighted measuring tape and record the total depth in the field notes if the borehole diameter is large enough to permit measurement.

5.11 Borehole Backfilling.

Following completion of each borehole in which a well is not installed, it must be properly backfilled with bentonite and/or bentonite grout by the drilling contractor. The drilling contractor is to be consulted to confirm the proper borehole abandonment procedures required by the local regulations (e.g., Ontario Regulation 903 (as amended) for Ontario sites).

Drill cuttings are not be used to backfill boreholes.

Record the borehole backfilling method and materials used in the field notes.

5.12 Borehole Location Documentation

For each borehole, complete the following to document its location:

1. Photograph the completed borehole location. Close up photographs of the borehole are to be taken as well as more distant photographs that show the location of site landmarks relative to the borehole so that the photograph can be used to locate the borehole in the future; and
2. Using a measuring tape or measuring wheel, measure the distance between the borehole and a nearby landmark (e.g., corner of the nearest building) and provide a borehole location sketch in the field notes. Measurements are to be made at right angles relative to the orientation of the landmark or to a fixed axis (e.g., relative to true north). If required by the Project Manager, measure the UTM coordinates of the borehole with a hand-held GPS device.

5.13 Field Notes

The field notes must document all drilling equipment used, sample depths and measurements collected during the borehole drilling activities. The field notes must be legible and concise such that the entire borehole drilling and soil sampling event can be reconstructed later for future reference. The field notes are to be recorded on the field forms or in a field book.

5.14 Additional Considerations for O. Reg. 153/04 Phase Two ESA Compliance

None. Following this SOP will be sufficient to comply with the Ontario Regulation 153/04 requirements for Phase Two Environmental Site Assessments.

5.15 Health and Safety

All work activities under this SOP will be completed in a safe manner following the requirements of Pinchin's Occupational Health and Safety Program, client site requirements and current legislation.

Pinchin Employees conducting work under this SOP must meet the job competency requirements as outlined in Section 2.3 Job Competency of the Pinchin Health and Safety Program.

Where technical occupational health and safety assistance is required in evaluating hazards and determining controls, a Qualified Person should be engaged following Pinchin Health and Safety Program Section 3.2 Project Hazard Assessments.

If, while working on a site and following this SOP, there is an incident resulting in loss (personal injury, property damage) or a near miss (potential loss), fill in and submit the appropriate incident form (3.3.1.) or near miss form (3.3.2).

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of Health & Safety Training by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Canadian Standards Association, *Phase II Environmental Site Assessment, CSA Standard Z769-00 (R2018)*, dated 2000 and reaffirmed in 2018.

Association of Professional Geoscientists of Ontario, *Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended)*, April 2011.

9.0 APPENDICES

None.

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Template: Master SOP Template – February 2014

SOP – EDR007 – REV006 – MONITORING WELL DESIGN AND CONSTRUCTION

Title:	Monitoring Well Design and Construction
Practice:	EDR
First Effective Date:	August 03, 2009
Version:	006
Version Date:	November 19, 2020
Author:	Robert MacKenzie
Authorized by:	Terry Duffy

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1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	August 03, 2009	N/A	MEM
001	November 26, 2010	Update approval signatures	FG
002	November 15, 2013	Streamlined to cross reference AAPGO guidance document/Added section on O. Reg. 153/04 compliance	RLM
003	April 29, 2016	Updated Section 4.0/Added procedure for outer casing installation in Ontario	RLM
004	April 28, 2017	Remove reference to Pinchin West/Added note to Section 5.2 about placing a reference mark at the top of the well pipe/Added note to Section 5.3 that O.Reg.153/04 requires well screens to intersect the water table when assessing groundwater for petroleum hydrocarbon impacts during a Phase Two ESA	RLM
005	January 30, 2020	Yearly Review	TJD
006	November 19, 2020	Formatting updates	RM

2.0 SCOPE AND APPLICATION

Monitoring wells are installed in overburden and bedrock to enable the collection of groundwater samples from water bearing formations at project sites. For some projects, monitoring wells are also used to monitor for combustible gases in the subsurface.

A monitoring well consists of two parts: the well screen and the well casing (also known as the well riser). The well screen allows groundwater to enter the well from the formation adjacent to the well so that it can be sampled. The well casing allows access to the well from the ground surface.

In Ontario, the regulatory requirements for monitoring well installation are provided in Ontario Regulation 903. All drilling contractors who install groundwater monitoring wells in Ontario must be licensed with the Ontario Ministry of the Environment and Climate Change (MOECC). In addition, for any well installed at a depth of greater than 3.0 metres below ground surface, a Water Well Record must be prepared by the drilling contractor and submitted to the MOECC and the well owner (typically our client).

The design and construction of soil vapour monitoring wells is beyond the scope of this SOP and is described in SOP-EDR018.

3.0 OVERVIEW

Not applicable.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier for distribution as appropriate.

5.0 PROCEDURE

5.1 General Considerations

5.1.1 Borehole and Well Diameters

The borehole diameter must be sufficient in size to accommodate the well casing, sand pack and seal materials. In Ontario, the borehole diameter and annular space surrounding the monitoring well must meet the requirements of Ontario Regulation 903. Other provinces have similar requirements that must be considered. It is the Project Manager’s responsibility to be aware of specific provincial requirements. Wherever possible, 2-inch (5.1. centimetre) interior diameter monitoring wells should be installed as they permit the use of most sampling and monitoring devices, and will generally provide greater water volume for sampling, especially in low permeability soils. Monitoring wells with interior diameters between 1-inch (2.5 centimetres) and 1.5-inches (3.8 centimetres) are also considered acceptable in some jurisdictions but the use of monitoring wells smaller than 1-inch (2.5 centimetres) is not permitted unless approved by the Project Manager.

5.1.2 Screen Length and Placement

Well screens typically range in length from 1.5 to 3.0 metres. Saturated well screen lengths beyond 1.8 metres, including sand pack, should be avoided in British Columbia, as per British Columbia Ministry of Environment Technical Guidance 8.

Wells screens must not straddle more than one hydrostratigraphic unit and should not be placed such that a preferential pathway for contaminant migration is created between two hydrostratigraphic units. In particular, a well screen must not straddle the overburden/bedrock interface, and the well screen, sand pack and seal must be situated entirely within either the overburden or the bedrock. An exception to this if the well is installed for assessing dense non-aqueous phase liquid (DNAPL), the penetration into the bedrock is minimal, and bedrock fractures are isolated from the sand pack. This type of well installation must only be completed under the guidance of staff with the appropriate geological expertise to ensure it is done correctly.

When determining the well screen length and depth of screen placement for a project, the following should be considered by the Project Manager:

- When assessing for the presence of light non-aqueous phase liquid (LNAPL) at the water table, longer well screens are preferred due to seasonal fluctuations in the water table and the well screen should intersect the water table whenever possible;
- When assessing for the presence of DNAPL, the well screen should be positioned at the bottom of the aquifer immediately above the aquitard;
- When assessing geochemical parameters, shorter well screens may be preferable to reduce the potential for mixing of water from distinct vertical geochemical zones;
- The use of long well screens within the saturated zone may result in the mixing of impacted and unimpacted groundwater from different depths within the aquifer, with the resulting dilution effect biasing the groundwater concentrations low; and
- Nested wells can be used to determine contaminant stratification within an aquifer or assess multiple aquifers, as long as the wells and individual aquifers are properly sealed off from each other within the borehole.

5.1.3 Well Screen/Casing Materials

Polyvinyl chloride (PVC) is the standard material used to construct groundwater monitoring wells. However, some organic compounds if present at excessive concentrations can degrade PVC, and stainless-steel or Teflon well materials may be considered for use by the Project Manager at such project sites.

A filter sock must not be placed over a well screen.

5.1.4 Well Screen Slot Size and Sand Pack

The slot size of the well screen will be determined by the size of the filter pack used. Pinchin typically uses No. 10 slot screen and #1 silica sand to form the sand pack around the well screen. When investigating a site with fine-grained soil, it may be appropriate to use a finer sand pack and smaller slot size to act as a “filter” to prevent as much fine-grained soil from entering the well as possible. The Project Manager should consult with the drilling contractor to determine the most appropriate screen slot size and sand pack size.

5.1.5 Bentonite Seal

The annular space above the sand pack in all wells is to be filled with bentonite. The purpose of placing the bentonite is create a seal above the sand pack that prevents a connection between other water bearing zones within the subsurface and/or water infiltration from the surface.

5.1.6 Surface Completions

A protective steel casing and lockable cap are to be installed at each well to protect the well and prevent tampering. Protective casings come in two varieties: aboveground casings (commonly known as monument casings) and flush-mount casings.

Aboveground casings have the advantage of having better visibility and can be located more easily, especially during winter, are less likely to need repair, and have fewer problems related to water intrusion and frost heave of the casing.

Flush-mount casings are usually the only available option for wells installed in areas of high vehicular or pedestrian traffic. Also, some clients prefer flush-mount casings for aesthetic reasons as they are less obtrusive.

When installing a well in a high vehicular traffic area such as a roadway, the flush-mount casing must have sufficient strength to avoid damage when run over by vehicles. Flush-mount casings with brass lids should not be installed in high vehicular traffic areas as they are easily damaged to the point where they can no longer be opened.

5.2 Well Installation Procedures

Note that Pinchin field staff are not trained, nor have the necessary licensing, to install monitoring wells. This task is to be performed by the drilling contractor in accordance with the applicable regulatory requirements (e.g., Ontario Regulation 903 (as amended) in Ontario). Pinchin field staff will assist the drilling contractor by specifying the general design of the monitoring well but will not perform the actual installation. The primary role of Pinchin field staff during well installation is to document the installation (e.g., measuring and/or recording the well length, screen length, depth to top of sand pack, etc.) as outlined below.

The following presents the general procedure for the completion of overburden and bedrock monitoring well installations after the borehole has been advanced to the appropriate depth:

1. Assemble the well by threading sufficient lengths of screen and riser materials together, and placing a threaded cap or slip-on cap at the bottom of the well. Well materials are to be kept in their plastic sleeves until immediately prior to well installation, and are not to be placed on the ground unless the ground surface is covered by clean plastic sheeting. Well materials should not be stored near potentially contaminated materials (e.g., soil cuttings;

   Dedicated, disposable nitrile gloves are to be worn by all personnel handling the well materials and are to be replaced if they become contaminated during well installation. Confirm the length of the well screen, well riser and total length of well. This is especially important if the screen and/or riser are trimmed to fit the borehole depth or desired screen interval. Record the length of the well screen, the length of the well casing, the total length of the well (including the bottom cap), the type of bottom cap used, and the interior diameter of the well screen/well casing in the field notes;

2. Prior to placing the assembled well into the borehole, measure the depth from ground surface to the bottom of the borehole and record this depth in the field notes;

3. When possible, place a minimum of 0.15 metres of filter pack into the bottom of the borehole to provide a firm base for the well. Note that the placement of such a filter pack base may not be appropriate when investigating a site where DNAPLs are suspected as the filter pack base may act as a DNAPL "sump" beneath the well and the DNAPL may go undetected when monitoring the well;
4. Place the assembled well into the open borehole or within the interior of the hollow stem augers. If trimming of the well casing is required, measure the length of the trimmed piece and record this information in the field notes. Before installing the sand pack, place a J-plug or slip cap on the top of the well to prevent sand and seal materials from entering the well when backfilling the annular space between the well and the borehole walls;
5. Install the sand pack around the exterior of the well screen and extend it to between 0.3 and 0.6 metres above the top of the well screen. The sand pack should be installed slowly, and with a tremie pipe if possible, to minimize the potential for bridging of the sand pack. When installing a sand pack in a borehole that has been drilled with hollow stem augers, the sand pack should be installed in lifts of approximately 0.5 metres. After placement of each lift, the augers are withdrawn from the ground by approximately 0.5 metres and the process repeated until the sand pack is placed to the required depth. Measure the depth to the top of the sand pack and record this depth in the field notes;
6. Install a bentonite seal comprised of granular and/or powdered bentonite above the sand pack to within approximately 0.6 metres of the ground surface. The bentonite should be installed slowly, and with a tremie pipe if possible, to minimize the potential for bridging of the seal. For the portion of the seal located above the water table, distilled water is to be poured into the borehole for each lift placed above the water table (approximately 0.3 to 0.6 metres per lift) to hydrate the seal. Approximately 1 to 2 litres of distilled water per lift is considered sufficient to hydrate the seal. Measure the depth to the top of the bentonite seal and record this depth in the field notes;
7. Record whether the seal was hydrated during installation and over which depth interval. Note that in some jurisdictions very long bentonite seals can be broken up with sand intervals. This reduces the potential for ground heaving due to bentonite shrinking and swelling but the sand intervals must not connect hydraulically separated aquifers;
8. (Ontario only) If the well is to be installed with a flush-mount protective casing, an outer casing comprised of a short length (10 to 15 cm) of PVC riser, or PVC coupling, that is slightly larger in diameter than the well casing needs to be installed around the well casing into the top of the bentonite seal, with the gap between the two casings sealed with bentonite. The top of the outer casing needs to be flush with or slightly below the top of the well casing. For example, if a 2-inch diameter well is installed, then a 10 to 15 cm

length of 3-inch or 4-inch diameter riser or coupling placed around the 2-inch diameter well casing will suffice provided that bentonite is placed between the two casings. The flush-mount protective casing is then installed around the two casings. The outer casing does not need to be capped, and we only need to cap the well casing with a J-plug or slip cap;

9. (Ontario only) If the well is to be installed with a stick up protected by a monument casing, the procedure for installing the outer casing is essentially the same, except that the outer casing will extend from 10 to 15 cm below ground to above the ground surface, preferably flush with or slightly below the top of the well casing if the design of the monument casing permits it;
10. Place a protective well casing (monument or flush-mount) around the well casing and cement it in place;
11. Using a permanent marker, mark a point on the top of the well casing that will serve as a reference point for all future depth to water and elevation survey measurements. Measure the depth to groundwater in the well at the time of completion. Note the depth to water and time of measurement in the field notes;
12. Place a lockable J-plug on the well casing and ensure that the J-plug is tightened sufficiently to prevent surface water from infiltrating into the well if the well has a flush-mount completion. Place a lock on the J-plug for a flush-mount completion or on the lockable cap for an aboveground completion if required by the Project Manager. A PVC slip cap can also be used, especially for an aboveground completion;
13. Photograph the completed well installation. Close up photographs of the well are to be taken as well as more distant photographs that show the location of site landmarks relative to the well so that the photograph can be used to locate the well in the future; and
14. Using a measuring tape or measuring wheel, measure the distance between the well and a nearby landmark (e.g., corner of the nearest building) and provide a well location sketch in the field notes. Measurements are to be made at right angles relative to the orientation of the landmark or to a fixed axis (e.g., relative to true north). If required by the Project Manager, measure the UTM coordinates of the well with a hand-held GPS device.

5.3 Additional Considerations for O. Reg. 153/04 Phase Two ESA Compliance

Ontario Regulation 153/04 mandates that well screens must not exceed 3.1 metres in length. In addition, whenever the Phase Two ESA includes the assessment of petroleum hydrocarbon impacts in groundwater, the well screen in each well must intersect the water table.

5.4 Health and Safety

All work activities under this SOP will be completed in a safe manner following the requirements of Pinchin's Occupational Health and Safety Program, client site requirements and current legislation.

Pinchin Employees conducting work under this SOP must meet the job competency requirements as outlined in Section 2.3 Job Competency of the Pinchin Health and Safety Program.

Where technical occupational health and safety assistance is required in evaluating hazards and determining controls, a Qualified Person should be engaged following Pinchin Health and Safety Program Section 3.2 Project Hazard Assessments.

If, while working on a site and following this SOP, there is an incident resulting in loss (personal injury, property damage) or a near miss (potential loss), fill in and submit the appropriate incident form (3.3.1.) or near miss form (3.3.2).

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Association of Professional Geoscientists of Ontario, *Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended),* April 2011.

British Columbia Ministry of the Environment, *Technical Guidance 8: Groundwater Investigation and Characterization*, July 2010.

9.0 APPENDICES

None.

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Template: Master SOP Template – February 2014

SOP – EDR008 – REV005 – MONITORING WELL SAMPLING

Title:	Monitoring Well Sampling
Practice:	EDR
First Effective Date:	November 8, 2013
Version:	005
Version Date:	January 3, 2018
Author:	Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	November 08, 2013	N/A	RM
001	September 25, 2015	Incorporated procedures specific to Pinchin West into SOP	RM
002	February 9, 2016	Revised overall procedure to be consistent with well development SOP/Added reference to revised well development field forms	RM
003	April 29, 2016	Updated Section 4.0	RM
004	April 28, 2017	Removed reference to Pinchin West	RM
005	January 3, 2018	Changed “submersible” to “centrifugal” throughout	RM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the standard procedures for groundwater monitoring well purging and sampling, and provides a description of the equipment required and field methods.

Note that this SOP pertains to monitoring well sampling using the “well volume” purging procedure. Groundwater monitoring well purging and sampling using low flow procedures is described in SOP-EDR023.

3.0 OVERVIEW

Groundwater sampling involves two main steps: well purging followed by sample collection. All groundwater monitoring wells must be purged prior to groundwater sampling to remove groundwater that may have been chemically altered while residing in the well so that groundwater samples representative of actual groundwater quality within the formation intersected by the well screen can be obtained.

Monitoring well sampling should not be completed until at least 24 hours have elapsed following monitoring well development to allow subsurface conditions to equilibrate. Any deviation from this procedure must be discussed with the Project Manager before proceeding.

4.0 DISTRIBUTION

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- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

5.1 Equipment and Supplies

5.1.1 Documents and Information Gathering

- A copy of the proposal or work plan;
- Monitoring well construction details (borehole logs, well construction summary table from a previous report or well installation field notes);
- A copy of this SOP;
- A site-specific Health and Safety Plan (as per the project requirements); and
- Client or site representative’s contact details.

5.1.2 Well Purging and Sampling Equipment

- Inertial pump (e.g., Waterra tubing and foot valve) (Optional depending on jurisdiction);
- Peristaltic pump (Optional depending on the parameters being sampled);
- Centrifugal or bladder pump (Optional depending on jurisdiction and well depth);
- Disposable bailer (Optional);
- Graduated pail (to contain purge water and permit the volume of groundwater purged to be tracked);
- Pails or drums for purge water storage prior to disposal;
- Well keys (if wells are locked);
- Tools to open monitoring well (T-bar, socket set, Allen keys, etc.);
- Interface probe;
- Equipment cleaning supplies (see SOP-EDR009);
- Disposable latex or nitrile gloves; and
- Field forms.

5.2 Purging Procedures

The well purging procedure employed will be determined by the hydraulic conductivity of the formation in which the groundwater monitoring well is installed. For this SOP, a high yield well is defined as a well that cannot be purged to dryness when pumping continuously at a rate of up to 2 litres per minute (L/min) and a low yield well is defined as a well that can be purged to dryness when pumping continuously at a rate of 2 L/min or less. This threshold represents a “normal” pumping rate when hand pumping with an inertial pump.

5.2.1 Purging of High Yield Wells

The procedure for purging a high yield monitoring well is as follows:

1. Decontaminate all non-dedicated monitoring and sampling equipment that will be used, including the interface probe and centrifugal or bladder pump (if used), in accordance with the procedures described in SOP-EDR009;
2. Review the well construction details provided in the borehole logs, previous field notes or well construction summary table from a previous report. Determine the well depth, well stick up, screen length, depth to top of sand pack and diameter of the borehole annulus. If the well depth is unavailable, measure it with the interface probe;
3. Measure the initial water level (i.e., static water level) from the reference point on the well (which should be marked at the top of the well pipe) with an interface probe. If measurable free-phase product is present on the water table, record the depth to the top of the free-phase product and the depth to the free-phase product/water boundary (i.e., water level), and discuss this with the Project Manager before proceeding further;
4. Calculate the well volume. **Note that for the purpose of this SOP, there are two definitions of well volume depending on the province in which the project is being conducted.** For Ontario and Manitoba, the well volume is defined as the volume of water within the wetted length of the well pipe (well pipe volume) plus the volume of water within the wetted length of the sand pack (sand pack volume). For British Columbia, Alberta and Saskatchewan, the well volume is defined as the volume of water within the wetted length of the well pipe (well pipe volume) only.

   The volume of water in the well pipe is calculated as follows:

   Well Pipe Volume (litres) = $h_w \times \pi r_w^2 \times 1{,}000$ litres per cubic metre (L/m^3)

   Where $\pi = 3.14$

   h_w = the height of the water column in the monitoring well in metres (wetted length)

   r_w = the radius of the monitoring well in metres (i.e., half the interior diameter of the well)

The volume of the sand pack in the monitoring well is calculated as follows:

Sand Pack Volume (litres) = h_w x [(0.3 π r_b^2 x 1,000 L/m^3) – (0.3 π r_w^2 x 1,000 L/m^3)]

Where 0.3 = the assumed porosity of the sand pack

h_w = the height of the water column in the monitoring well in metres (wetted length)

π = 3.14

r_b = the radius of the borehole annulus in metres

r_w = the radius of the monitoring well in metres

For Ontario and Manitoba projects, the following table provides well volumes in litres/metre for typical well installations:

Borehole Annulus Diameter (Inches/Metres)	Well Interior Diameter (Inches)	Well Pipe Volume (Litres/Metre)*	Well Volume (Litres/Metre)*
4/0.1	1.25	0.8	2.9
	1.5	1.1	3.2
	2	2.0	3.8
6/0.15	1.25	0.8	5.9
	1.5	1.1	6.1
	2	2.0	6.7
8.25/0.21	1.5	1.1	11.2
	2	2.0	11.8
10.25/0.26	1.5	1.1	16.7
	2	2.0	17.3

* Litres to be removed per metre of standing water in the well (wetted length).

If the borehole annulus and well interior diameters match one of those listed above, to determine the volume of one well volume simply multiply the number in the last column of the table by the wetted length in the well. For example, if a 2-inch diameter well installed in a 8.25-inch diameter borehole has 2.2 metres of standing water, one well volume equals 26.0 litres (2.2 metres x 11.8 litres/metre).

<u>Note that the above well volume calculations apply only to wells where the water level in the well is below the top of the sand pack</u>. If the water level is above the top of the sand pack, then the well volume is the volume of water in the sand pack and well pipe within the sand pack interval, plus the volume of water in the well pipe (i.e., well pipe volume) above the top of the sand pack. For example, assume a 2-inch diameter well has been installed in a 8.25-inch diameter borehole to a depth of 6.0 metres below ground surface (mbgs), with a 3.05 metre long screen. The sand pack extends from 6.0 mbgs to 2.5 mbgs and the water level is at 1.85 mbgs. One well volume equals ([6.0 metres – 2.5 metres] x 11.8 litres/metre) + ([2.5 metres – 1.85 metres] x 2.0 litres/metre) or 42.6 litres.

For British Columbia, Alberta and Saskatchewan projects, the well volume is calculated using the conversion factor listed in the third column of the above table. For example, if there are 2.5 metres of standing water in a 1.5-inch diameter well, one well volume equals 2.75 litres (2.5 metres x 1.1 litres/metre);

5. Lower the pump intake into the well until it is approximately 0.3 metres above the bottom of the well. Remove half a well volume while pumping at a rate of approximately 1 to 2 L/min. Record the approximate purge volume, pump intake depth and pertinent visual/olfactory observations (e.g., sheen, odour, free-phase product, sediment content, clarity, colour, etc.);
6. Move the pump intake upward to the middle of the water column (or middle of the screened interval if the water level in the well is above the top of the screen). Remove half a well volume (for a cumulative total of 1 well volume) while pumping at a rate of approximately 1 to 2 L/min. Record the approximate purge volume, pump intake depth and any pertinent visual/olfactory observations;
7. Move the pump intake upward to near the top of the screened interval (or near the top of the water column if the water level is currently below the top of the screen). Remove half a well volume (for a cumulative total of 1.5 well volumes) while pumping at a rate of approximately 1 to 2 L/min. Record the approximate purge volume, pump intake depth and any pertinent visual/olfactory observations.

   Note that if the wetted length is short within a well (e.g., 1.5 metres or less), there will not be enough separation between pump intake depths to warrant pumping from three depths (i.e., near the bottom, middle and top of the water column). In this case, pumping from two depths (i.e., near the bottom and top of the water column) is sufficient;
8. Repeat steps 5 through 7 until a minimum of 3 well volumes in total have been removed. If the purge water contains high sediment content after the removal of 3 well volumes, well purging should continue by removing additional well volumes until the sediment content visibly decreases. If the purge water continues to have high sediment content after the removal of 2 additional well volumes (i.e., 5 well volumes in total), contact the Project Manager to discuss whether well purging should continue; and

9. Proceed with groundwater sample collection (see below).

Note that the use of a bailer to purge a high yield well with a wetted interval greater than 2 metres is not recommended given that the depth from which groundwater is removed is difficult to control.

5.2.2 Purging of Low Yield Wells

The procedure for purging a low yield monitoring well is as follows:

1. Decontaminate all non-dedicated monitoring and sampling equipment that will be used, including the interface probe and centrifugal or bladder pump (if used), in accordance with the procedures described in SOP-EDR009;
2. Review the well construction details provided in the borehole logs, previous field notes or well construction summary table from a previous report. Determine the well depth, well stick up, screen length, depth to top of sand pack and diameter of the borehole annulus. If the well depth is unavailable, measure it with the interface probe;
3. Measure the initial water level (i.e., static water level) from the reference point on the well (which should be marked at the top of the well pipe) with an interface probe. If measurable free-phase product is present on the water table, record the depth to the top of the free-phase product and the depth to the free-phase product/water boundary (i.e., water level), and discuss this with the Project Manager before proceeding further;
4. Position the pump intake at the bottom of the well. Purge the well to dryness at a rate of between approximately 1 and 2 litres L/min. At the conclusion of purging, drain the pump tubing if possible. Record the approximate purge volume;
5. After allowing sufficient time for the well to recover, proceed with sample collection (see below). Note that wherever possible, the well should be allowed to recover to at least 90% recovery before proceeding with sample collection. However, if recovery to this level requires more than one hour to complete, it is better to sample the well as soon as it recovers sufficiently to permit sampling, especially if samples are being collected for volatile parameters such as volatile organic compounds (VOCs) and petroleum hydrocarbons (PHCs) (F1); and
6. Record the water levels, time of water level measurements and well status (e.g., well recovery incomplete, 90% recovery target met) on the field form to document the well recovery. Purging of wells at the end of a day and returning to the site the following day to collect samples is not permitted unless the well recovery is so poor that this amount of time is needed for there to be sufficient recovery to permit sample collection.

Note that bailers can be used in lieu of a pump to purge a low yield well provided that the well yield is low enough to permit the draining of all of the groundwater in the well with the bailer.

5.3 Well Purging Record

Well purging prior to sampling is to be documented through the completion in full of the following field forms located in the Pinchin Orchard:

- EDR-GW-Well Sampling-Low Yield Well; or
- EDR-GW-Well Sampling-High Yield Well.

Any deviations from this SOP along with the rationale for these deviations must be recorded on the forms.

5.4 Sample Collection

5.4.1 General Considerations

Inertial pumps are generally suitable for all sample collection for due diligence projects. However, the motion of the inertial pump in the water column of a well, even when pumping at a low rate, can create turbulence in the well that can suspend sediment already in the well or draw it in from the formation. Sediment captured in a sample can often result in positive bias to the analytical results, especially for the parameters PHCs (F3 and F4) and polycyclic aromatic hydrocarbons (PAHs), resulting in "false positives" that are not representative of actual groundwater quality. Sampling for these parameters following low flow purging and sampling procedures (SOP-EDR023) is an acceptable option to minimize potential sediment bias but because it is more expensive and time consuming than "conventional" sampling, it is typically not completed for due diligence projects. In lieu of low flow purging and sampling, a peristaltic pump, centrifugal pump or bladder pump is to be used as a "grab sampler" when sampling for PHCs (F2-F4) and PAHs.

In Ontario and Manitoba, or where otherwise prohibited by provincial guidance documents, peristaltic pumps must not be used to collect samples for analysis of volatile parameters, namely VOCs and PHCs (F1). As such, if the suite of parameters to be sampled at a given well includes VOCs and/or PHCs (F1), a "hybrid" sampling procedure is to be followed, in which samples for VOCs, PHCs (F1), PCBs and/or metals analysis are to be collected using an inertial pump and samples for PHCs (F2-F4) and PAHs analysis are to be collected using a peristaltic pump. Alternatively, the entire suite of parameters can be collected using a centrifugal or bladder pump.

The following table summarizes the pump types, parameters that can be sampled using each pump and how the well volume is determined for each province:

Jurisdiction	**Pump Type**	**Parameters**	**Well Volume**
BC	Inertial Pump	All Parameters	Well Pipe Volume
	Peristaltic Pump	All Parameters	Well Pipe Volume

Jurisdiction	Pump Type	Parameters	Well Volume
Alberta/Saskatchewan	Inertial Pump	All Parameters Except PHCs (F2) and PAHs	Well Pipe Volume
	Peristaltic Pump	PHCs (F2) and PAHs	Well Pipe Volume
Manitoba/Ontario	Inertial Pump	All Parameters Except PHCs (F2-F4) and PAHs	Well Pipe Volume + Casing Volume
	Peristaltic Pump	PHCs (F2-F4) and PAHs	
All Provinces	Centrifugal Pump	All Parameters	As Per Above
All Provinces	Bladder Pump	All Parameters	As Per Above

Bailers should not be used for sample collection unless there is no other option (e.g., when there is minimal groundwater in a well). They can be used as a substitute for an inertial pump but may bias concentrations of volatile parameters low and concentrations of PHCs (F2-F4) and PAHs high. The use of a bailer for groundwater sample collection must be approved by the Project Manager.

There is a common misconception that using a peristaltic pump, centrifugal pump or bladder pump and sampling at a low pumping rate is “low flow sampling”. Sampling in this manner is essentially “grab sampling” using a device other than an inertial pump and is not “low flow sampling”. Only if groundwater sampling was completed in accordance with SOP-EDR023 can the sampling be referred to as “low flow sampling”.

5.4.2 Sampling of High and Low Yield Wells

The procedure for collecting groundwater samples from a high or low yield monitoring well is as follows:

1. Label the sample containers with the sample identifier, project number and date and time of sample collection. The sample containers for each well are be filled in the following order:
   - Volatiles parameters (e.g., VOCs, PHCs (F1));
   - Semi-volatile parameters (e.g., PHCs (F2-F4), PAHs); and
   - Non-volatile parameters (e.g., inorganic parameters, metals).

   There is an exception to the above sample collection order when using the “hybrid” sampling method. In this case, the semi-volatile parameters (PHCs (F2-F4) and/or PAHs) are to be sampled first using the peristaltic pump, centrifugal pump or bladder pump, followed by sampling volatile parameters and then non-volatile parameters using the inertial pump;

2. Position the pump intake at the approximate middle of the screened interval (or middle of the water column if the water level is below the top of the screen). At the discretion of the Project Manager, the pump intake may be positioned near the top of the water column if light non-aqueous phase liquids (LNAPLs) are being investigated (e.g., gasoline, fuel oil) and at the bottom of the well when dense non-aqueous phase liquids (DNAPLs) (e.g., chlorinated solvents) are being investigated. For a low yield well when the tubing was (or could) not be drained at the conclusion of purging, or when a high yield well is not sampled immediately after purging, pump sufficient water from the tubing before initiating sample collection at a rate of approximately 0.5 L/min to remove any water that was left over in the tubing following purging;
3. When sampling for volatile parameters (i.e., VOCs and PHCs (F1)), pump at a rate of approximately 0.5 L/min. When using an inertial pump, hold the pump vertical while pumping to minimize agitation and possible contaminant volatilization. During volatile parameter sampling, the tubing of the inertial pump must not contain air bubbles. If air bubbles are present, continue pumping until there are no air bubbles in the tubing. Once the tubing is full and free of air bubbles, carefully pour the groundwater from the tubing into the sample vials until they are filled to be headspace-free. When using a peristaltic pump (BC only), centrifugal pump or bladder pump for volatile parameter sampling, the samples can be collected by pumping directly into the sample containers until they are headspace-free. Once filled and capped, check each vial for air bubbles by turning it upside down. If bubbles are present in a vial, reopen it and add additional groundwater until there are no remaining bubbles;
4. When sampling for semi-volatile parameters, pump at a rate of between 0.5 and 1 L/min. The samples can be collected by pumping directly into the sample containers;
5. When sampling for non-volatile parameters, pump at a rate of between 0.5 and 1 L/min. The samples can be collected by pumping directly into the sample containers;
6. Samples collected for dissolved metals analysis are to be filtered in the field using dedicated, disposable 0.45 micron in-line filters or marked to be filtered by the laboratory, except for samples collected in Ontario for methyl mercury analysis which are not to be filtered. Field filtering must occur before samples for metals analysis are preserved. Prior to filling the first sample container using a new filter, the filter is to be “primed” by flushing a volume of water equal to twice the capacity of the filter through the filter. Samples for other parameters are not to be filtered in the field. In situations where field filtering cannot be completed, such as when sampling with a bailer, samples for metals analysis

are to be collected in sample containers without preservatives and the analytical laboratory is to be instructed on the Chain-of-Custody to filter and preserve the samples upon receipt;

7. When collecting samples in containers that are pre-charged with preservatives, care must be taken not to overfill the containers as some of the preservative may be lost which will result in the sample not being properly preserved. Also, sample containers for metals analysis typically have a fill line marked on the container and the container must not be filled to above this line as this will cause dilution of the preservative and the sample may not be properly preserved;
8. Record the parameters sampled for, the purging and sampling equipment used, whether samples for metals analysis were field filtered, and the time and date of sample collection in the field forms; and
9. Immediately following collection, place each sample container in a cooler containing ice bags or ice packs.

5.5 Additional Considerations for O. Reg. 153/04 Phase Two ESA Compliance

Groundwater sampling conducted for a Phase Two ESA completed in accordance Ontario Regulation 153/04 must be completed when well yields permit using the low flow purging and sampling methods provided in SOP-EDR023 unless authorized by the Qualified Person responsible for the Phase Two ESA.

6.0 TRAINING

The Practice Leader is responsible for identifying the initial training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Association of Professional Geoscientists of Ontario, "*Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended)",* April 2011.

SOP – EDR009 – REV004 – FIELD DECONTAMINATION OF NON-DEDICATED MONITORING AND SAMPLING EQUIPMENT

Title:	Field Decontamination of Non-Dedicated Monitoring and Sampling Equipment
Practice:	EDR
First Effective Date:	August 03, 2009
Version:	004
Version Date:	January 3, 2018
Author:	Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

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1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	August 02, 2009	N/A	MEM
001	November 26, 2010	Updated Approval Signature/Added reference to Ontario Regulation 511/09	FG
002	September 20, 2013	Revised majority of text to reflect current practices/Focused on equipment cleaning and removed reference to personnel decontamination/Added section on O. Reg. 153/04 requirements/Revised reference list	RLM
003	April 29, 2016	Updated Section 4.0/Removed methanol as optional cleaning reagent	RLM
004	April 28, 2017	Removed reference to Pinchin West/In Section 5.2.2, modified requirements for cleaning water level tapes and interface probes/In Section 5.2.3, modified requirements for cleaning electrical or retrieval cables for pumps	RLM
004	January 3, 2018	Reviewed and confirmed current	RLM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) presents the general requirements for field decontamination of non-dedicated equipment used for monitoring of environmental media and the collection of environmental samples (i.e., equipment that is re-used between monitoring and sampling locations). Note that the procedures described in this SOP also apply to pumps used for well development.

3.0 OVERVIEW

The main purpose of non-dedicated monitoring and sampling equipment decontamination is to minimize the potential for cross-contamination during monitoring/sampling activities completed for site investigations. Cross-contamination can occur when equipment used to monitor/sample contaminated soil, groundwater or sediment is reused at another monitoring/sampling location without cleaning. This can result in the transfer of contaminants from a “dirty” monitoring/sampling location to a “clean” monitoring/sampling location, causing possible positive bias of subsequent samples. Positive sample bias can result in reported analytical results that are not representative of actual site conditions and, if significant cross-contamination occurs, can result in reported exceedances of the applicable regulatory standards for samples that would have met the standards had cross-contamination not occurred.

Site investigations completed by Pinchin typically use the following non-dedicated monitoring/sampling equipment:

- Manually operated equipment (e.g., water level tapes/interface probes using during groundwater monitoring and sampling, knifes/spatulas used for soil sampling, hand augers);
- Pumps for groundwater monitoring well development, purging and/or sampling (e.g., bladder pumps, submersible pumps); and
- Downhole drilling/sampling equipment (e.g., split-spoon samplers, augers).

The above list is not all inclusive and other non-dedicated monitoring/sampling equipment may be employed during a site investigation that requires decontamination. For example, it may be appropriate to decontaminate the bucket of a backhoe used for test pitting between test pit locations. The Project Manager will be responsible for identifying the additional monitoring/sampling equipment that requires decontamination and instructing field staff regarding the procedure to be followed for cleaning this equipment.

When conducting field monitoring and sampling work in the field, it is not always possible to judge whether a monitoring/sampling location is uncontaminated. Because of this, it is important that all non-dedicated monitoring/sampling equipment be properly cleaned before initial use and between uses to minimize the potential for cross-contamination to occur.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

5.1 Equipment and Supplies

The following is a list of equipment needed to perform the decontamination of non-dedicated monitoring and sampling equipment in accordance with this SOP:

- Personal Protective Equipment (PPE);
- Potable tap water;
- Distilled water (store bought);

- Volatile organic compound (VOC)-free deionized distilled water (supplied by the analytical laboratory);
- Laboratory grade, phosphate-free soap;
- Wash buckets (minimum of three);
- Scrub brushes;
- Paper towels; and
- Buckets or drums with resealable lids for containing liquids generated by equipment cleaning.

Other equipment required to clean drilling equipment (e.g., steam cleaner, power washer, tub for containing wash water, etc.) is typically provided by the drilling subcontractor. The Project Manager is responsible for ensuring that the drilling subcontractor brings the required cleaning equipment to the project site. Prior to mobilization, the Project Manager should also assess the availability of a potable water supply for drilling equipment cleaning at the project site. When no accessible potable water supply is available at a project site, the drilling subcontractor will need to bring a potable water supply to the site in the drill rig water supply tank or separate support vehicle, or arrange to have a third-party supplier deliver potable water to the site.

5.2 Procedure

5.2.1 *General Procedures and Considerations*

The following general procedures and considerations apply to all decontamination of non-dedicated monitoring/sampling equipment activities:

- Personnel will dress in suitable PPE to reduce personal exposure during equipment decontamination activities;
- In addition to cleaning between monitoring/sampling locations, all non-dedicated monitoring/sampling equipment must be cleaned before initial use. Field staff should not assume that the equipment was properly cleaned by the last person to use it;
- Prior to starting a drilling program, the downhole drilling equipment (e.g., augers) must be inspected and any “dirty” equipment must not be used in the drilling program or it must be cleaned prior to use; and
- All liquids and solids generated by the cleaning of non-dedicated monitoring/sampling equipment are to be containerized and managed in accordance with the procedures outlined in SOP-EDR020 – Investigation Derived Wastes.

5.2.2 Decontamination of Manually Operated Monitoring/Sampling Equipment

The procedure for decontaminating manually operated monitoring/sampling equipment is as follows:

- Wash the equipment in a bucket filled with a mixture of phosphate-free soap/potable water, while using a brush to remove any obvious contamination and/or adhered soil;
- Rinse the equipment thoroughly in a bucket filled with potable water;
- Rinse the equipment thoroughly using a spray bottle filled with distilled water, capturing the rinsate in a bucket; and
- Allow the equipment to air dry. If there is insufficient time to allow the equipment to air dry before reusing, or the equipment cleaning is occurring during winter conditions, the equipment should be dried after the final rinse with a clean paper towel.

At the discretion of the Project Manager, it may be acceptable to use spray bottles, rather than buckets, for lightly contaminated equipment or if no obvious contaminants are present.

Should soil or obvious contaminants remain on the equipment after cleaning, the above procedure must be repeated until the soil or contaminants have been removed. The equipment should not be reused if repeated cleanings do not remove the soil or contaminants.

The above equipment cleaning procedure applies to, but is not limited to, the following non-dedicated monitoring/sampling equipment:

- Knives/spatulas used for soil sampling;
- Hand augers;
- Water level tapes and interface probes (both the end probe and portion of the tape that entered the well);
- The exterior of submersible pumps and interior/exterior of bladder pumps (including the portion of the electrical or retrieval cables that contact groundwater in a well); and
- Various pieces of drilling equipment, including split-spoon samplers, hollow stem auger centre plugs, continuous sampling tubes, and the reusable portions of dual-tube samplers.

At the discretion of the Project Manager, the distilled water used for the final equipment rinse will be VOC-free deionized distilled water supplied by the analytical laboratory. For example, the use of VOC-free distilled water would be appropriate for a project where trace VOCs are being investigated and it is important to minimize the potential for cross-contamination and positive bias of VOC sample results.

For tapes associated with water level tapes and interface probes, if they were submerged in a monitoring well water free of non-aqueous phase liquids or obvious contamination, the tape can be cleaned at the discretion of the Project Manager by pulling the tape through a towel dampened with phosphate-free soap/potable water as the tape is retrieved. The end probe should then be cleaned as described above.

5.2.3 Decontamination of Groundwater Sampling Pumps

The exterior of each bladder or submersible pump that is used for well development, well purging and/or groundwater sampling, and the portion of any electrical or retrieval cables that entered the well, are to be cleaned following the procedure described above for decontaminating manually operated monitoring/sampling equipment.

Submersible pumps are not designed to be disassembled in the field and cleaning of the interior of this type of pump requires flushing of cleaning solutions through the pump. After cleaning the exterior of the pump, the minimum decontamination requirement for a submersible pump is the flushing of a phosphate-free soap/potable water mixture contained in a bucket through the pump (i.e., pumping the mixture through the pump and capturing the pump outflow in the same bucket or a separate bucket), followed by flushing distilled water contained in a separate bucket through the pump and capturing the pump outflow in the same bucket or separate bucket. Note that store bought distilled water is acceptable for this purpose.

At the discretion of the Project Manager and depending on the requirements of the project, the final step in the process is a final flush with laboratory-supplied VOC-free distilled water.

The following summarizes the flushing sequence for decontaminating the interior of a submersible pump:

- Soap/water mixture*;
- Distilled water (store bought)*; and
- Distilled water (laboratory supplied VOC-free distilled water - to be confirmed by the Project Manager).

* Minimum requirement.

Bladder pumps are designed for disassembly in the field to facilitate the replacement of the bladders. The internal parts of a bladder pump are to be cleaned in accordance with the procedure described above for decontaminating manually operated monitoring/sampling equipment. Whenever possible, bladders are to be disposed of between well locations. However, if it is necessary to reuse a bladder, it must be cleaned in accordance with the procedure for cleaning manually operated monitoring/sampling equipment. It should be noted that bladders are difficult to clean and the decontamination procedure needs to be thorough.

Flushing of a bladder pump with distilled water after cleaning and reassembly is not required unless specified by the Project Manager.

5.2.4 Decontamination of Downhole Drilling Equipment

Hollow stem and solid stem augers used for borehole advancement are to be decontaminated by the drilling contractor using the following procedure:

- Wherever possible, all augers used for borehole drilling should be cleaned before initial use and between borehole locations by steam cleaning or power washing with potable water. However, the minimum requirements for auger cleaning are as follows:
  - Use a brush or shovel to remove excess soil from all used augers; and
  - Any augers that may come into contact with groundwater are to be decontaminated by steam cleaning or power washing with potable water. An auger must not be used for the balance of the drilling program if obvious contaminants or residual soil remain on the auger following decontamination, unless subsequent cleaning efforts remove these materials.

As noted previously, downhole drilling equipment used for soil sample retrieval (e.g., split-spoon samplers, continuous sampling tubes and the reusable portions of dual-tube samplers used with direct push rigs) and the hollow stem auger centre plug are to be decontaminated following the procedure outlined above for cleaning manually operated monitoring/sampling equipment.

5.3 Decontamination Records

Field personnel will be responsible for documenting the decontamination of non-dedicated monitoring/sampling equipment and drilling equipment in their field log book or field forms. The documentation should include the type of equipment cleaned and the frequency of cleaning, the methods and reagents used for equipment cleaning, and how fluids generated by the equipment cleaning were stored.

5.4 Additional Considerations for Ontario Regulation 153/04 Phase Two ESA Compliance

When completing a Phase Two Environmental Assessment (ESA) in accordance with Ontario Regulation 153/04, the following additional procedures must be undertaken:

- All augers must have excess soil removed by a brush or shovel and be steam cleaned or power washed before initial use and between borehole locations regardless of whether they contact the groundwater or not (i.e., the minimum requirements listed above for auger cleaning are not sufficient); and

- Thorough records of the frequency and cleaning materials used for the decontamination of non-dedicated monitoring/sampling equipment and downhole drilling equipment must be kept. The Quality Assurance/Quality Control section of the Phase Two ESA report requires a summary of what steps were taken to minimize the potential for cross-contamination during the Phase Two ESA. The handling and disposal of fluids generated by equipment decontamination must also be well documented in the field for inclusion in the Phase Two ESA report.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Association of Professional Geoscientists of Ontario, *Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended),* April 2011.

9.0 APPENDICES

None.

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Template: Master SOP Template – February 2014

SOP – EDR013 – REV004 – SAMPLE HANDLING DOCUMENTATION

Title:	Sample Handling Documentation
Practice:	EDR
First Effective Date:	August 03, 2009
Version:	004
Version Date:	January 3, 2018
Author:	Mark McCormack and Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	August 03, 2009	N/A	MEM
001	November 26, 2010	Updated Approval Signature/Added reference to Ontario Regulation 511/09	FG
002	September 12, 2013	Updated text/Added tables from MOE lab protocol/Streamlined reference section/Added O. Reg. 153/04 compliance section	RLM
003	April 29, 2016	Updated Section 4.0/Aligned document retention with PEP	RLM
004	April 28, 2017	Removed reference to Pinchin West	RLM
004	January 3, 2018	Reviewed and confirmed current	RLM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) presents the general requirements for sample handling and documentation practices.

3.0 OVERVIEW

Not applicable.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

5.1 Equipment Required

- Laboratory-supplied sample containers;
- Field log book or field forms; and
- Laboratory-supplied Chain-of-Custody forms.

5.2 Procedures

5.2.1 Sample Labelling

Sample labels are to be filled out in the field at the time of sampling as completely as possible by field personnel. All sample labels shall be filled out using waterproof ink. At a minimum, each label shall contain the following information:

- Sample identifier, consisting of sample location (borehole number, monitoring well number, surface sample location, etc.) and sample number (if appropriate). For example, the second soil sample collected during borehole advancement at borehole BH3 would be labelled “BH3-2”;
- Pinchin project number;
- Date and time of sample collection;
- Company name (i.e., Pinchin); and
- Type of analysis.

5.2.2 Sample Containers, Preservation and Holding Times

The sample containers, sample preservation and holding times for projects in Ontario are to be those specified in Table A (for soil and sediment) and Table B (groundwater) from the Ontario Ministry of the Environment Climate Change (MOECC, formerly the Ontario Ministry of the Environment) document entitled *“Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act”,* dated March 9, 2004, amended as of July 1, 2011. These tables are attached and form part of this SOP.

With reference to the attached Tables A and B, field personnel must use the sample containers appropriate for the parameters being sampled for, undertake any required field preservation or filtration and observe the sample holding times.

Each province has its own preservation and holding time regulations or guidance, which are generally similar. It is the Project Manager’s responsibility to ensure that field staff are aware of, and can meet, the requirements in the province they are working in.

5.2.3 Sample Documentation

The following sections describe documentation required in the field notes and on the Chain-of-Custody forms.

Field Notes

Documentation of observations and data from the field will provide information on sample collection and also provide a permanent record of field activities. The observations and data will be recorded using a pen with permanent ink in the field log book or on field forms.

The information in the field book or field forms will, at a minimum, include the following:

- Site name;
- Name of field personnel;
- Sample location (borehole number, monitoring well number, surface sample location, etc.);
- Sample number;
- Date and time of sample collection;
- Description of sample;
- Matrix sampled;
- Sample depth (if applicable);
- Method of field preservation (if applicable);
- Whether filtration was completed for water samples;
- Analysis requested;
- Field observations;
- Results of any field measurements (e.g., field screening measurements, depth to water, etc.); and
- Volumes purged (if applicable).

In addition to the above, other pertinent information is to be recorded in the field log book or field forms depending on the type of sampling being completed (e.g., field parameter measurements and pumping rates for low flow sampling) as required by the SOP for the particular sampling activity.

Sufficient information should be recorded to allow the sampling event to be reconstructed without relying on the sampler’s memory.

All field notes are to be scanned and saved to the project folder on the server immediately upon returning from the field.

Sample Chain-of-Custody

Sample Chain-of-Custody maintains the traceability of the samples from the time they are collected until the analytical data are issued by the laboratory. Initial information concerning collection of the samples will be recorded in the field log book or field forms as described above. Information on the custody, transfer, handling and shipping of samples will be recorded on a Chain-of-Custody for each sample submission.

All signed Chain-of-Custody forms will be photocopied or duplicate copies retained prior to sample shipment. A Chain-of-Custody should be laboratory-specific and will typically be supplied by the laboratory with the sample containers requested for the project. The sampler will be responsible for fully filling out the Chain-of-Custody for each sample submission.

The Chain-of-Custody will be signed by the sampler when the sampler relinquishes the samples to anyone else (i.e., courier or laboratory). Until samples are picked up by the courier or delivered to the laboratory, they must be stored in a secure area. The following information needs to be provided on the Chain-of-Custody at a minimum:

- Company name;
- Name, address, phone number, fax number and e-mail address of the main contact for the submission (typically the Project Manager);
- Project information (project number, site address, quotation number, rush turnaround number, etc.);
- Regulatory standards or criteria applicable to the samples (including whether the samples are for regulated drinking water or whether the samples are for a Record of Site Condition);
- Sample identifiers;
- Date and time of sample collection;
- Matrix (e.g., soil, groundwater, sediment, etc.);
- Field preservation information (e.g., whether groundwater samples for metals analysis were field filtered);
- Analyses required;
- Number of sample containers per sample;
- Analytical turnaround required (i.e., standard or rush turnaround);
- Sampler’s name and signature;
- Date and time that custody of the samples was transferred;

- Name and signature of person accepting custody of the samples from Pinchin, and date and time of custody transfer; and
- Method of shipment (if applicable).

The person responsible for delivery of the samples to the laboratory or transfer to a courier will sign the Chain-of-Custody, retain a duplicate copy or photocopy of the Chain-of-Custody so it can be scanned and saved to the project file, document the method of shipment, and send the original copy of the Chain-of Custody with the samples.

5.3 Additional Considerations for Ontario Regulation. 153/04 Phase Two ESA Compliance

Custody seals must be placed on all coolers containing samples prior to transfer to a courier or delivery to the laboratory. The laboratory will comment on the presence/absence of custody seals in the Certificate-of-Analysis for each submission and this information must be discussed in the Quality Assurance/Quality Control section of the Phase Two Environmental Site Assessment report.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Ontario Ministry of the Environment and Climate Change, *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act*, March 9, 2004, as amended as of July 1, 2011.

9.0 APPENDICES

Appendix I	Tables A and B From Ontario MOECC Laboratory Protocol

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Template: Master SOP Template – February 2014

APPENDIX I

Tables A and B From Ontario MOECC Laboratory Protocol

TABLE A: SOIL AND SEDIMENT Sample Handling and Storage Requirements

SOIL Inorganic Parameters	Container[1]	Field Preservation	Storage Temp.[2]	Preserved Holding Time[3]	Unpreserved Holding Time[3]
Chloride, electrical conductivity	glass, HDPE or PET	none	5 ± 3 °C		30 days as received (without lab drying); indefinite when dried at the lab
Cyanide (CN^-)	glass wide-mouth jar, Teflon™ lined lid	protect from light	5 ± 3 °C		14 days
Fraction organic carbon (FOC)	glass jar, Teflon™ lined lid	none	5 ± 3 °C		28 days as received(without lab drying); indefinite storage time when dried
Hexavalent chromium	glass, HDPE	none	5 ± 3 °C		30 days as received
Metals (includes hydride-forming metals, SAR, HWS boron, calcium, magnesium, sodium)	glass, HDPE	none	5 ± 3 °C		180 days as received (without lab drying); indefinite when dried at the lab
Mercury, methyl mercury	glass, HDPE or PET	none	5 ± 3 °C		28 days
pH	glass, HDPE or PET	none	5 ± 3 °C		30 days as received
SOIL Organic Parameters	**Container [1,5,6,7,20]**	**Field Preservation**	**Storage Temp.[2]**	**Preserved Holding Time[3]**	**Unpreserved Holding Time[3]**
BTEX [8], PHCs (F1)[8], THMs, VOCs[7] **NB: SEE FOOTNOTE #20**	40–60 mL glass vial (charged with methanol preservative, pre-weighed)[6]AND glass jar (for moisture content) [hermetic samplers are an acceptable alternative [5, 18]]	methanol (aqueous $NaHSO_4$ is an acceptable alternative for bromomethane)[6, 7, 18,20]	5 ± 3 °C	14 days	hermetic samples: stabilize with methanol preservative within 48 hours of sampling[18]
1,4-Dioxane[9, 15]	when processed as a VOC sample: same as per VOCs above; when processed as an extractable: same as per ABNs below; (consult laboratory)[9,15,18]		5 ± 3 °C	14 days	when processed as a VOC sample: same as per VOCs above; when processed as an extractable: same as per ABNs below; (consult laboratory)[18]
PHCs (F2–F4)	glass wide-mouth jar, Teflon™ lined lid	none	5 ± 3 °C		14 days
ABNs, CPs, OCs, PAHs	glass wide-mouth jar, Teflon™ lined lid	none	5 ± 3 °C		60 days
Dioxins and furans, PCBs	glass wide-mouth jar Teflon™ lined lid	none	5 ± 3 °C		indefinite storage time

HDPE = high density polyethylene; PET = polyethylene terephthalate; HWS = hot water soluble boron; THM = trihalomethanes; VOC = volatile organic compounds; BTEX = benzene, toluene, ethylbenzene, xylenes; PHCs = petroleum hydrocarbons; CPs = chlorophenols; PCBs = polychlorinated biphenyls; OCs = organochlorine pesticides

[1–20]footnotes immediately follow Table B

TABLE B: GROUND WATER Sample Handling and Storage Requirement

GROUND WATER Inorganic Parameters	**Container**[10]	**Field Preservation**	**Storage Temperature**[2]	**Preserved Holding Time**[3]	**Unpreserved Holding Time**[3]
Chloride, electrical conductivity, pH	HDPE or glass	none	5 ± 3 °C		28 days
Cyanide (CN^-)	HDPE or glass	NaOH to a pH > 12	5 ± 3 °C	14 days	must be field preserved
Hexavalent chromium	HDPE or glass	field filter followed by buffer solution to a pH 9.3–9.7 [17]	5 ± 3 °C	28 days[17]	24 hours[17]
Metals (includes hydride-forming metals, calcium, magnesium, sodium)	HDPE or Teflon™ [10]	field filter followed by HNO_3 to pH < 2[11]	room temperature when preserved	60 days	must be field preserved
Mercury	glass or Teflon™ [10]	field filter followed by HCl to pH < 2[11]	room temperature when preserved	28 days	must be field preserved
Methyl mercury	glass or Teflon™	DO NOT FILTER HCl or H_2SO_4 to pH <2[12]	5 ± 3 °C	28 days	DO NOT FILTER must be field preserved[12]
GROUND WATER Organic Parameters[10, 13, 14]	**Container**[10, 13, 14]	**Field Preservation**	**Storage Temperature**[2]	**Preserved Holding Time**[3]	**Unpreserved Holding Time**[3]
BTEX, PHCs (F1),THMs, VOCs;	40–60 mL glass vials (minimum of 2)[14] (no headspace)	$NaHSO_4$ or HCl to a pH < 2[16]	5 ± 3 °C	14 days	7 days
1,4-Dioxane[9, 15]	when processed as a VOC sample: same as per VOCs above; when processed as an extractable: same as per ABNs below; (consult laboratory)[9, 15]		5 ± 3 °C	14 days	14 days
PHCs (F2–F4)	1L amber glass bottle, Teflon™ lined lid	$NaHSO_4$ or HCl to a pH < 2[16]	5 ± 3 °C	40 days	7 days
ABNs, CP, OCs, PAHs[19], PCBs	1L amber glass bottle, Teflon™ lined lid	none	5 ± 3 °C		14 days
Dioxins and furans	1L amber glass bottle, Teflon™ lined lid	None	5 ± 3 °C		indefinite storage time

HDPE = high density polyethylene;THM = trihalomethanes; VOC = volatile organic compounds; BTEX = benzene, toluene, ethylbenzene, xylenes; PHCs = petroleum hydrocarbons; CPs = chlorophenols; PCBs = polychlorinated biphenyls; OCs = organochlorine pesticides

[1] One soil container is generally sufficient for inorganic analysis and another for extractable organics. A separate container is required for BTEX, THM, VOC and PHC (F1) moisture analysis.

[2] Storage temperature refers to storage at the laboratory. Samples should be cooled and transported as soon as possible after collection.

[3] Holding time refers to the time delay between time of sample collection and time stabilization/analysis is initiated. For samples stabilized with methanol, the hold time for the recovered methanol extract is up to 40 days.

[4] PET can not be used for samples requiring antimony analysis.

[5] As an alternative, the USEPA has investigated hermetic sample devices that take and seal a single core sample. The sample is submitted as is to the laboratory where it is extruded into an extracting solvent. Samples must be received at the laboratory within 48 hours of sampling. (Note that replicate samples are necessary for bisulphate and methanol extraction for all samples plus laboratory duplicates and spikes.) Consult the laboratory for the number of samples required.

[6] The USEPA has approved field preservation. Pre-weighed vials containing known weights of methanol preservative (or aqueous sodium bisulphate if used for bromomethane) are sent to the field. Sample cores (approximately 5 g) are extruded directly into the vial. The vials are sealed, and submitted directly to the laboratory. In practice, this technique requires great care to prevent losses of methanol due to leaking vials or through splashing. Consult the laboratory for the number of containers required.

[7] Methanol-preserved samples may elevate the detection limit for bromomethane (VOC); a separate bisulphate-preserved sample or hermetically sealed sample may be submitted at the time of sampling if bromomethane is a chemical of concern – contact the laboratory to determine if a separate sample should be collected.

[8] For BTEX and PHC (F1) pre-charging the soil sampling container with methanol preservative is an accepted deviation from the CCME method.

[9] 1,4-Dioxane may be analyzed with the ABNs or VOCs; sample container requirements used for ABNs or VOCs are both acceptable. If 1,4-dioxane is to be analyzed with ABNs, follow the ABN sample container requirements; similarly if it is to be analyzed with VOCs, follow VOC sample container requirements. Consult the laboratory for the container type and the total number required (see also footnote #15).

[10] Samples containing visual sediment at the time of analysis should be documented and noted on the Certificate of Analysis or written report as results may be biased high due to the inclusion of sediment in the extraction.

[11] Field filter with 0.45µm immediately prior to adding preservative or filling pre-charged container.

[12] Sample directly into a HCl or H_2SO_4 preserved container, or add acid to an unfiltered sample immediately after sample collection in the field.

[13] Aqueous organic samples should be protected from light. If amber bottles are not available, glass should be wrapped in foil.

[14] Separate containers are required for each organic water analysis. Consult the laboratory for required volumes. Chloride and electrical conductivity can be taken from the same container.

[15] For 1,4-dioxane in soil and sediment, no preservative is required if processed as an ABN, however. Methanol is an acceptable alternative if processed as a VOC. For 1,4-dioxane in groundwater, no preservative is required, however, $NaHSO_4$ or HCl are acceptable alternatives.

[16] Preserved to reduce biodegradation, however effervescence/degassing may occur in some ground water samples. In this case, rinse preservative out three times with sample and submit to the laboratory as unpreserved.

[17] To achieve the 28-day holding time, use the ammonium sulfate buffer solution [i.e., $(NH_4)_2SO_4/NH_4OH$] or $(NH_4)_2SO_4/NH_4OH/NaOH + NaOH$] as specified in EPA Method 218.6 (revision 3.3, 1994) or Standard Methods 3500-Cr Chromium (2009).Using only NaOH without the ammonium sulfate buffer to adjust the pH would require analysis within 24 hours of sampling.

[18] Alternatively, to achieve a longer hold time, hermetic samples may be frozen within 48 hours of sampling as per ASTM method D6418 – 09; however, storage stability must be validated by the laboratory with no more than 10% losses.

[19] For benzo(a)pyrene in ground water samples filtration prior to analysis on a duplicate sample is permitted.

[20] For VOC, BTEX, F1 PHCs, 1,4 dioxane soil samples collected before July 1, 2011, the following sampling and handling requirements are also permitted.

SOIL Organic Parameters	**Container**	**Preservative**	**Storage Temperature**	**Preserved Holding Time**	**Unpreserved Holding Time**
VOC, BTEX, F1 PHCs, 1,4-dioxane*	glass jar, Teflon lined lid, no headspace, separate container required Hermetic samplers are an acceptable alternative	none field preservation with aqueous sodium bisulphate and methanol is an acceptable alternative	5 ± 3C	See notations 1-3 below	Stabilize by extraction or freezing within 48 hrs of receipt at the laboratory (7days from sampling). Frozen or field preserved samples must be extracted within 14 days of sampling.

*Special care must be used when sampling for VOC, BTEX and F1 in soil and sediment. Studies have shown that substantial losses can occur through volatilization and bacterial degradation. There are several allowable options for field collection of samples. Each is discussed below. Consult SW846, Method 5035A for additional detail. The laboratory is required to stabilize the sample on the day of receipt, either by extraction or freezing.

1. Collection in soil containers: To minimize volatilization losses, minimize sample handling and mixing during the process of filling the sample container. The bottle should be filled with headspace and voids minimized. Care is required to ensure that no soil remains on the threads of the jar, preventing a tight seal and allowing volatilization losses. To minimize losses through bacterial degradation, commence cooling of the samples immediately and transport the samples to the lab as soon as possible, ideally on the day of sampling. Samples must be received at the laboratory within 48 hours of sampling. Freezing can be used to extend the hold time to 14 days, however the practice is difficult to implement in the field and can cause sample breakage.
2. As an alternative, the USEPA has investigated hermetic sample devices that take and seal a single core sample. The sampler is submitted as is to the laboratory where it is extruded into the extracting solvent. Samples must be received at the laboratory within 48 hours of sampling. This technique minimizes volatilization losses and is worth consideration for critical sites. (Note that replicate samplers are necessary for bisulphate and methanol extraction for all samples plus lab duplicates and spikes). Consult the laboratory for the number of samplers required.
3 The USEPA has also approved field preservation. Pre-weighed vials containing known weights of methanol and aqueous sodium bisulphate preservative are sent to the field. Sample cores (≈5 g) are extruded directly into the vial. The vials are sealed, and submitted directly to the laboratory. In practice, this technique requires great care to implement successfully. Losses due to leaking vials, through splashing and effervescence (aqueous bisulphate) can easily occur and make the sample unusable. Consult the laboratory for the number of containers required.

9.0 APPENDICES

None.

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Template: Master SOP Template – February 2014

SOP – EDR016 – REV003 – FIELD MEASUREMENT OF WATER QUALITY PARAMETERS

Title:	Field Measurement of Water Quality Parameters
Practice:	EDR
First Effective Date:	November 24, 2010
Version:	003
Version Date:	January 3, 2018
Author:	Paresh Patel
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	November 24, 2010	N/A	PDP
001	October 31, 2013	Cross-referenced low flow sampling SOP/Added section on O. Reg. 153/04 compliance	RLM
002	April 29, 2016	Updated Section 4.0	RLM
003	April 28, 2017	Removed reference to Pinchin West	RLM
003	January 3, 2018	Reviewed and confirmed current	RLM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the standard procedures for measuring water quality parameters during water sampling, and covers the calibration and use of multi-parameter and single-parameter probes for monitoring in situ water quality parameters in streams, down hole in monitoring wells and in flow-through cells. Water quality parameters may include temperature, pH, dissolved oxygen (DO), oxidation reduction potential (ORP), conductivity and turbidity.

Measurements of water quality parameters are typically made for two main purposes: to provide information on water geochemistry to assist in designing in situ remediation programs and to assess whether representative formation groundwater is being sampled during low flow purging and sampling. They can also be used to assess whether well development is complete in certain situations (see SOP-EDR018).

3.0 OVERVIEW

Not applicable.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

5.1 Equipment and Reagents Required

- Single or multi-parameter probes for monitoring water quality parameters;
- Calibration solutions for calibrating the probes to the standard values;
- Field book or field forms;
- Distilled water;
- Beaker or bucket;
- Stirrer for DO measurement (optional); and
- Flow-through cell (optional).

5.2 Probe Measurement Accuracy

The probes utilized for measuring water quality parameters shall be capable of producing measurement accuracy greater or equal to the following specifications:

Temperature:	± 0.5 degrees Celsius (ºC)
Conductivity:	± 1 microSiemens per centimetre (µS/cm)
pH:	±0.1 pH unit
Dissolved Oxygen:	±0.2 milligrams per litre (mg/L) up to20 mg/L
	± 0.6 mg/L greater than 20 mg/L
Turbidity:	±1% up to 100 Nephelometric Turbidity Units (NTU)
	±3% up to 100-400 NTU
	±5% up to 400-3,000 NTU
ORP:	± 20 millivolts (mV)

5.3 Probe Calibration

Calibrate the water quality probes used for field parameter measurement in accordance with the manufacturer's specifications. Wherever possible, arrange for the equipment rental company to calibrate the water quality probes and provide a calibration sheet that contains information such as calibration date and calibration measurements for each parameter. If the water quality probes are used for more than one day, a calibration check must be performed using standard calibration solutions at the start of each day at a minimum. If the calibration check shows deviations from the standard values that exceed the ranges provided below, the probe(s) that exceed the ranges must be calibrated prior to further use:

pH	±0.1 pH units
Specific Conductance	±3%
Temperature	±3%

DO	±10%
ORP	±10 mV
Turbidity	±10%

A calibration check should also be performed if the parameter measurements suggest that calibration drift has occurred. Document all calibration activities in the field notes, including date and time of calibration/calibration check, calibration solutions used, probe readings, and make, model and serial number of the instrument(s). Note that if the water quality probe manufacturer recommends more frequent calibration/calibration checks than specified above, the manufacturer's recommendations are to be followed.

Extra care must be taken to calibrate a multi-parameter probe to prevent cross-contamination. Specifically, following immersion of the probes into each calibration standard, all probes should be thoroughly rinsed in distilled water and the excess water shaken off or blotted dry with a lint-free wipe. Conductivity standards are much more sensitive to cross contamination/dilution than other standards, and prior to immersion in a conductivity standard, all probes should be thoroughly rinsed and completely dried with lint-free wipes. Besides being easily diluted, conductivity also affects other parameters (specifically DO), and the conductivity probe should always be the first probe calibrated. The following order for calibration of a multi-parameter probe is to be followed:

1. Specific Conductance;
2. pH;
3. DO; and
4. Turbidity.

There is no recommended order for calibration of other parameters.

5.4 Single-Parameter Probes

Prior to conducting field measurements, probe sensors must be allowed to equilibrate to the temperature of the water being monitored. Probe sensors have equilibrated adequately when the temperature reading has stabilized. Deployment of single-parameter probes will follow the following procedures:

5.4.1 Temperature

Whenever possible the temperature shall be measured in situ (i.e., within a stream, direct deployment in a monitoring well). When temperature cannot be measured in situ, it can be measured in a beaker or bucket. The following conditions must be met when measuring temperature within a beaker or bucket:

- The beaker or bucket shall be large enough to allow full immersion of the temperature probe. The beaker or bucket is to be rinsed with water from the well or stream being measured prior to obtaining the measurement;

- The probe must be placed in the beaker or bucket immediately before the temperature changes due to ambient conditions;
- The beaker or bucket must be shaded from direct sunlight and strong breezes before and during temperature measurement; and
- The probe must be allowed to equilibrate for at least 1 minute before temperature is recorded.

5.4.2 pH

Preferably, pH is measured in situ at the centroid of flow and at the mid-depth of a stream, or the mid-point of the well screen in a well. The pH probe must be allowed to equilibrate according to the manufacturer's recommendations before the pH value is recorded without removing the probe from the water.

If the pH cannot be measured in situ, it should be measured in a bucket or beaker using the procedures outlined above for measuring temperature.

5.4.3 Dissolved Oxygen

As for pH, it is preferable to measure DO in situ at the centroid of flow and at the mid-depth of a stream, or the mid-point of the well screen in a well. The DO probe must be allowed to equilibrate according to manufacturer's recommendations before the DO value is recorded without removing the probe from the water.

If DO cannot be measured in situ, it should be measured in a bucket or beaker using the procedures outlined above for measuring temperature.

Some types of DO probes require a sufficient flow of fresh water across the membrane to maintain the accuracy and precision of the DO measurement. When taking DO measurements in a bucket or beaker, either employ a stirrer, or physically move the probe in a gentle motion. Moving the probe in a gentle motion should also be completed when measuring DO in situ down hole in a monitoring well.

5.4.4 ORP

ORP shall be measured using the procedures outlined above for measuring pH. Note that changes in temperature directly affect ORP values and ORP should be measured as soon as possible after the probe has stabilized.

5.4.5 Turbidity

In situ turbidity shall be measured using the procedures outlined above for measuring pH.

If turbidity cannot be measured in situ, it can be measured with a probe in a bucket or beaker using the procedures outlined above for measuring temperature. Note that some turbidity measuring instruments do not use a probe, and a sample of the water is collected in a small vial that is inserted into the instrument which then measures the turbidity of the water.

5.4.6 Multi-Parameter Probe Use With A Flow-Through Cell

A multi-parameter probe and a flow-through cell are typically employed when undertaking low flow purging and sampling of groundwater. SOP-EDR023 describes the procedures to be followed when using a multi-parameter probe and a flow-through cell.

5.5 Additional Considerations for Ontario Regulation 153/04 Phase Two ESA Compliance

When completing a Phase Two Environmental Assessment (ESA) in accordance with Ontario Regulation 153/04, the following additional procedures must be undertaken:

- Thorough records of the calibration and calibration checks of the probes/instruments used for water quality parameter measurement must be kept, including any calibration sheets provided by the equipment supplier. The Quality Assurance/Quality Control section of the Phase Two ESA report requires a discussion of field equipment calibration, and equipment calibration records must be appended to the Phase Two ESA report; and
- If groundwater samples collected for a Phase Two ESA are not collected using low flow purging and sampling, which mandates the measurement of water quality parameters, water quality parameters must be measured (pH, temperature and specific conductance at a minimum) and the measurements included in the Phase Two ESA report. Ontario Regulation 153/04 does not provide specifics as to when or how these water quality parameter measurements are to be made but one set of measurements made at the conclusion of purging prior to sampling is the minimum requirement. These measurements can be made by filling a clean bucket or beaker with purge water and immersing the probes in the purge water.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

New Jersey Department of Environmental Protection, *Field Sampling Procedures Manual,* August 2005.

Commonwealth of Kentucky – Department of Environmental Protection, *Standard Operating Procedure – In Situ Water Quality Measurements and Meter Calibration,* January 1, 2009.

U.S Environmental Protection Agency – Science and Ecosystem Support Division, Athens, Georgia, *In Situ Water Quality Monitoring,* December 7, 2009.

U.S. Geological Survey, *National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chapters A1-A9,* Various dates.

9.0 APPENDICES

None.

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Template: Master SOP Template – February 2014

SOP – EDR017 – REV006 – MONITORING WELL DEVELOPMENT

Title:	Monitoring Well Development
Practice:	EDR
First Effective Date:	November 23, 2010
Version:	006
Version Date:	January 3, 2018
Author:	Paresh Patel and Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	November 23, 2010	N/A	PDP
001	June 15, 2013	Streamlined background section/Focused procedure on tasks that can be completed by Pinchin personnel/Provided step-by-step summary of field procedure	RLM
002	January 22, 2015	Incorporated procedures specific to Pinchin West into SOP	RLM
003	February 9, 2016	Revised overall procedure to include initial determination of well yield/Added reference to revised well development field forms/Provided guidance on assessing field parameter stabilization when developing wells where water or air were used during drilling	RLM
004	April 29, 2016	Updated Section 4.0	RLM
005	April 28, 2017	Removed references to Pinchin West	RLM
006	January 3, 2018	Modified Section 3.0 to allow well development to occur immediately after well installation under certain circumstances.	RLM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the standard procedures for groundwater monitoring well development and provides a description of the equipment required and field methods.

All groundwater monitoring wells are to be developed following installation prior to groundwater sampling or the completion of hydraulic conductivity testing. In addition, previously installed groundwater monitoring wells that have not been purged in over one year should be redeveloped prior to additional sampling or hydraulic conductivity testing if there is evidence of sediment impacting the monitoring well (e.g., the depth to bottom of well measurement indicates sediment accumulation) or at the discretion of the Project Manager.

This SOP pertains to monitoring well development that can be undertaken by Pinchin personnel. Monitoring well development completed by drilling rigs is beyond the scope of this SOP.

3.0 OVERVIEW

The main objective of groundwater monitoring well development is to ensure that groundwater sampled from a well is representative of the groundwater in the formation adjacent to the well and that hydraulic conductivity testing provides data representative of the hydraulic characteristics of the adjacent formation.

The specific goals of well development include the following:

- Rectifying the clogging or smearing of formation materials that may have occurred during drilling of the borehole;
- Retrieving lost drilling fluids;
- Improving well efficiency (i.e., the hydraulic connection between the sand pack and the formation);
- Restoring groundwater properties that may have been altered during the drilling process (e.g., volatilization of volatile parameters due to frictional heating during auger advancement or use of air rotary drilling methods); and
- Grading the filter pack to effectively trap fine particles that may otherwise interfere with water quality analysis.

Monitoring well development should not be completed until at least 24 hours have elapsed following monitoring well installation to permit enough time for the well seal to set up, unless both of the following conditions are met:

- The well seal is entirely above the water table; and
- Surface runoff (e.g., from heavy rainfall or snow melt) is not occurring at the well location at the time of development.

Any deviation from this procedure must be approved by the Project Manager before proceeding.

4.0 DISTRIBUTION

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5.0 PROCEDURE

5.1 Equipment and Supplies

- Inertial pump (e.g., Waterra tubing and foot valve);
- Surge block for use with an inertial pump (Optional);
- Submersible pump (including pump controller and power supply) (Optional);
- Disposable bailer (Optional);
- Graduated pail (to contain purge water and permit the volume of groundwater purged to be tracked);
- Pails or drums for purge water storage prior to disposal;
- Well keys (if wells are locked);
- Tools to open monitoring well (T-bar, socket set, Allen keys, etc.);
- Interface probe;
- Equipment cleaning supplies (see SOP-EDR009);
- Field parameter measurement equipment (see SOP-EDR016) (Optional);
- Disposable nitrile gloves; and
- Field forms.

Pinchin typically employs inertial pumps or bailers for well development because they can be dedicated to each well. However, the use of submersible pumps is a viable alternative for developing deep wells with high well volumes at the discretion of the Project Manager.

5.2 Procedures

The well development procedures employed will be determined by the hydraulic conductivity of the formation in which the groundwater monitoring well is installed. For this SOP, a high yield well is defined as a well that cannot be purged to dryness when pumping continuously at a rate of up to 2 litres per minute (L/min) and a low yield well is defined as a well that can be purged to dryness when pumping continuously at a rate of up to 2 L/min or less. This threshold represents a “normal” pumping rate when hand pumping with an inertial pump.

The initial stage of well development (Stage 1) will apply to all wells and will involve the removal of up to one well volume, followed by an evaluation of the well yield. The procedures followed for Stage 2 of well development will be contingent on whether the well is determined to be a low yield or high yield well.

5.2.1 Well Development for Low and High Yield Wells - Stage 1

The initial procedure for developing a low yield or high yield monitoring well is as follows:

1. Decontaminate all non-dedicated monitoring and pumping equipment that will be used, including the interface probe and submersible pump (if used), in accordance with the procedures described in SOP-EDR009;
2. Review the well construction details provided in the borehole log, previous field notes or well construction summary table from a previous report. Determine the well depth, well stick up, screen length, depth to the top of the sand pack and diameter of the borehole annulus. If the well depth is unavailable, measure it with the interface probe;
3. Measure the initial water level (i.e., static water level) from the reference point on the well (which should be marked at the top of the well pipe) with an interface probe. If measurable free-phase product is present on the water table, record the depth to the top of the free-phase product and the depth to the free-phase product/water boundary (i.e., water level), and discuss this with the Project Manager before proceeding further;
4. Calculate the well volume. **Note that for the purpose of this SOP, there are two definitions of well volume depending on the province in which the project is being conducted.** For Ontario and Manitoba, the well volume is defined as the volume of water within the wetted length of the well pipe (well pipe volume) plus the volume of water within the wetted length of the sand pack (sand pack volume). For British Columbia, Alberta and Saskatchewan, the well volume is defined as the volume of water within the wetted length of the well pipe (well pipe volume) only.

   The volume of water in the well pipe is calculated as follows:

   Well Pipe Volume (litres) = $h_w \times \pi r_w^2 \times$ 1,000 litres per cubic metre (L/m^3)

   Where $\pi = 3.14$

   h_w = the height of the water column in the monitoring well in metres (wetted length)

   r_w = the radius of the monitoring well in metres (i.e., half the interior diameter of the well)

   The volume of the sand pack in the monitoring well is calculated as follows:

   Sand Pack Volume (litres) = $h_w \times [(0.3\ \pi\ r_b^2 \times 1{,}000\ \text{L/m}^3) - (0.3\ \pi\ r_w^2 \times 1{,}000\ \text{L/m}^3)]$

   Where 0.3 = the assumed porosity of the sand pack

h_w = the height of the water column in the monitoring well in metres (wetted length)

$\pi = 3.14$

r_b = the radius of the borehole annulus in metres

r_w = the radius of the monitoring well in metres

For Ontario and Manitoba projects, the following table provides well volumes in litres/metre for typical well installations:

Borehole Annulus Diameter (Inches/Metres)	Well Interior Diameter (Inches)	Well Pipe Volume (Litres/Metre)*	Well Volume (Litres/Metre)*
4/0.1	1.25	0.8	2.9
	1.5	1.1	3.2
	2	2.0	3.8
6/0.15	1.25	0.8	5.9
	1.5	1.1	6.1
	2	2.0	6.7
8.25/0.21	1.5	1.1	11.2
	2	2.0	11.8
10.25/0.26	1.5	1.1	16.7
	2	2.0	17.3

* Litres to be removed per metre of standing water in the well (wetted length).

If the borehole annulus and well interior diameters match one of those listed above, to determine the volume of one well volume simply multiply the number in the last column of the table by the wetted length in the well. For example, if a 2-inch diameter well installed in a 8.25-inch diameter borehole has 2.2 metres of standing water, one well volume equals 26.0 litres (2.2 metres x 11.8 litres/metre).

Note that the above well volume calculations apply only to wells where the water level in the well is below the top of the sand pack. If the water level is above the top of the sand pack, then the well volume is the volume of water in the sand pack and well pipe within the sand pack interval, plus the volume of water in the well pipe (i.e., well pipe volume) above the top of the sand pack.

For example, assume a 2-inch diameter well has been installed in a 8.25-inch diameter borehole to a depth of 6.0 metres below ground surface (mbgs), with a 3.05 metre long screen. The sand pack extends from 6.0 mbgs to 2.5 mbgs and the water level is at 1.85 mbgs. One well volume equals ([6.0 metres – 2.5 metres] x 11.8 litres/metre) + ([2.5 metres – 1.85 metres] x 2.0 litres/metre) or 42.6 litres.

For British Columbia, Alberta and Saskatchewan projects, the well volume is calculated using the conversion factor listed in the third column of the above table. For example, if there are 2.5 metres of standing water in a 1.5-inch diameter well, one well volume equals 2.75 litres (2.5 metres x 1.1 litres/metre);

5. Lower the pump into the well until the pump intake is approximately 0.3 metres above the bottom of the well. Remove half a well volume while pumping at a rate of approximately 1 to 2 L/min. Measure the depth to water after the half a well volume is removed. Record the approximate purge volume, pump intake depth and any pertinent visual/olfactory observations (e.g., sheen, odour, free-phase product, sediment content, clarity, colour, etc.); and
6. Move the pump intake upward to the middle of the water column (or middle of the screened interval if the static water level in the well is above the top of the screen). Remove half a well volume (for a cumulative total of 1 well volume) or purge until dry while pumping at a rate of approximately 1 to 2 L/min, whichever occurs first. Measure the depth to water after the half a well volume is removed unless dry. Record the approximate purge volume, pump intake depth and any pertinent visual/olfactory observations. Note that if suction is broken (indicating that drawdown to the pump intake depth has occurred), move the pump intake to the bottom of the well and continue purging.

After completing Step 6, review the water level data to assess whether the well is a low yield or high yield well. If the well is purged dry or close to dryness, or significant drawdown has occurred, then the well is a low yield well. If little or no drawdown has occurred then the well is a high yield well. Some judgement will be required by field personnel when classifying the well yield if moderate drawdown has occurred during removal of the first well volume.

5.2.2 Well Development for High Yield Wells - Stage 2

The procedure for the second stage of developing a high yield monitoring well is as follows:

1. Move the pump intake upward to near the top of the screened interval (or near the top of the water column if the water level is currently below the top of the screen). Remove half a well volume (for a cumulative total of 1.5 well volumes) while pumping at the maximum practical rate that is greater than 2 L/min. Record the approximate purge volume, pump

intake depth and any pertinent visual/olfactory observations (e.g., sheen, odour, free-phase product, sediment content, clarity, colour, etc.);

2. Note that if the wetted length is short within a well (e.g., 1.5 metres or less), there will not be enough separation between pump intake depths to warrant pumping from three depths (i.e., near the bottom, middle and top of the water column). In this case, pumping from two depths (i.e., near the bottom and top of the water column) is sufficient;
3. Lower the pump intake until it is approximately 0.3 metres above the bottom of the well. Remove half a well volume (for a cumulative total of 2 well volumes) while pumping at the maximum practical rate that is greater than 2 L/min. Record the approximate purge volume, pump intake depth and any pertinent visual/olfactory observations;
4. Move the pump intake upward to the middle of the water column (or middle of the screened interval if the water level in the well is above the top of the screen). Remove half a well volume (for a cumulative total of 2.5 well volumes) while pumping at the maximum practical rate that is greater than 2 L/min. Record the approximate purge volume, pump intake depth and any pertinent visual/olfactory observations;
5. Move the pump intake upward to near the top of the screened interval (or near the top of the water column if the water level is currently below the top of the screen). Remove half a well volume (for a cumulative total of 3 well volumes) while pumping at the maximum practical rate that is greater than 2 L/min. Record the approximate purge volume, pump intake depth and any pertinent visual/olfactory observations;
6. If the purge water contains high sediment content after the removal of 3 well volumes, well development should continue by removing additional well volumes following the same procedure as above until the sediment content visibly decreases. If the purge water continues to have high sediment content after the removal of 2 additional well volumes (i.e., 5 well volumes in total), contact the Project Manager to discuss whether well development should continue. A cap of 10 well volumes removed is considered sufficient for high yield well development regardless of sediment content; and
7. Record the water level at the conclusion of well development.

Note that at the discretion of the Project Manager, when developing a monitoring well using an inertial pump, a surge block can be attached to the foot valve before completing Step 1 (i.e., the first time groundwater is pumped from near the top of the screened interval or water column) and then leaving it on the foot valve for the remainder of well development. A surge block is used to increase the turbulence created by pumping and enhance the removal of fine-grained material from the sand pack.

Note that the use of a bailer to develop a high yield well with a wetted interval greater than 2 metres is not recommended given that the depth from which groundwater is removed is difficult to control. However, a bailer can be used as a substitute for a surge block by raising and lowering it through the screened interval for approximately 5 to 10 minutes before the start of Step 1.

5.2.3 Well Development for Low Yield Wells - Stage 2

The procedure for the second stage of developing a low yield monitoring well is as follows:

1. Position the pump intake at the bottom of the well and purge the well to dryness if it was not purged to dryness during completion of Stage 1 at the maximum practical rate that is greater than 2 L/min. Allow sufficient time for the well to recover to at least 90% of the initial static water level or allow the well to recover for a period of time designated by the Project Manager; and
2. Repeat Step 1 until the well has been purged to dryness a minimum of 3 times. An exception to this is that if recovery is slow, and especially if sediment content is low, repeat purging (i.e., purging the well to dryness more than once) may not be necessary and the need for additional purging is to be discussed with the Project Manager. If the purge water contains high sediment content after purging to dryness 3 times, well development should continue by purging the well to dryness until the sediment content visibly decreases. If the purge water continues to have high sediment content after purging the well to dryness 2 additional times (i.e., purging the well to dryness 5 times in total), contact the Project Manager to discuss whether well development should continue. A cap of purging a well to dryness 10 times is considered sufficient for low yield well development regardless of sediment content.

As per the procedure for high yield well development, a surge block can be attached to the foot valve to increase the effectiveness of the pumping action. If a surge block is used, pumping should commence at the top of the water column in the well (instead of near the bottom of the well as described above) with the pump intake progressively lowered as the water level in the well decreases.

Note that bailers can be used in lieu of an inertial pump for the development of a low yield well. The turbulence created in a well by the act of dropping a bailer into it and then removing it full of groundwater can be effective in removing fine-grained material from the sand pack. If a bailer is left in a well, it should be “hung” above the water table to facilitate future water level monitoring.

5.2.4 Removal of Water Lost During Well Installation

When water has been used during well installation (e.g., for bedrock coring, to control heaving sands), the total volume of water required to be purged from a well during development will be equal to 3 times the estimated volume of water lost during drilling plus the volume of water that would normally be removed during well development.

For example, for a high yield well where 25 litres of water were lost during drilling and the well volume is 10 litres, the minimum amount of water to be purged during development is 105 litres (i.e., 3 times the volume of water lost during drilling [75 litres] plus a minimum of 3 well volumes [30 litres]).

For a low yield well, the well will need to be purged to dryness enough times to remove a volume equivalent to 3 times the volume of water lost during drilling plus the volume of water that would normally be removed during well development.

As an alternative to removing 3 times the volume of water lost during drilling, field parameter stabilization during well development can be used to assess whether sufficient water has been removed. For example, the conductivity of drill water (which is usually tap water) is typically much lower than groundwater, and conductivity measurements can act as a guide during development as to whether the water being removed is formation groundwater or drill water.

For assessing field parameter stability when developing a high yield well, field parameter measurements of pH, conductivity, temperature and oxidation-reduction potential are to be made after every half well volume is removed and stability is considered achieved if the field parameters are all within ±10% over 3 consecutive readings. Note that a minimum of 3 well volumes must be removed even if field parameter stabilization is achieved prior to the removal of 3 well volumes to comply with the minimum well purging requirements of this SOP (i.e., removal of a minimum of 3 well volumes from a high yield well).

For assessing field parameter stability when developing a low yield well, field parameter measurements of pH, conductivity, temperature and oxidation-reduction potential are to be made once each time a well is purged to dryness, approximately halfway through purging. For example, if based on the current water level it is estimated that 10 litres will be removed before a well is purged to dryness, the field parameters are to be measured after 5 litres have been removed. Stability is considered achieved if the field parameters are all within ±10% over 3 consecutive readings. After stabilization is achieved, continue to purge the well to dryness a final time at which point development is complete.

A second alternative would be to allow sufficient time for the drill water to dissipate into the formation. The appropriate amount of time will depend on the amount of water lost to the formation and the formation characteristics, but will be a minimum of one week. A Senior Project

Manager or Senior Technical Reviewer will be responsible for determining the suitability of this approach and the required length of time. At the discretion of the Senior Project Manager or Senior Technical Reviewer, field parameter measurements may be made during pre-sampling purging to assess whether the drill water has dissipated by the time of sampling.

Note that it can be difficult to estimate the amount of water lost during drilling. If the driller's water tank is accessible, measure the water levels in the water tank before and after drilling the well and then estimate the volume of water used during drilling using the water tank dimensions and subtract this volume from the volume of water recovered at the end of drilling from this volume to estimate the volume of water lost. If this is not possible, ask the driller to estimate the approximate volume of water lost during drilling.

For some well installations, determining even an approximate volume of water lost during drilling is not possible. In this situation, field parameter stabilization should be used as a guide in deciding how much water to remove during well development.

5.2.5 Development of Monitoring Wells Installed Using Air Rotary Drilling Methods

When developing a monitoring well installed using an air rotary drilling procedure, field parameter stabilization must be used to assess whether sufficient water has been removed and the field parameters measured must include dissolved oxygen. This is particularly important when the contaminants of concern at a site include volatile organic compounds (VOCs) as the use of compressed air during the drilling process can result in sparging of VOCs from the groundwater, resulting in groundwater samples that are biased low with respect to VOC concentrations.

The well development procedure is the same as described in Section 5.2.4, except that the field parameters measured are to include pH, conductivity, temperature, oxidation-reduction potential and dissolved oxygen. The criterion for determining field parameter stabilization for dissolved oxygen is ±10% over 3 consecutive readings or 3 consecutive readings with concentrations less than 0.5 milligrams per litre.

5.2.6 Assessing Field Parameter Stabilization

When determining whether field parameter stabilization has occurred over 3 consecutive readings (except for dissolved oxygen when using the less than 0.5 milligrams per litre over 3 consecutive readings criterion), the following procedure is to be followed:

1. For each parameter, use the first of the 3 readings and calculate 10% of this reading; and
2. The range that the next 2 readings must be within is ± 10% of the first reading.

For example, if the temperature of the first of 3 consecutive readings is 10º C, the next 2 readings must fall between 9 and 11 º C for temperature to be considered stable.

5.3 Well Development Record

Well development is to be documented through the completion in full of the following field forms located in the Pinchin Orchard:

- EDR-GW-Well Development-S1-Low/High Yield Well (completed for Stage 1 for both low and high yield wells);
- EDR-GW-Well Development-S2-Low Yield Well (completed for Stage 2 for low yield wells); and/or
- EDR-GW-Well Development-S2-High Yield Well (completed for Stage 2 for high yield wells).

Any deviations from this SOP along with the rationale for these deviations must be recorded on the EDR-GW-Well Development-S1-Low/High Yield Well form.

5.4 Additional Considerations for O. Reg. 153/04 Phase Two ESA Compliance

When developing a low yield well, the well must be purged to dryness a minimum of 3 times regardless of the recovery time unless reduced purging is authorized by the Qualified Person responsible for the Phase Two ESA.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Association of Professional Geoscientists of Ontario, "*Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended)",* April 2011.

9.0 APPENDICES

None.

SOP – EDR019 – REV004 – SOIL SAMPLE LOGGING

Title:	Soil Sample Logging
Practice:	EDR
First Effective Date:	August 03, 2013
Version:	004
Version Date:	January 3, 2018
Author:	Francesco Gagliardi and Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	November 26, 2010	N/A	FG
001	October 31, 2013	Streamlined SOP to focus only on soil sample logging/Added O. Reg. 153/04 compliance section	RLM
002	April 29, 2016	Updated Section 4.0	RLM
003	April 28, 2017	Removed reference to Pinchin West	RLM
004	January 3, 2018	Modified percentages of minor constituents in Section 5.1.3/Clarified when geotechnical terms can be used for soil logging in Section 5.2	RLM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) presents the methods used to describe the physical characteristics of soil samples collected during site investigations.

The methods and equipment used for retrieving soil samples are provided in other SOPs (e.g., SOP-EDR007 – Borehole Drilling) and will not be repeated herein.

3.0 OVERVIEW

Not applicable.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

5.1 General Procedures

For each soil sample collected during a site investigation, the following information is to be recorded in the field log book or field forms in the order presented below:

- Depth;
- Primary soil texture;
- Colour;
- Minor constituents*;
- Noticeable odours;
- Noticeable staining;
- Noticeable free-phase product/sheen*; and
- Moisture content.

*These constituents only need to be noted if they are actually present in the sample.

5.1.1 Primary Soil Texture

The primary soil texture should be determined using the attached flow chart as a guide to help classify the soil.

5.1.2 Colour

Describe the primary colour of the soil sample (e.g., brown, grey, black, green, white, yellow, red). The relative lightness or darkness of the primary colour can be described using the adjectives “light” or “dark” as appropriate. Soil that exhibits different shades or tints is to be described by using two colours (e.g., brown-grey). If the soil sample contains spots of a different colour, this is to be described as “mottling” (e.g., grey with green mottling).

5.1.3 Minor Constituents

Note the presence of minor constituents in the soil that are “natural” materials (e.g., gravel, cobbles, sand, oxidation, etc.) or “man-made” materials (e.g., asphalt, brick, concrete, coal or glass fragments, coal ash, etc.). Gravel comprises particles between 5 millimetres (mm) and 75 mm in diameter. Cobbles comprise particles greater than 75 mm in diameter (approximately the size of a man’s fist) and boulders are particles greater than 150 mm in diameter (approximately the size of man’s head).

When the percentage of the minor constituents in the soil is between approximately 1 and 10%, the adjective used to describe the relative amount of the minor constituent is “trace” (e.g., silty sand with trace brick fragments).

When the percentage of minor constituents of soil is between approximately 10 and 20%, the adjective used to describe the relative amount of the minor constituent is "some" (e.g., silty sand with some concrete fragments).

When the percentage of the "natural" minor soil constituents is between approximately 20 and 35%, the minor soil type is described by adding a 'y' or 'ey' to the soil type (e.g., silty, sandy, clayey).

When the percentage of the "natural" minor soil constituents is also greater than 35%, the minor soil type is described by using "and" the soil type (e.g., sand and gravel, sand and silt).

When the percentage of the "man-made" minor soil constituents is between approximately 30 and 50%, describe the soil as per the normal procedure and add "with" the minor constituent type(s) (e.g., silty sand with coal ash and brick fragments).

5.1.4 Noticeable Odours

Field staff are not expected to directly smell soil samples to assess the presence/absence of odours.

If it is possible to identify the likely type of odour then this information should be recorded along with a comment on the severity of the odour (e.g., slight, strong, etc.). Identification of specific chemical compounds, such as petroleum hydrocarbons (PHCs) or solvents is acceptable; however, this identification should be referenced as "xxxx-like" (e.g., PHC-like, solvent-like, etc.). This principle also applies when describing staining and free-phase product.

If the odour cannot be readily identified, it should be described in the field notes as "unidentified odour". If no noticeable odours are observed, this needs to be recorded in the field notes as "no odour".

5.1.5 Noticeable Staining

Describe the colour and possible source of the staining (e.g., black PHC-like staining).

If no noticeable staining is observed, this needs to be recorded in the field notes as "no staining".

5.1.6 Noticeable Free-Phase Product/Sheen

Describe the colour, odour, possible composition and relative viscosity (if sufficient product is present to assess) of the product (e.g., dark brown, viscous, motor oil-like product). Identification of the composition of the product is acceptable but needs to be described as PHC-like, motor oil-like. Alternatively, the product can be described as "resembling" a substance (e.g., "resembling motor oil").

The presence of any observed iridescent sheen is to be recorded in the field notes. Note that the presence of an iridescent sheen by itself in the soil does not constitute the presence of free-phase product but may be an indicator that free-phase product is present within the vicinity of the borehole.

5.1.7 Moisture Content

Describe the moisture content of the soil sample using one of the following three terms:

- Dry – no visible evidence of water and the soil is dry to the touch;
- Moist – visible evidence of water but the soil is relatively dry to the touch. Do not use the term "damp" to describe this type of soil; and
- Wet – visible evidence of water and the soil is wet to the touch. Free water is evident when sandy soil is squeezed. Do not use the term "saturated" to describe this type of soil.

5.1.8 Recording Soil Sample Descriptions in Field Notes

Recording the information in the field notes consistently in the above order will make it easier to prepare the borehole logs for the site investigation report.

Example soil sample descriptions are as follows:

- Sand, grey, trace gravel, PHC-like odours, free-phase PHC-like product, wet;
- Silty sand, brownish-grey, some gravel, trace asphalt and brick fragments, no odours or staining, moist; and
- Silty clay, brown, trace gravel, no odours or staining, moist to wet at 2.4 mbgs.

5.2 General Considerations

Where any physical properties change within a soil sample, the depth at which this transition takes place needs to be recorded. For example, for a soil sample collected from 1.8 to 2.4 metres below ground surface (mbgs), if the upper 0.3 metres has no odours but PHC-like odours are present below this depth then the field notes need to state "no odours from 1.8 to 2.1 mbgs, PHC-like odours from 2.1 to 2.4 mbgs".

Some soil samples will contain a thin seam of a different soil type, such as a sand seam within a silty clay. The depth interval of any such seam is to be recorded in the field notes, and the material comprising the seam should be described separately using the logging procedure outlined above.

Unless soil sampling is being completed as part of a combined environmental/geotechnical investigation and EDR staff logging the soil samples have the appropriate geotechnical training, avoid the use of geotechnical terms (e.g., stiff, dense, high plasticity, etc.) when logging soil samples. If any geotechnical terms are inadvertently included in the field notes by staff who have not had geotechnical training, they must not be included in the borehole logs provided in our report.

5.3 Additional Considerations for Ontario Regulation 153/04 Phase Two ESA Compliance

None. Following this SOP will be sufficient to comply with the Ontario Regulation 153/04 requirements for Phase Two ESAs with respect to field logging. Risk assessments completed in accordance with Ontario Regulation 153/04 will typically require soil samples to be submitted to a laboratory for full soil texture analysis, but this is beyond the scope of field logging.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

American Society for Testing and Materials, *ASTM D2487-11 - Standard Practice for Classification of Soils for Engineering Purposes (United Soil Classification System)*, 2011.

Association of Professional Geoscientists of Ontario, *Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended)*, April 2011.

9.0 APPENDICES

Appendix 1 Soil Texture by Feel Chart

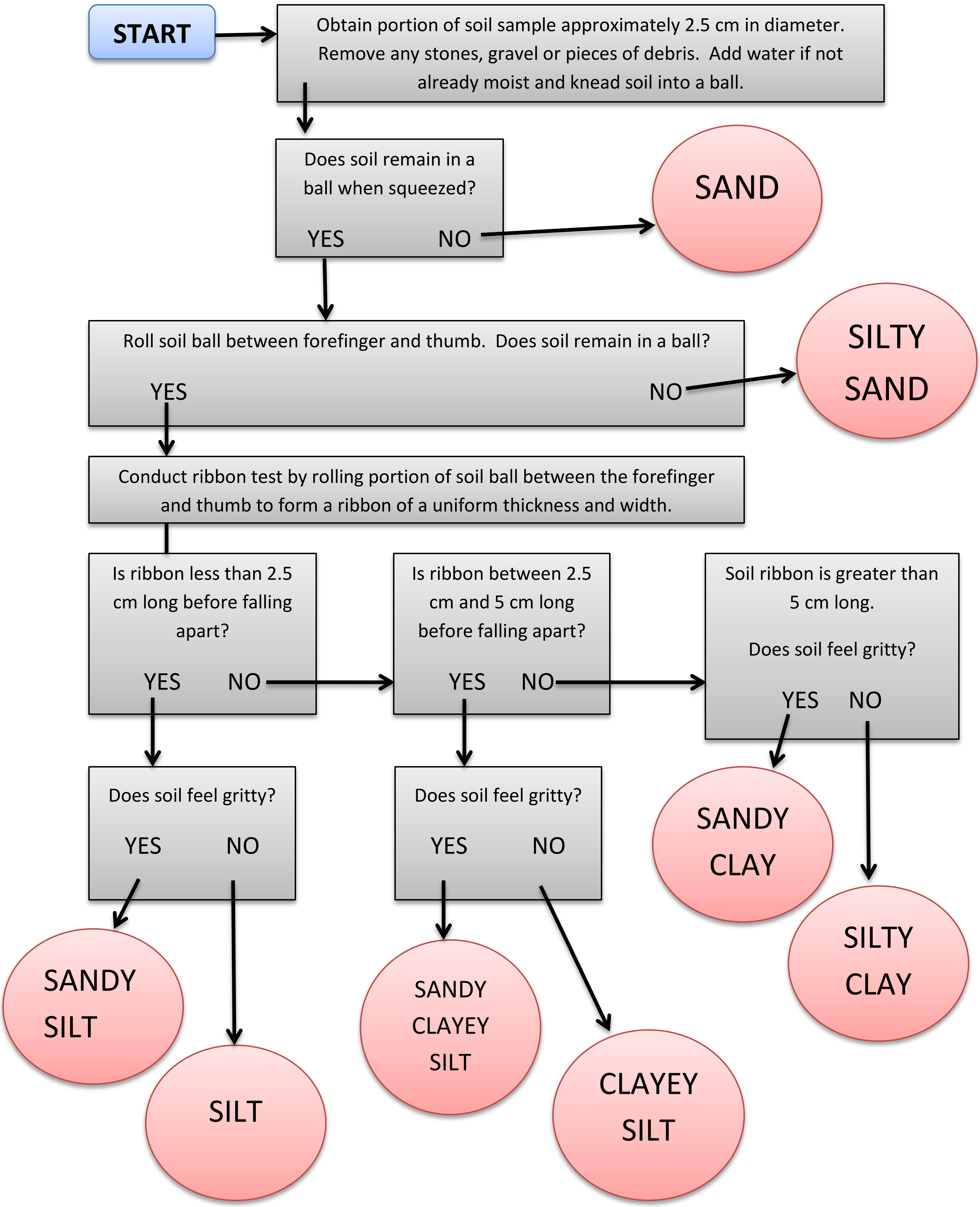
I:\2018 SOP Updates\SOP - EDR019 - REV004 - Soil Sampling Logging.docx

Template: Master SOP Template – February 2014

APPENDIX I

Soil Texture by Feel Chart

Key to Soil Texture by Feel



Obtain portion of soil sample approximately 2.5 cm in diameter. Remove any stones, gravel or pieces of debris. Add water if not already moist and knead soil into a ball.

Does soil remain in a ball when squeezed?

Roll soil ball between forefinger and thumb. Does soil remain in a ball?

Conduct ribbon test by rolling portion of soil ball between the forefinger and thumb to form a ribbon of a uniform thickness and width.

Is ribbon less than 2.5 cm long before falling apart?

Is ribbon between 2.5 cm and 5 cm long before falling apart?

Soil ribbon is greater than 5 cm long.

Does soil feel gritty?

Does soil feel gritty?

Does soil feel gritty?

SOP – EDR023 – REV006 – LOW FLOW GROUNDWATER SAMPLING

Title:	Low Flow Groundwater Sampling
Practice:	EDR
First Effective Date:	July 08, 2011
Version:	006
Version Date:	January 3, 2018
Author:	Paresh Patel and Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	July 08, 2011	N/A	PDP
001	April 15, 2013	Streamlined background section/Provided step-by-step summary of field procedure/Added O. Reg. 153/04 compliance items	RLM
002	September 11, 2013	Added centrifugal submersible pump to list of pumps suitable for low flow sampling	RLM
003	January 26, 2015	Adjusted well development, sampling and field parameter measurement procedures to reflect Pinchin West practices.	RLM
004	April 29, 2016	Updated Section 4.0/Updated Section 5.3 to reflect current field documentation requirements and new document retention policy	RLM
005	April 28, 2017	Removed reference to Pinchin West/In Section 5.2, removed the requirement to complete a post-sampling water level and total purge volume, and added requirement to record pump intake depth at the time of sampling	RLM
006	January 3, 2018	Minor wording changes throughout	RLM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the standard procedures for collecting groundwater samples from monitoring wells using low flow (low stress) sampling techniques and provides a description of the equipment required and field procedures.

Low flow sampling provides an alternative to the conventional groundwater purge and sampling technique using inertial pumps, submersible pumps and/or bailers, and emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water level drawdown, and by using low pumping rates during purging and sampling. Rather than removing a specified number of well volumes or purging a well to dryness a specified number of times prior to sampling, purging is completed at a low pumping rate until first, a stable water level is achieved, and second, field parameters such as pH, temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP), specific conductance and turbidity, which are monitored during purging, have stabilized indicating that representative formation groundwater is being purged. It is important that water level and field parameter stabilization are achieved prior to groundwater sampling as this indicates that fresh formation water is being purged and not stagnant groundwater from within the well itself.

Low flow groundwater sampling methods work best for moderate to high yield wells (i.e., wells installed in permeable soils such as sand, silty sand and some silts). For low yield wells (e.g., wells installed in silty clay), low flow groundwater sampling may not be suitable and alternate purging and sampling procedures will be required (see SOP-EDR008 for low yield well sampling procedures).

Conventional sampling can result in sediment entrainment in samples which can result in "positive bias" (i.e., reported concentrations greater than actual groundwater concentrations). This is particularly an issue with petroleum hydrocarbons (PHCs) in the F3 and F4 fraction ranges and polycyclic aromatic hydrocarbons (PAHs) and low flow sampling as per this SOP is strongly recommended when sampling for these parameters unless the hybrid sampling method described in SOP-EDR008 is employed.

This SOP is based primarily on the procedures described in the United States Environmental Protection Agency Region 1 document *"Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells"*, revised January 19, 2010.

3.0 OVERVIEW

The low flow sampling technique can be implemented for any size of monitoring well that can accommodate a positive lift pump or tubing assembly. Note that low flow sampling can be conducted for bedrock monitoring wells without well screens (i.e., with an open interval below the well casing) but for simplicity the screen interval or open interval will be referred to collectively in this SOP as the "screen interval".

Advantages of the low flow sampling technique over conventional groundwater sampling techniques include:

- Minimal disturbance at the sampling point, reducing the potential for sediment to be entrained during the purging process which can result in positive bias (elevated and unrepresentative concentrations) of parameters such as heavy fraction range PHCs and PAHs;
- Reduced operator variability resulting in greater operator control;
- Reduced purge water volumes resulting in reduced investigation derived waste disposal costs; and
- Improved sample consistency resulting in more representative (unbiased) and reproducible sample results.

Disadvantages of the low flow sampling technique over conventional groundwater sampling techniques include:

- Purging and sampling typically requires more time than conventional sampling methods;
- Use of non-dedicated equipment (e.g., submersible pumps) that requires cleaning before initial use and between monitoring well locations; and
- Overall project costs for low flow groundwater sampling programs are typically higher than groundwater sampling programs completed using conventional sampling methods.

It is imperative that the monitoring wells to be sampled are properly developed prior to conducting low flow groundwater sampling. This often includes redevelopment of previously installed wells that have not been sampled for a prolonged period of time (i.e., more than one year). During well development or redevelopment, the hydraulic characteristics of each well should be assessed to provide guidance on the suitability of using the low flow groundwater sampling procedure. Well development procedures are provided in SOP-EDR017.

When groundwater conditions are known, sample the background monitoring wells (i.e., outside of the impacted groundwater area) and wells with low concentrations of contaminants of concern first prior to sampling wells with known impacts. Leave impacted wells to the last to minimize the potential for cross contamination.

In Ontario and Manitoba, or where otherwise specified by provincial guidance documents, a peristaltic pump is not to be used for the collection of groundwater samples for analysis of volatile parameters (i.e., volatile organic compounds (VOCs) and PHCs F1 Fraction). When sampling for volatile parameters using low flow groundwater sampling methods, a bladder pump or centrifugal pump (collectively referred to herein as “submersible pumps”) must be used. A “hybrid” groundwater purging and sampling procedure using a peristaltic pump to undertake low flow groundwater sampling for non-volatile parameters as described in this SOP followed by conventional purging and sampling methods for volatile parameters is an acceptable alternative to using a bladder pump or centrifugal pump.

Peristaltic pumps cannot be used where the suction lift (i.e., vertical distance between the pump and ground level) is more than 8.5 metres (28 feet).

It is very important to maintain consistency in applying low flow groundwater sampling procedures to purging and sampling for each monitoring well and for each sampling event. Any deviation from the field procedures described in this SOP can induce variability in the analytical results.

Our primary objective is to obtain unbiased groundwater samples whose analytical results are representative of actual groundwater quality at the property being investigated.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

5.1 Equipment and Supplies

5.1.1 Documents and Information Gathering

The following documents and information are required to complete low flow groundwater sampling:

- A copy of the proposal or work plan;
- Monitoring well construction details;
- A copy of this SOP;
- Field data from the last sampling event (if available);
- Operation, maintenance and calibration manuals for the multi-parameter water quality meter;
- A site-specific Health and Safety Plan (as per the project requirements); and
- Client or site representative’s contact details.

5.1.2 Extraction Devices and Tubing

This SOP will not discuss in detail the various pumps and tubing options that are available for completing low flow groundwater sampling. The following section provides some general guidelines for the use of this equipment and it is recommended that the equipment supplier be consulted when selecting the appropriate pump and tubing, taking into account site-specific parameters (e.g., well depth, well diameter, site accessibility) and the parameters that will be sampled.

5.1.3 Extraction Devices

For purging and sampling using the low flow sampling procedure, submersible pumps (e.g., centrifugal, bladder) and peristaltic pumps are the most commonly used extraction devices. Regardless of the type of extraction device used, the low flow sampling procedure requires precise control over the flow rate during purging and sample collection. A battery-operated pump controller is required to operate submersible pumps and to control the extraction flow rate. Peristaltic pumps have built-in flow rate adjusters.

Submersible pumps with internal parts constructed of stainless-steel or Teflon are preferred. If the internal parts are constructed of other materials, adequate information must be provided by the equipment supplier to show that the substituted materials do not leach contaminants nor cause interference to the analytical procedures to be used. The use of any such substituted materials must be approved by the Project Manager prior to the field program.

If a bladder pump is selected for the collection of samples for volatile parameters analysis, it should be capable of delivering a water volume sufficient to fill a VOC sample vial in one pulse.

5.1.4 Tubing

Teflon, Teflon-lined polyethylene or polyethylene 1/4-inch interior diameter (ID) or 3/8-inch ID tubing is to be used to connect to the pump and the flow-through cell. In the winter time, the use of 3/8-inch ID tubing is recommended to avoid groundwater freezing in the tubing during severe cold weather conditions.

If the tubing is constructed of other materials (other than mentioned above), adequate information must be provided to show that the substitute materials do not leach contaminants nor cause interference with the analytical procedures. The use of any such substituted materials must be approved by the Project Manager prior to the field program.

Direct sunlight and hot ambient air temperatures may cause groundwater in the tubing to heat up and de-gas resulting in loss of volatile parameters. When sampling under these conditions, the length of the tubing between the top of the monitoring well and the flow-through cell should be kept as short as possible to minimize exposure to sunlight or ambient air and heating of the groundwater.

5.1.5 Groundwater Monitoring, Purging and Sampling

The following equipment is required to complete the low flow purging and sampling procedure described in this SOP:

- Well keys;
- Interface probe;
- Assorted tools (e.g., knife, screwdriver, etc.);
- Equipment cleaning reagents required as per SOP-EDR009 (e.g., distilled water, phosphate-free detergent, etc.);
- Multi-parameter water quality meter (including calibration solutions);
- Graduated cylinder, graduated measuring cup or graduated bucket;
- Stopwatch;

- Flow-through cell;
- Peristaltic pump, centrifugal pump or bladder pump;
- Tubing;
- Pails or drums for storing purge water;
- Paper towels or wipes;
- Calculator;
- Field forms (see Section 5.3) and/or field notebook (hereafter the "field notes");
- Waterproof and permanent markers;
- Disposable gloves and appropriate personal protective equipment based on site-specific conditions;
- Cooler and ice packs;
- Sample bottles and labels. Several extra sample bottles of each type should be available in case of breakage or other problems; and
- Laboratory Chain of Custody forms.

The following equipment may be used during well sampling, in addition to the above:

- Disposable field filtration units/filters (if appropriate).

5.2 Low Flow Groundwater Sampling Procedures

The following is the summary of the procedures to be followed for low flow groundwater sampling:

1. Develop the monitoring wells to be sampled (if required) prior to sampling by removing between three and five well volumes or by purging them to dryness between one and three times. Further details regarding well development are provided in SOP-EDR017. Well development is to be completed for all newly installed wells prior to low flow sampling and may be required for previously installed monitoring wells that have not been sampled in more than one year. Ideally, well development should occur at least one day prior to low flow sampling. At the discretion of the Project Manager, low flow sampling can occur on the same day as the well is developed but the well must be allowed to fully recover to its original static level prior to the start of purging;
2. Decontaminate all non-dedicated monitoring and sampling equipment that will be used, including the interface probe, submersible pump (if used), water quality meter probes and flow-through cell in accordance with the procedures described in SOP-EDR009;

3. Calibrate the water quality meter used for field parameter measurement in accordance with the manufacturer's specifications. Wherever possible, arrange for the equipment rental company to calibrate the water quality meter and provide a calibration sheet that contains information such as calibration date and calibration measurements for each parameter. If the water quality meter is to be used for more than a one day, a calibration check shall be performed using standard calibration solutions at the start of each day at a minimum. If the calibration check shows deviations from the standard values that exceed the ranges provided in bullet 10 below, the instrument shall be calibrated prior to further use. A calibration check should also be performed during the course of purging and sampling if the parameter measurements suggest that calibration drift has occurred. Document all calibration activities in the field notes, including date and time of calibration/calibration check, calibration solutions used, probe readings and make, model and serial number of the water quality meter. Note that if the water quality meter manufacturer recommends more frequent calibration/calibration checks than specified above, the manufacturer's recommendations are to be followed. See SOP-EDR016 for additional procedures regarding water quality meter calibration.

   Extra care must be taken when calibrating the multi-parameter probe to prevent cross-contamination. Specifically, following immersion of the probes into each calibration standard, all probes should be thoroughly rinsed in distilled or de-ionized water and the excess water shaken off or blotted dry with a lint-free wipe. Conductivity standards are much more sensitive to cross contamination/dilution than other standards. Besides being easily diluted, conductivity standards also affect other parameters (specifically DO), and the conductivity probe should always be the first probe calibrated. The following order for calibration of a multi-parameter probe is to be followed:

   - Specific Conductance;
   - pH;
   - DO;
   - Turbidity; and
   - All other parameters (there is no recommended order for these parameters).

4. Review the well construction details provided in the well development forms, borehole logs or well construction summary table from a previous report. Determine the well depth, well stick up, length of the screen interval, and depth to the top of the screen interval. If the well depth is unavailable, measure it with the interface probe;

Measure the initial water level (i.e., static water level) from the reference point on the well (which should be marked at the top of the well casing) with an interface probe. If measurable free-phase product is present in the well, discuss this with the Project Manager before proceeding further. Using the known well depth, confirm that at least 0.6 metres of water is present within the well. If less than 0.6 metres of water is present, low flow sampling may not be appropriate and the Project Manager is to be contacted before proceeding further;

5. Following decontamination, slowly install the pump or tubing (for peristaltic pumps) to the appropriate depth within the well. Do not connect the pump discharge tubing to the flow-through cell at this time. If the water level in the well is above the top of the screen interval, the pump or tubing intake depth will be the mid-point of the screen interval. If the water level is below the top of the screen interval, the pump or tubing intake will be set at the mid-point of the wetted interval (i.e., the distance between the static water level and the bottom of the well) or 0.6 metres from the bottom of the well, whichever is a greater distance from the bottom of the well. Pumping from within 0.6 metres of the bottom of the well has a higher potential to entrain sediment from the bottom of the well and is not to be completed unless authorized by the Project Manager.

   The pump intake depth may vary from that described above at the discretion of the Project Manager depending on the specific purpose of the groundwater sampling program. For example, if chlorinated solvents that are denser than water are being assessed, it may be desirable to position the pump intake as close to the bottom of the well as possible, or if PHC-related parameters which are lighter than water are being assessed, it may be preferable to position the pump intake as close to the water table as possible. Pump intake depth should be confirmed with the Project Manager prior to the field program;

6. Turn on the pump and discharge groundwater into a purge bucket. Purge initially at a flow rate of approximately 250 millilitres/minute (mL/min). Increase or decrease the flow rate until the water level in the well reaches a steady state condition (i.e., a stabilized water level). The goal is to purge at as high a pumping rate as the well will sustain and still maintain a stabilized water level; however, purging rates should not exceed 500 mL/min during purging and sampling. Also, it is important that during the early phase of purging, emphasis should be put on minimizing pumping stress (i.e., rapid fluctuations in pumping rates).

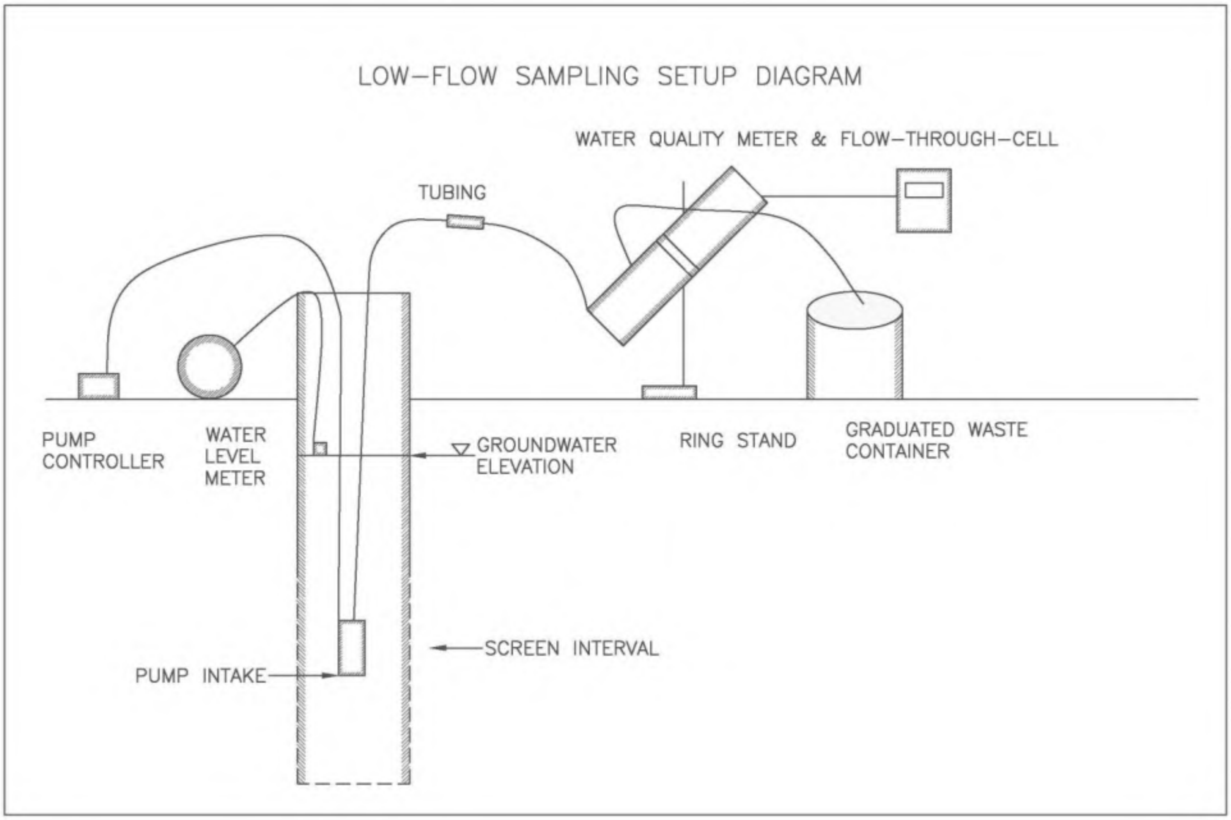
Whenever possible, purge at a pumping rate low enough to keep the total drawdown in the well to less than 10 centimetres although this may not be achievable for low to moderate yield wells. Once a steady state condition is achieved, the purge rate must be maintained constant and should not be changed. Determine the flow rate using a graduated bucket, graduated measuring cup or graduated cylinder and a stop watch. If the well is purged dry even after reducing the flow rate to the minimum practical purging rate of approximately 50 mL/min to 100 mL/min, then low flow sampling procedures will not work for the well and the sampling procedure described in SOP-EDR008 for sampling low yield wells is to be followed. During purging and sampling, it is important to keep the pump intake below the water level in the well at all times to avoid aeration of the groundwater;

7. If the visual appearance of the groundwater is highly turbid once a stabilized water level is achieved, continue to discharge purged water directly into the purge bucket until the groundwater clears, as highly turbid groundwater may foul the flow-through cell. Once the turbidity clears up, connect the flow-through cell to the pump discharge tubing. If the groundwater remains highly turbid after approximately 15 minutes of purging, contact the Project Manager to discuss whether sampling should occur. Further well development may be required to remove excess sediment from the monitoring well before sampling can proceed;
8. Confirm the volume of the flow-through cell excluding the volume of the water quality meter probes. If this information is not readily available, fill the cell with water with the water quality probes inserted and empty its contents into a graduated cylinder or measuring cup to determine the volume. After connecting the discharge tubing to the flow-through cell, continue purging until the flow-through cell is full and turn on the multi-parameter meter. Record the initial field parameter readings in the field notes. At a minimum, the field parameters that are to be monitored are pH, specific conductance, temperature, DO and ORP. The monitoring of turbidity is also a minimum requirement in Ontario and Manitoba. Field parameter readings are to be obtained at a frequency of no less than once every 5 minutes. Obtaining field parameter readings at a spacing of greater than 5 minutes apart may be required if the volume of the flow-through cell is large or pumping occurs at a low rate (e.g., 50 or 100 mL/min). For example, if the flow-through cell has a volume of 300 mL and the pumping rate is 50 mL/min, it will take 6 minutes for the volume of water equivalent to the flow-through cell volume to pass through the cell and field parameter readings should be taken 6 minutes apart. If the pumping rate for the same flow-through cell is 100 mL/min, although it will take only 3

minutes for the volume of water equivalent to the flow-through cell volume to pass through the cell, field parameter readings are to be taken at 5 minute intervals.

Figure 1 shows a typical low flow groundwater sampling set up using a submersible pump. The set up when using a peristaltic pump is similar except that the only part of the extraction system in the well is tubing that is connected to the peristaltic pump at the ground surface (i.e., there is no pump mechanism within the well), and a second section of tubing connects the discharge of the peristaltic pump to the flow-through cell.

Figure 1: Low Flow Sampling Set Up Diagram



Reference: USEPA Region I EQASOP-GW 001, July 30, 1996, Revised January 19, 2010.

Air bubbles in the flow-through cell can result in inaccurate field parameter measurements, in particular for DO. If air bubbles appear in the flow-through cell, check that the discharge tubing is properly connected to the flow-through cell and check that the pump intake is located below the water table by confirming the pump intake depth and checking the water level in the well. If air bubbles persist in the flow-through cell, position the flow-through cell at a 45-degree angle with the ports facing upwards. This configuration should keep any gas bubbles entering the cell away from the multimeter probes and allow the air bubbles to exit the cell easily;

9. Regardless of the frequency of field parameter readings, purging is to be completed until field parameter stabilization is achieved, which occurs when the field parameter measurements for <u>all</u> of the parameters are within the following ranges for <u>three consecutive</u> sets of readings:

pH	±0.1 pH units
Specific Conductance	±3%
Temperature	±3%
DO	±10% for values greater than 0.5 milligrams per litres (mg/L), or three consecutive values less than 0.5 mg/L
ORP	±10 millivolts
Turbidity	±10% for values greater than 5 Nephelometric Turbidity Units (NTUs), or three consecutive values less than 5 NTU

10. Check the water level in the well during purging a minimum of once every 10 minutes to confirm that steady state conditions are being maintained. Although not mandatory, more frequent water level measurements can be made (e.g., at the time of each set of water quality parameters). Reduce the pumping rate if the water level measurements indicate that drawdown is occurring. Confirm the new pumping rate as per Step 7 and record it in the field notes;
11. Record the time of all water level and field parameter measurements in the field notes;
12. Should field parameter stabilization not occur within one hour of the start of purging, contact the Project Manager to discuss whether to continue purging to attempt to achieve field parameter stabilization or whether to proceed with groundwater sample collection. The Project Manager will consider the total volume of water purged to this point and may

deem it suitable to collect the groundwater sample if, for example, three or more well volumes in total have been purged despite the lack of field parameter stability. Note that achieving stabilization of some parameters is more important with respect to certain contaminant types. For example, the stabilization of DO readings is important for volatile parameter sampling because fluctuations in DO concentrations may indicate that the groundwater is being aerated during the purging process which could result in volatile loss from the groundwater samples;

13. Following field parameter stabilization, disconnect the tubing from the flow-through cell and collect the groundwater samples by filling the appropriate laboratory-supplied sample containers directly from the discharge tubing. Note that it is important not to sample groundwater that has passed through the flow-through cell. If pumping at a moderate to high pumping (i.e., > 200 mL/min), the pumping rate should be reduced to prevent overfilling or the splashing of preservatives out of the sample containers. The order of sample collection should be most volatile parameters to least volatile parameters as follows:

- VOCs and PHCs F1 Fraction;
- PHCs F2-F4 Fraction;
- PAHs and Base/Neutral/Acid Extractables;
- Metals and Inorganics; and
- Polychlorinated Biphenyls and Organochlorine Pesticides.

Special Notes for Volatile Parameter Sampling

When collecting samples for volatile parameter analysis (i.e., VOCs and PHCs F1 Fraction), the tubing must be filled completely and must not contain air bubbles prior to sample collection. If this is observed, increase the pumping rate slightly prior to sample collection until the tubing is filled and/or there are no longer any air bubbles, and then collect the sample. When collecting the groundwater samples for volatile parameter analysis, the sample vials should be tilted to avoid agitation and bubbling to minimize the potential for volatilization.

Special Notes for Metals Sampling

Groundwater samples collected for metals analysis will require filtering prior to preservation if dissolved metals concentrations are sought. Depending on the type and diameter of the discharge tubing used, in-line filters can be used for field filtering. Disposable filtration kits (e.g., Nalgene 0.45 micron filters) can also be used for field filtering. When collecting samples in containers that are pre-charged with preservatives, care must be taken not to overfill the containers as some of the preservative may be lost which will result in the sample not being properly preserved. Also, sample containers for metals analysis typically have a fill line marked on the container and the container must not be filled to above this line as this will cause dilution of the preservative and the sample may not be properly preserved.

If field filtering cannot be completed, then the groundwater samples are to be collected in sample containers that do not contain preservatives, and the analytical laboratory is to be instructed to filter and preserve the samples immediately upon receipt. The procedure and necessary equipment required to filter and preserve metals samples using the low flow methods should be discussed with the Project Manager prior to mobilization to the field; and

14. Record the pump intake depth at the time of sample collection. Remove the pump and/or tubing from the well and decontaminate the sampling equipment.

5.3 Fieldwork Records

The purging and sampling of a monitoring well using the low flow groundwater sampling procedure described in this SOP are to be documented through the completion in full of the following field forms located in the Pinchin Orchard:

- EDR-GW-Low Flow Sampling; and
- EDR-GW-Water Quality Parameters.

Any deviations from this SOP along with the rationale for these deviations must be recorded on the forms.

Upon completion of the sampling event, the field notes must be submitted to the Project Manager for review. The field notes must also be scanned and a copy of the scan placed in the project folder on the server.

5.4 Additional Considerations for O. Reg. 153/04 Phase Two ESA Compliance

When completing a Phase Two Environmental Assessment (ESA) in accordance with Ontario Regulation 153/04, the following must be undertaken:

- Calibration checks must be made for the water quality meter used for field parameter measurements at the frequency specified in Step 3 of Section 5.2. Records of the calibration checks must be kept and appended to the Phase Two ESA report;

- At least one field duplicate groundwater sample must be collected for every ten samples submitted for analysis. The frequency is one for one to 10 samples, two for 11 to 20 samples, etc. for all parameters analyzed. For example, even if only one groundwater sample is collected for PAHs analysis, a duplicate of this sample must be collected; and
- When sampling for VOCs, one trip blank sample must be submitted to the laboratory for VOCs analysis for each submission to the laboratory. In other words, if a groundwater sampling program lasts three days and samples are submitted to the laboratory at the end of each day, there must be a total of three trip blanks submitted with the samples (i.e., one per day of sampling). Note that analysis of trip blank samples for other volatile parameters (e.g., PHCs (F1 Fraction)) is not mandatory but can be completed at the discretion of the Qualified Person.

In addition, low flow groundwater sampling using a bladder pump or centrifugal pump should be completed whenever well yields are high enough to permit it for all Phase Two ESAs undertaken to support the filing of a Record of Site Condition. This will minimize potential issues the Ministry of the Environment and Climate Change may have regarding the representativeness of the groundwater analytical data.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

U.S. Environmental Protection Agency Region I, *Low Stress (‘low flow’) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells,* EQASOP-GW 001, July 30, 1996, Revised January 19, 2010.

SOP – EDR025 – REV004 – QA/QC SAMPLING

Title:	QA/QC Sampling
Practice:	EDR
First Effective Date:	January 17, 2014
Version:	004
Version Date:	January 3, 2018
Author:	Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	January 17, 2014	N/A	RLM
001	June 26, 2014	Amended blind duplicate sampling requirements	RLM
002	April 29, 2016	Updated Section 4.0/Amended O.Reg. 153/04 trip blank requirements	RLM
003	April 28, 2017	Removed reference to Pinchin West	RLM
004	January 3, 2018	In Section 5.2.6, clarified order of regular investigative sample and duplicate sample collection	RLM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the standard procedures for collecting soil, water and sediment samples for quality assurance/quality control (QA/QC) purposes.

A QA/QC program is essentially a management system that ensures that quality standards are met within a stated level of confidence. The QC component of the program comprises daily activities in the field and laboratory that are used to control the quality of both the samples collected and the sample analytical data. The QA component of the program is made up of measures used to determine whether the QC activities are effective.

When completing a site investigation, one of our primary goals is to obtain analytical data that are representative of actual soil, water and/or sediment conditions at the site. The completion of a QA/QC program, consisting of the collection and analysis of various QA/QC samples, provides information for use in evaluating the accuracy of the analytical data used to assess the environmental quality of the site.

The type and number of samples comprising the QA/QC program will be determined by the Project Manager on a site-by-site basis, but will typically include at a minimum a trip blank when collecting water samples for volatile parameter analysis and duplicate soil, water or sediment samples. Other types of QA/QC samples may be collected (e.g., equipment or field blanks) to meet project-specific requirements at the discretion of the Project Manager or to meet regulatory requirements.

The QA/QC sampling requirements and procedures for indoor air, soil vapour and sorbent tube samples are described in SOP-EDR012, SOP-EDR018 and SOP-EDR027, respectively.

3.0 OVERVIEW

The types of samples collected for the QA/QC program during site investigations may include the following:

- Trip blanks;
- Field blanks;
- Equipment blanks; and
- Field duplicates.

Trip blanks are used to assess whether ambient air conditions may have resulted in positive bias of water samples collected for volatile parameter analysis during transportation of the sample containers to and from a project site. Note that the term “positive bias” means that reported sample concentrations are greater than actual in situ sample concentrations due to some form of “cross-contamination”.

Field blanks are collected to assess whether ambient air conditions may have resulted in positive bias of samples collected at a project site for volatile parameter analysis at the time of sampling.

Equipment blanks are collected to assess the efficiency of non-dedicated monitoring/sampling equipment cleaning procedures.

Duplicate samples are collected to assess whether field sampling and laboratory analytical methods are suitable and reproducible.

The analytical results of the QA/QC samples are reviewed by the Project Manager to assess whether any data quality issues are evident which may affect the interpretation of the soil, water and/or sediment sample analytical data.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document.

This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and
- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

5.1 Equipment and Supplies

The equipment/supplies required for QA/QC sample collection are the same as that used for regular investigative sampling, except for the following:

- Volatile organic compound (VOC)-free distilled water supplied by the analytical laboratory for use in the collection of field blanks and/or equipment blanks;
- Additional sample jars supplied by the analytical laboratory for the collection of field blanks, equipment blanks and field duplicates; and
- Trip blanks supplied by the analytical laboratory.

5.2 QA/QC Sampling Procedures

5.2.1 General Procedures for QA/QC Blank Sampling

The analytical laboratory that will be completing the analysis of the regular investigative samples and QA/QC samples for a project must supply the water used to collect field blanks and equipment blanks. Water provided by another analytical laboratory or store-bought distilled water must not be used.

5.2.2 Trip Blanks

A trip blank is a set of VOC sample vials filled by the analytical laboratory with VOC-free distilled water and shipped with the sample containers. A trip blank is to be stored with the sample containers provided by the analytical laboratory during travel to the project site, while on the project site, and during travel from the project site back to the analytical laboratory. The sample containers comprising a trip blank are not to be opened in the field.

For some projects, submissions of volatile parameter samples to the analytical laboratory over several days will be required. In this case, a trip blank sample should accompany each submission to the laboratory. If this situation is anticipated, the Project Manager must request that the analytical laboratory provide sufficient trip blanks so that a trip blank can accompany the submission of each set of samples to the laboratory.

Trip blanks are to be analyzed for the same volatile parameters (i.e., VOCs and/or petroleum hydrocarbons (PHCs) (F1 fraction)) as the regular investigative samples. For example, if the groundwater sampling program includes analysis of VOCs and PHCs (F1-F4 fractions), then the trip blank(s) require analysis of VOCs and PHCs (F1 fraction). If the groundwater sampling program only includes VOC analysis, then the trip blank(s) require analysis of VOCs only.

Unless specified by the Project Manager, trip blanks are not required for soil and sediment sampling, or for water sampling involving only non-volatile parameters. At the discretion of the Project Manager and to meet project-specific requirements, trip blanks for non-volatile parameters can be prepared and analyzed using the same principles as for volatile parameter trip blanks.

5.2.3 Field Blanks

A field blank is a set of VOC sample vials filled during a sampling event at a project site with VOC-free distilled water supplied by the analytical laboratory and submitted for analysis of volatile parameters (i.e., VOCs and/or PHCs (F1 fraction)).

Field blanks are to be collected at a sample location considered “worst case” with respect to ambient air conditions (e.g., adjacent to and downwind of the pump island of an active retail fuel outlet, inside an active on-the-premises dry cleaner, etc.). At project sites where there is no obvious “worst case” ambient air location, the field blank can be collected at a sampling location picked randomly. The field blank collection location and rationale for selecting it must be documented in the field notes.

If a groundwater sampling event at a project site occurs over more than one day, a field blank is to be collected for each day of sampling.

Some project sites may have an isolated area where the ambient air conditions are significantly poorer than the remainder of the site and a field blank collected from this area may not be representative of conditions elsewhere on the site. In this case, at the discretion of the Project Manager, the collection of two field blanks may be appropriate, with one field blank collected from the poor ambient air area and one field blank collected from a location outside of this area.

Unless specified by the Project Manager, field blanks are not required for soil and sediment sampling, or for water sampling involving only non-volatile parameters. At the discretion of the Project Manager and to meet project-specific requirements, field blanks for non-volatile parameters can be collected and analyzed using the same principles as for volatile parameter field blanks.

5.2.4 Equipment Blanks

An equipment blank is collected by pouring VOC-free distilled water supplied by the analytical laboratory either over or through non-dedicated sampling/monitoring equipment that has been cleaned following sampling/monitoring using the procedures outlined in SOP-EDR009. The resulting rinsate is then captured in sample containers appropriate for the intended analysis. Note that the surface over which the distilled water is poured must be the surface from which samples are collected from or that is in contact with the medium being monitored. For example, if an equipment blank is being collected from a split-spoon sampler, the distilled water must be poured through the interior of the sampler, and not the exterior of the sampler.

The Project Manager will be responsible for determining the sampling/monitoring equipment from which equipment blanks will be obtained, the number of equipment blanks and the parameters to be analyzed. Regarding the latter, the parameters analyzed for equipment blanks are typically the parameters of concern for a given project site.

5.2.5 Evaluation of Blank Sample Results

The Project Manager will evaluate the results of the blank sample analysis to assess whether these results show that bias may have been introduced to investigative samples collected during the field sampling activities. Judgement by the Project Manager will be required to assess whether the blank sample results have any effect on the interpretation of the investigative sample results. This is assessed on a case-by-case basis, but the following general principles can be applied:

- If all soil, groundwater and/or sediment samples collected for a site investigation meet the applicable environmental standards/criteria, the presence of detectable or elevated parameter concentrations in the blanks has no effect on the interpretation of the investigative sample results;
- If parameters have detectable or elevated concentrations in the blank samples but none of these parameters are present in the regular investigative samples at concentrations exceeding the applicable environmental standards/criteria, the blank sample results have no effect on the interpretation of the investigative sample results;
- If parameters have detectable or elevated parameter concentrations in the blank samples and one or more of these parameters are present in the regular investigative samples at concentrations exceeding the applicable environmental standards/criteria, then positive bias of the regular investigative samples may have occurred. The Project Manager will need to assess a number of variables, including the relative parameter concentrations in the blank and regular investigative samples, to determine whether the regular investigative sample data are considered representative and usable for assessing the environmental quality of the site. If the regular investigative sample data are questionable, then resampling may be required; and
- If the regular investigative samples have exceedances of the applicable environmental standards/criteria and the blank samples have non-detectable parameter concentrations, the blank sample results have no effect on the interpretation of the investigative sample results.

5.2.6 General Procedures for QA/QC Duplicate Sampling

Whenever possible, duplicate samples are to be collected from "worst case" sample locations. The reason for this is that Relative Percent Differences (RPDs) are calculated using the analytical results of the duplicate and regular investigative samples to evaluate the suitability and reproducibility of field sampling and laboratory analytical methods. However, RPDs for a given parameter can only be calculated if there are detectable concentrations in both samples, and "worst case" sample locations are the most likely to have detectable levels of parameters of concern. The calculation and evaluation of RPDs is discussed at the end of this section.

When filling sample containers, the order of collection is to fill the sample container for a particular parameter or parameters for the regular investigative sample first and then fill the sample container for the same parameter or parameters for the duplicate sample second. For example, if groundwater was being sampled for PAHs and metals and a duplicate sample was required, the order of filling the sample containers would regular investigative sample for PAHs, duplicate sample for PAHs, regular investigative sample for metals and duplicate sample for metals.

5.2.7 Field Duplicate Samples – Soil/Sediment

Soils/sediments are frequently heterogeneous because they are typically deposited in horizontal layers over time, causing both small scale and large scale grain size variations that can often result in significant variations in contaminant concentrations between layers. Because of this, it is important that duplicate soil/sediment samples be collected from the same vertical depths as the regular investigative samples in sample cores or at discrete sampling locations (e.g., grab samples).

When collecting a duplicate soil/sediment sample from a sampling device that provides a soil core (e.g., dual-tube sampler, split-spoon sampler), the soil core is to be split in half vertically (i.e., longitudinally). A portion of one half of the core is used for the regular investigative sample and a portion of the other half of the core is used for the duplicate sample. The portion of each core placed in sample jars for analysis must be obtained from the same depth interval within the cores.

When collecting a duplicate soil/sediment sample from a grab sample (e.g., excavation floor or sidewall), the field duplicate sample must be collected as close as possible to the regular investigative sample location at the sample depth and within the same soil layer.

There are no special procedures for collecting field duplicates of composite soil/sediment samples given that the soil/sediment is homogenized during the composite sample collection procedure.

A field duplicate soil/sediment sample must be collected at the same time as the regular investigative sample. Retroactively splitting a soil/sediment sample to obtain a field duplicate sample is not permitted.

5.2.8 Field Duplicate Samples – Surface Water/Potable Water/Groundwater

There are no special procedures for collecting surface water/potable water/groundwater field duplicate samples with the following exceptions:

- When collecting a duplicate water sample for metals analysis and field filtering is required, a new filter is to be used to collect the duplicate sample unless the groundwater has a low sediment content; and
- When collecting a duplicate surface water sample, the sample containers for the same parameter(s) should be immersed in the surface water body at the same location and at the same time whenever possible.

5.2.9 Duplicate Sample Labelling

The duplicate sample should have the term “DUP” in the sample identifier to distinguish it as a duplicate sample.

5.2.10 Evaluation of Duplicate Sample Results

Duplicate sample results are evaluated by calculating RPDs using the following equation:

$$\text{RPD} = \frac{\underline{\text{Absolute Value (Original Concentration – Duplicate Concentration)}}}{\text{(Original Concentration + Duplicate Concentration)/2}} \text{ X } 100\%$$

RPDs are not calculated unless the parameter concentrations in both the regular investigative sample and duplicate sample are detectable concentrations above the corresponding practical quantitation limit (PQL) for the parameter, which is equal to five times the lowest laboratory reportable detection limit (RDL).

For example, if the RDL for a parameter is 0.1 parts per million (ppm), and the concentration in the regular investigative sample is 0.4 ppm and the concentration in the duplicate sample is 0.6 ppm, the RPD cannot be calculated because the concentration in the regular investigative sample (0.4 ppm) is less than the PQL of 0.5 ppm (5 times the RDL of 0.1 ppm).

Also, if the regular investigative sample concentration is 2 ppm and the duplicate sample concentration is <1 ppm, then the RPD cannot be calculated regardless of the PQL since detectable concentrations were not reported for both samples.

Calculated RPDs for the regular investigative and field duplicate samples are compared to established performance standards to evaluate the suitability and reproducibility of field sampling and laboratory analytical methods. In Ontario, the Ontario Ministry of the Environment and Climate Change (formerly the Ontario Ministry of the Environment) provides duplicate sample performance standards in the document *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the*

Environmental Protection Act, dated March 9, 2004, amended as of July 1, 2011. Although these performance standards only strictly apply to laboratory duplicate samples, they are considered suitable for comparison to field duplicate samples. Other provinces provide their own similar guidance.

When calculated RPDs exceed the performance standards, the Project Manager will evaluate whether these results have any effect on the interpretation of the investigative sample results. This is judged on a case-by-case basis, but in many situations RPD values above the performance standards can be attributed to small scale heterogeneity inherent in soil samples or variations in the quantity of sediment in groundwater or surface water samples, and are not indicative of poor field sampling or laboratory procedures. The results of internal laboratory QA/QC sampling may provide additional information as to the precision of the data. Furthermore, if all soil, water and/or sediment samples collected for a site investigation meet the applicable environmental standards/criteria, the apparent lack of precision shown by elevated RPD values should not affect the interpretation of the investigative sample results.

Sometimes a regular investigative sample will meet the applicable environmental standards/criteria and its corresponding duplicate sample will fail the applicable environmental standards/criteria (or vice versa). In Ontario, it is permitted to average the parameter concentrations of two samples provided they are collected at the same time and from the same sample location and depth. The resulting average parameter concentrations are then compared with the applicable standards to determine whether the sample meets or fails the standards. This approach is not acceptable in all jurisdictions. In situations where averaging is not acceptable to the regulatory agency, the “worst case” sample result is to be used in assessing the environmental condition of the project site.

5.3 Fieldwork Records

The field notes must include the following information with respect to QA/QC samples:

- The date and time of sampling for all blank/duplicate samples;
- The sample location for field blanks and the rationale for selecting the field blank locations;
- The type of equipment from which a rinsate was collected for equipment blanks and the parameters to be analyzed; and
- The corresponding regular investigative sample location/sample interval for duplicate samples and the parameters to be analyzed.

5.4 Additional Considerations for Ontario Regulation 153/04 Phase Two ESA Compliance

When completing a Phase Two ESA in accordance with Ontario Regulation 153/04, the QA/QC sampling program must consist of the following as a minimum:

- At least one field duplicate soil, sediment or groundwater sample must be collected for every ten samples submitted for analysis. The frequency is one duplicate sample for one to 10 regular investigative samples, two duplicate samples for 11 to 20 samples, etc. for all parameters analyzed. For example, even if only one groundwater sample is collected for PAHs analysis, a duplicate of this sample must be collected.

When sampling for VOCs, one trip blank sample must be submitted to the laboratory for VOCs analysis for each submission to the laboratory. In other words, if a groundwater sampling program lasts three days and samples are submitted to the laboratory at the end of each day, there must be a total of three trip blanks submitted with the samples (i.e., one per day of sampling). Note that analysis of trip blank samples for other volatile parameters (e.g., PHCs (F1 Fraction)) is not mandatory but can be completed at the discretion of the Qualified Person.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Association of Professional Geoscientists of Ontario, *Guidance for Environmental Site Assessments under Ontario Regulation 153/04 (as amended),* April 2011.

Ontario Ministry of the Environment and Climate Change, *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act*, March 9, 2004, as amended as of July 1, 2011.

Water, Air and Climate Change Branch, Ministry of Water, Land and Air Protection, Province of British Columbia, *British Columbia Field Sampling Manual*, 2003.

9.0 APPENDICES

None.

I:\2018 SOP Updates\SOP - EDR025 - REV004 - QA QC Sampling.docx

Template: Master SOP Template – February 2014

9.0 APPENDICES

None.

I:\2018 SOP Updates\SOP - EDR023 - REV006 - Low Flow Groundwater Sampling.docx

Template: Master SOP Template – February 2014

SOP – EDR026 – REV005 – VERTICAL ELEVATION SURVEYING

Title:	Vertical Elevation Survey
Practice:	EDR
First Effective Date:	April 3, 2014
Version:	005
Version Date:	January 3, 2018
Author:	Kathryn Matheson and Robert MacKenzie
Authorized by:	Robert MacKenzie
Signature:	

TABLE OF CONTENTS

1.0 VERSION HISTORY

Version	Date	Summary of Changes	Author
Original	April 2, 2014	N/A	KM
001	April 22, 2014	Text and figure edits	KM/RM
002	January 22, 2015	Added instruction regarding need to include a least one TP in a survey	RM
003	April 29, 2016	Updated Section 4.0	RM
004	April 28, 2017	Removed reference to Pinchin West	RM
005	January 3, 2018	Minor wording changes throughout	RM

2.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) presents a description of the methods employed for the completion of vertical elevation surveys of monitoring wells.

Relative vertical elevation surveys are typically completed on sites where three or more monitoring wells have been installed in order to allow for the triangulation of groundwater flow direction. The relative vertical elevation surveys completed by Pinchin are typically not used to determine elevations relative to sea level. However, if elevations relative to sea level are needed, a local benchmark with a known geodetic elevation is required.

Two methods are available for the completion of vertical elevation surveys: completion of the survey using a manual scope and survey rod (which requires a two-person team); or completion of the survey using a laser level. The use of a laser level and associated sensor is the most common surveying method used by Pinchin and will be the focus of this SOP. With minor modifications, this SOP can also be used for “conventional” surveying using a manual scope, survey rod and two-person team.

3.0 OVERVIEW

Not applicable.

4.0 DISTRIBUTION

This is an on-line document. Paper copies are valid only on the day they are printed. Refer to the author if you are in any doubt about the accuracy of this document. This SOP will be distributed to all Pinchin staff and others as follows:

- Posted to the SOP section of the Environmental Due Diligence and Remediation (EDR) Practice Line on the Pinchin Orchard; and

- Distributed to senior staff at Le Groupe Gesfor Poirier and Pinchin LeBlanc for distribution as appropriate.

5.0 PROCEDURE

The following terms are used in the completion of a vertical elevation survey:

Temporary Benchmark (TBM): A permanent landmark either on the site, or in a nearby location, which is used as an elevation reference and can be located again if required, including during winter. For our purposes, the benchmark is assigned an arbitrary elevation of 100.00 metres (m). If a geodetic benchmark is available and will be used instead, the elevation of this benchmark relative to sea level is used in lieu of 100.00 m.

Turning Point (TP): A temporary benchmark used to provide a reference point so that the tripod and laser level can be moved to a new location.

Backsight (BS): A reading taken on a point of known or assigned elevation (This will always be the first reading to determine the Height of the Instrument (HI)).

Foresight (FS): A reading taken on a point where the elevation is unknown.

Intermediate Sight (IS): A reading taken that is not a part of the main circuit of the survey. These points are not used as TPs or benchmark readings. Monitoring well elevations are usually recorded as IS.

5.1 Equipment and Supplies

5.1.1 Documents and Information Gathering

- A copy of the Site plan with monitoring well locations;
- A copy of Pinchin's Elevation Survey Sheet obtained from the Pinchin Orchard;
- A copy of this SOP;
- A site-specific Health and Safety Plan (as per the project requirements); and
- Client or site representative's contact details.

5.1.2 Vertical Survey Equipment

- Laser level and associated sensor;
- Tri-pod;
- Survey rod;
- Interface probe and equipment cleaning materials (Optional if water level measurements are required);
- Well keys;
- Tools to open monitoring wells (T-bar, socket set, Allen keys, etc.);

- Extra batteries; and
- Field forms or field log book.

5.2 Theory

Vertical elevation surveys use a benchmark to determine the relative or actual elevation of select points (i.e., monitoring wells). For relative elevation surveys, the benchmark is given an arbitrary elevation of 100.00 m and is used to calculate the relative elevations of the monitoring wells. If a geodetic benchmark is available, the elevation of this benchmark may be used to calculate the actual elevations of the monitoring wells relative to sea level.

BS, FS and IS are measured using a laser level mounted on a tripod. The laser level shoots a beam at a survey rod which is equipped with a sensor. With the rod standing vertically on top of the point to be measured, the field technician moves the laser receiver up the rod until the receiver indicates it is in the right position. The measurement is then read off the rod and recorded on the survey sheet. This process is repeated until measurements are obtained at all required locations.

Vertical elevation surveys are typically completed on a site in the following situations:

- At least three monitoring wells have been installed on-site and determining inferred groundwater flow direction is required;
- The casing or pipe elevation of a well has changed. This could be due to repairs, damage or frost heave;
- New monitoring well(s) have been installed on the site. Note that in this situation, the new monitoring well(s) may be “tied in” to the existing survey by using the original TBM or to at least three of the previously surveyed wells as reference points. If this is not possible, then an entirely new survey must be completed that includes all new and previously installed wells; and
- The survey error exceeds the allowable error.

5.3 Vertical Elevation Survey

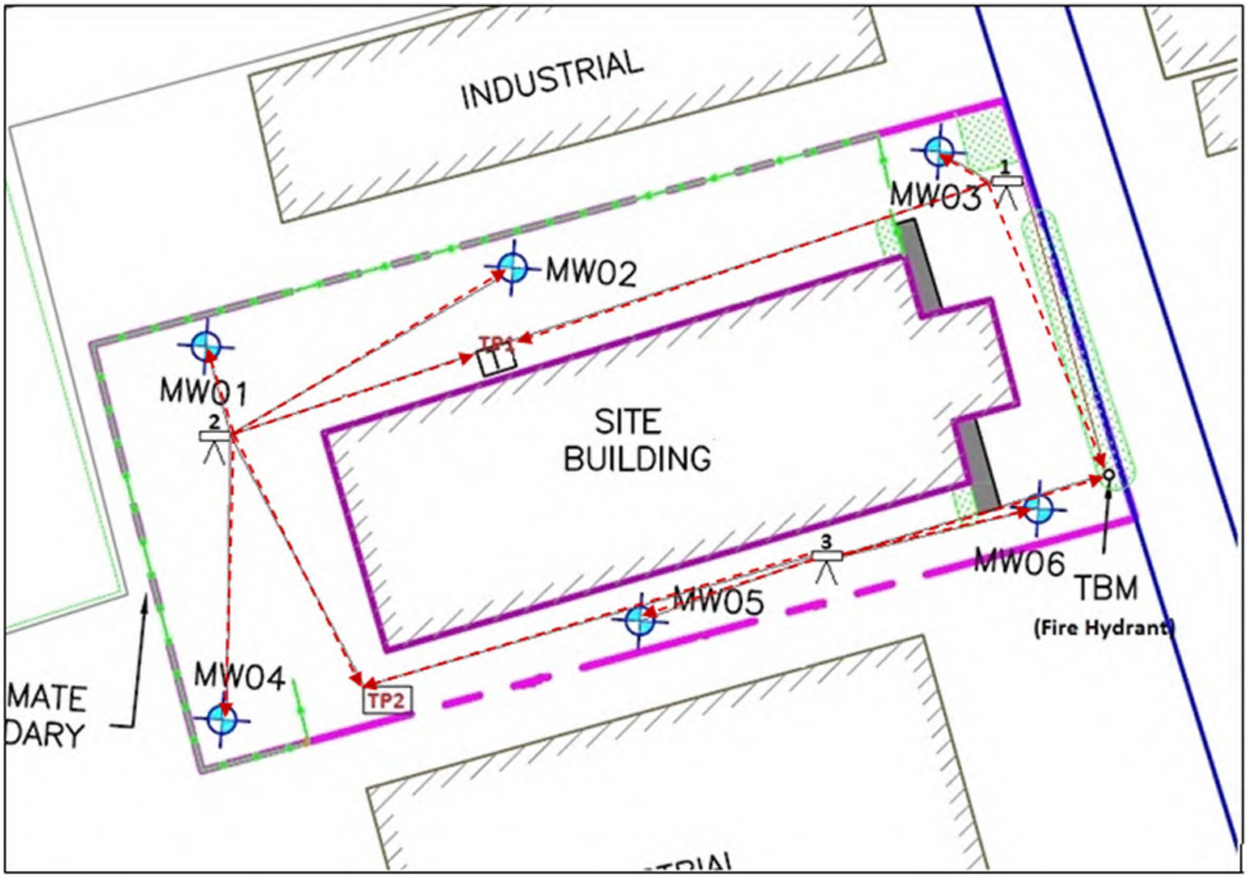
The following general procedures and considerations apply to all vertical elevation surveys:

- Prior to use, turn on the laser level and receiver to ensure the batteries are fully charged; and
- Check equipment calibration (Equipment rentals should come with a calibration sheet for the survey equipment).

The following presents the general procedure for vertical elevation surveying:

1. Open all wells and, if required by the Project Manager, monitor the depth to groundwater from the top of the well casing with the interface probe. If the wells are flushmount installations located in an area with vehicle or pedestrian traffic, place a traffic cone or the original well cover over top of each well after it is opened so that the open well doesn't get run over or pedestrians do not trip over the open well.

   Select a permanent fixture to be the TBM whose elevation **should not change over time.** All elevations will be relative to this spot. Good choices for a TBM include concrete pads, gas shut offs, corners of catch basins or fire hydrants. The TBM will be assigned an arbitrary reference elevation of 100.00 m for ease of calculation. *Note: if using a fire hydrant as the TBM, do not use the bolts on the top or sides of the hydrant. If the hydrant is used in the future, the elevation of those bolts may change. Ideally, new personnel should be able to come to the site and reproduce or continue the survey using the same TBM at a later date;*
2. Using the Site Plan, plan the route for the survey. The ideal route requires as few TPs as possible as moving the tri-pod increases the chance of error in the measurements. However, at least one TP is required to create a survey loop and allow the error to be assessed unless a calibrated, self-levelling survey instrument is being used. The survey route must start by taking a BS to the TBM, followed by an IS to each of the well locations. The last shot of the survey will be a FS to the TBM location. Figure 1 below shows an example of a survey route;



3. Once the survey layout is complete, walk the survey route to ensure it is free of obstructions. Next, set up the tripod in a secure location where it is not likely to tip or be knocked over;
4. Hold the survey rod vertically on top of the TBM. Use the leveling bubble on the sensor to ensure the rod is level, and then move the sensor up the rod until it signals it is in the correct position. Record the BS of the TBM on the survey sheet;
5. Use the same method to record IS for the monitoring wells. Record an IS for both the top of casing and grade level for each monitoring well location. The top of casing elevation is to be measured with the survey rod placed at the reference point marked at the time of well installation. If no reference point is marked on the well, one should be added and used for all subsequent elevation survey and depth to groundwater measurements. All FS, BS and IS are to be recorded to the nearest 0.001 m;
6. If it is necessary to move the tri-pod, record the FS to the TP. Next, move the tripod to the new location and shoot a BS back to the TP (see Figure 2). **Make sure the location of the TP does not change between shooting the FS and the BS**;

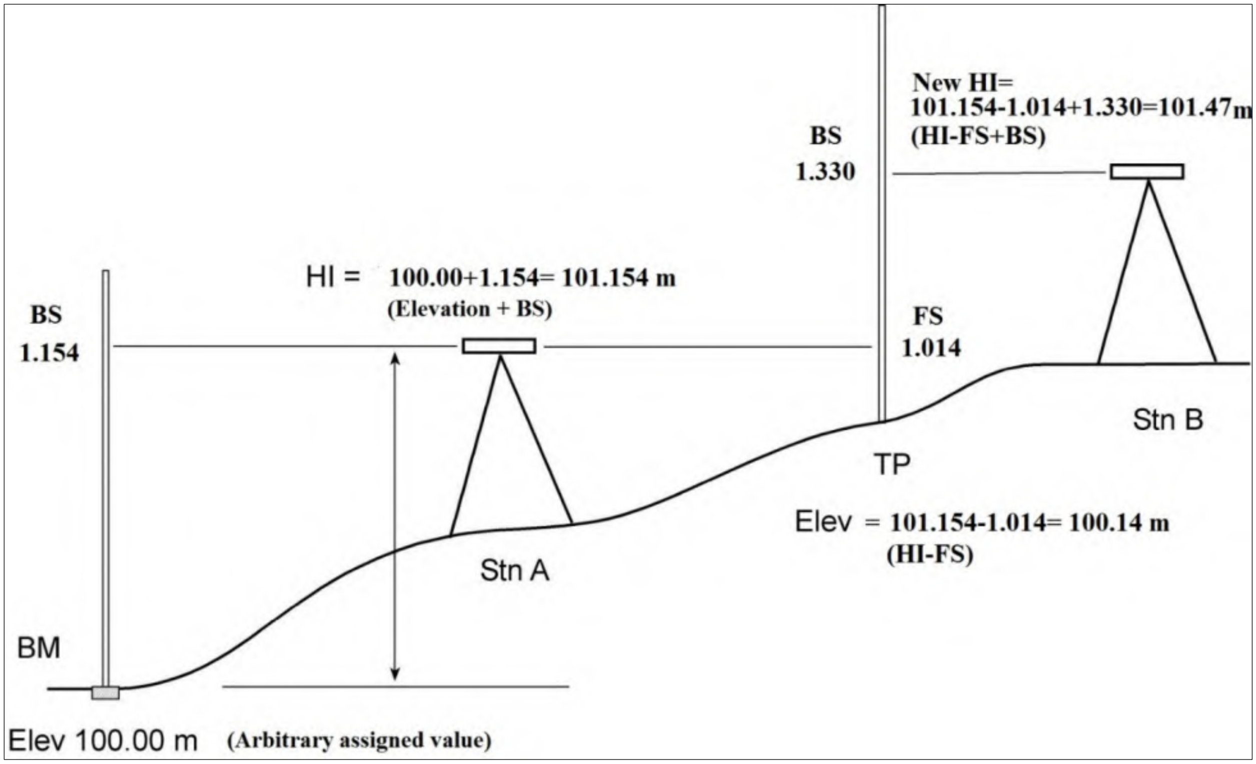


Figure 1: Survey set up from TBM with one TP.

7. Repeat steps 5 and 6 until a top of casing and grade IS have been recorded for all monitoring wells;
8. Record a final FS reading back to the TBM to close the survey; and
9. Perform a field calculation to ensure the survey error is within acceptable limits. The calculated difference between the sum of the FS and the sum of the BS values should be approximately equal. The difference between these values will be equal to the error. If the difference between these values is greater than the allowable error (see Section 5.4), the survey will have to be repeated. If the error is acceptable, the survey is complete and you may leave the site. The remaining calculations may be completed at the office.

5.4 Allowable Error

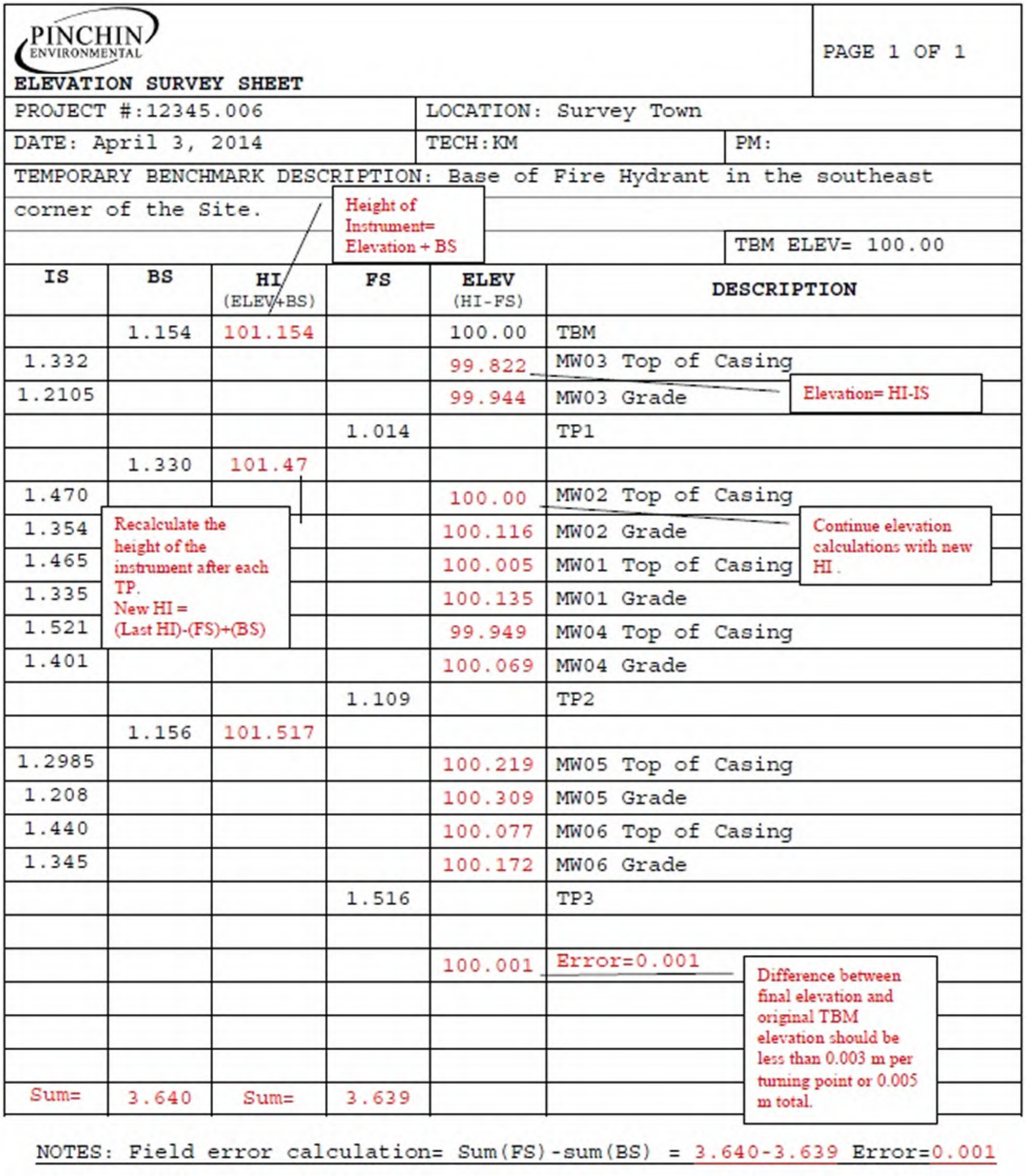
The acceptable error limit is 3 millimetres (mm) (0.003 m) per TP, with a maximum allowable error of 5 mm per survey. If the total error per survey exceeds 0.003 m per TP or 0.005 m per survey, the survey must be repeated. Common sources of error include:

- Tripod movement;
- Errors in reading the survey rod; and
- Not keeping the TP location consistent between FS and BS readings.

As noted in Section 5.3, an error check must be performed **before leaving the site** to ensure the survey error is within acceptable limits.

5.5 Calculations

Once the survey is complete, calculate the relative elevations of each surveyed point. This can be done in the field or at the office. Calculate each elevation by subtracting the IS values from the height of the instrument. A new HI will need to be calculated following each TP. The following is an example of the survey calculations for the survey layout shown in Figure 1.



PINCHIN ENVIRONMENTAL

ELEVATION SURVEY SHEET

PAGE 1 OF 1

PROJECT #:12345.006	LOCATION: Survey Town	
DATE: April 3, 2014	TECH:KM	PM:

TEMPORARY BENCHMARK DESCRIPTION: Base of Fire Hydrant in the southeast corner of the Site.

TBM ELEV= 100.00

IS	BS	HI (ELEV+BS)	FS	ELEV (HI-FS)	DESCRIPTION
	1.154	101.154		100.00	TBM
1.332				99.822	MW03 Top of Casing
1.2105				99.944	MW03 Grade
			1.014		TP1
	1.330	101.47			
1.470				100.00	MW02 Top of Casing
1.354				100.116	MW02 Grade
1.465				100.005	MW01 Top of Casing
1.335				100.135	MW01 Grade
1.521				99.949	MW04 Top of Casing
1.401				100.069	MW04 Grade
			1.109		TP2
	1.156	101.517			
1.2985				100.219	MW05 Top of Casing
1.208				100.309	MW05 Grade
1.440				100.077	MW06 Top of Casing
1.345				100.172	MW06 Grade
			1.516		TP3
				100.001	Error=0.001
Sum=	3.640	Sum=	3.639		

Height of Instrument= Elevation + BS

Elevation= HI-IS

Recalculate the height of the instrument after each TP. New HI = (Last HI)-(FS)+(BS)

Continue elevation calculations with new HI.

Difference between final elevation and original TBM elevation should be less than 0.003 m per turning point or 0.005 m total.

NOTES: Field error calculation= Sum(FS)-sum(BS) = 3.640-3.639 Error=0.001

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5.6 Horizontal Survey

A horizontal survey should be completed on every site in conjunction with the vertical elevation survey if not already completed during the borehole drilling/well installation program. To complete a horizontal survey, measure the distance of each of the well locations relative to a nearby permanent or semi-permanent landmark (e.g., corner of the nearest building, fire hydrant, etc.) using a measuring wheel or tape. Measurements are to be made at 90 degree angles relative to the orientation of the landmark, and parallel or perpendicular to the long or short axis of the landmark or to a fixed axis (i.e., relative to true north) as appropriate. Record these measurements in a field book or on the site plan. If required by the Project Manager, measure the UTM coordinates of the well location with a hand-held GPS device.

5.7 General Considerations

When surveying a site where one or more well locations are located inside a building and inaccessible to survey, it is acceptable to survey the concrete foundation of the building in place of the well. If this method is used this must be noted on the survey sheet.

A higher error factor may be acceptable on very large sites and sites where a large number of TPs are used. These situations should be discussed with the Project Manager.

On sites with large elevation changes, the use of a scope and manual survey rod in place of the laser level may be more appropriate. This method requires a two-person team and allows the surveying of sites with large elevation changes without the use of unnecessary TPs. This method should be discussed with the Project Manager prior to use to ensure it meets project budget requirements.

5.8 Additional Considerations for Ontario Regulation 153/04 Phase Two ESA Compliance

When completing a Phase Two Environmental Assessment in accordance with Ontario Regulation 153/04, all surveying work must be undertaken by a licensed Ontario Land Surveyor and this SOP is not applicable.

6.0 TRAINING

The Practice Leader is responsible for identifying the training needs of EDR staff and ensuring that staff are trained and competent before undertaking work assignments.

All trained personnel are responsible for identifying coaching or re-training needs (if they are uncomfortable with work assignments that have been assigned).

The careful application of *Health & Safety Training* by each employee is an integral part of all activities and is assumed as part of this SOP.

7.0 MAINTENANCE OF SOP

1 Year.

8.0 REFERENCES

Canadian Standards Association, *Environmental Investigation Methodology for Contaminated Sites*, 2005.

9.0 APPENDICES

None.

I:\2018 SOP Updates\SOP - EDR026 - REV005 - Vertical Elevation Surveying.docx

Template: Master SOP Template – February 2014

APPENDIX C

Borehole Logs

Log of Borehole: MW03

Project #: 291968 **Logged By:** ET

Project: Phase II Environmental Site Assessment

Client: Forest Gate Financial Corp.

Location: 3770 & 3930 Montrose Road, Niagara Falls, Ontario

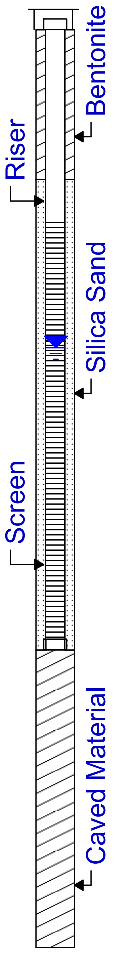
Drill Date: May 25, 2021

SUBSURFACE PROFILE

Depth
ft: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
m: 0 1 2 3 4 5 6 7

Description	Measured Depth (m)
Ground Surface	0.00
Asphalt	
Sand and Gravel Some asphalt pieces, brown, dry.	0.52
Silty Clay Brown with trace grey mottling, damp.	1.52
Clayey Silt Some fine sand, brown, moist. Wet from 2.29 to 3.05 mbgs. Moist from 3.05 to 3.81 mbgs. Wet below 3.81 mbgs.	6.71
End of Borehole Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).	

Monitoring Well Details



Water level measured at 2.43 mbgs on Jan. 12 2022.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
70	MW03-1	<5/<1	
85	MW03-2	<5/1	PHCs, VOCs, PAHs, pH
65	MW03-3	<5/<1	
70	MW03-4	<5/<1	
100	MW03-5	<5/<1	
95	MW03-6	<5/1	
90	MW03-7	<5/<1	
90	MW03-8	<5/<1	
90	MW03-9		

Contractor: Landshark Drilling Inc.

Drilling Method: Split Spoon, Hollow Augers

Well Casing Size: 5.08 cm

Grade Elevation: 194.764 mamsl

Top of Casing Elevation: 194.575 mamsl

Sheet: 1 of 1

Log of Borehole: BH04

Project #: 291968 **Logged By:** ET

Project: Phase II Environmental Site Assessment

Client: Forest Gate Financial Corp.

Location: 3770 & 3930 Montrose Road, Niagara Falls, Ontario

Drill Date: May 26, 2021

SUBSURFACE PROFILE					SAMPLE			
Depth	Symbol	Description	Measured Depth (m)	Monitoring Well Details	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
ft m		Ground Surface	0.00	No Monitoring Well Installed				
		Concrete	0.20					
		Granular Grey, wet.	0.91		50	BH04-1	<5/<1	PHCs, VOCs, PAHs
		Silty Clay Some gravel, brown, damp.			65	BH04-2	<5/<1	
		Clayey Silt Some fine sand, brown, moist. Wet below 1.22 mbgs.	2.29		70	BH04-3	<5/<1	
					100	BH04-4	<5/<1	
		End of Borehole						

ft: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

m: 0 1 2 3 4 5 6 7

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Landshark Drilling Inc.

Drilling Method: Direct Push

Well Casing Size: NA

Grade Elevation: 194.947 mamsl

Top of Casing Elevation: NA

Sheet: 1 of 1

Log of Borehole: BH05

Project #: 291968 **Logged By:** ET

Project: Phase II Environmental Site Assessment

Client: Forest Gate Financial Corp.

Location: 3770 & 3930 Montrose Road, Niagara Falls, Ontario

Drill Date: May 26, 2021

SUBSURFACE PROFILE

Depth (ft / m)	Description	Measured Depth (m)	Monitoring Well Details
0 / 0	Ground Surface	0.00	No Monitoring Well Installed
	Concrete		
	Granular Grey, wet.		
	Silty Clay Some gravel, brown, damp.	1.07	
	Clayey Silt Some fine sand, brown, moist. Wet below 1.52 mbgs. Black staining and PHC-like odour from 2.13 to 2.44 mbgs.	2.90	
	End of Borehole		

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
50	BH05-1	<5/<1	
85	BH05-2	<5/<1	
75	BH05-3	<5/<1	
85	BH05-4	<5/<1	PHCs, VOCs, PAHs
60	BH05-5	<5/<1	

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Landshark Drilling Inc.

Drilling Method: Direct Push

Well Casing Size: NA

Grade Elevation: 194.947 mamsl

Top of Casing Elevation: NA

Sheet: 1 of 1

PINCHIN

Log of Borehole: BH06

Project #: 291968 **Logged By:** ET
Project: Phase II Environmental Site Assessment
Client: Forest Gate Financial Corp.
Location: 3770 & 3930 Montrose Road, Niagara Falls, Ontario
Drill Date: May 26, 2021

SUBSURFACE PROFILE

Depth (ft / m)	Symbol	Description	Measured Depth (m)	Monitoring Well Details
0 / 0		Ground Surface	0.00	No Monitoring Well Installed
		Concrete	0.20	
		Granular Grey, wet.		
		Silty Clay Some gravel, brown, damp. Trace gravel from 1.07 to 1.22 mbgs.	1.22	
		Clayey Silt Some fine sand, brown, moist. Wet below 1.52 mbgs.	2.13	
		End of Borehole		

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
65	BH06-1	<5/<1	PHCs, VOCs, PAHs
60	BH06-2	<5/<1	
55	BH06-3	<5/<1	
100	BH06-4	<5/<1	

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Landshark Drilling Inc.
Drilling Method: Direct Push
Well Casing Size: NA
Grade Elevation: 194.947 mamsl
Top of Casing Elevation: NA
Sheet: 1 of 1

Log of Borehole: MW101

Project #: 296202.001 **Logged By:** ET

Project: Phase Two Environmental Site Assessment

Client: Cassone Dwelling Inc.

Location: North Portion of 3770 Montrose Road, Niagara Falls, Ontario

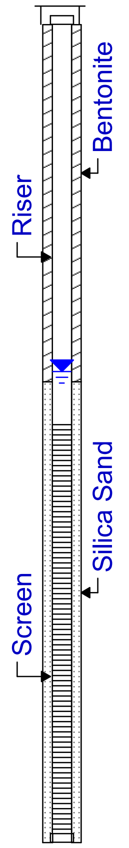
Drill Date: December 6, 2021

SUBSURFACE PROFILE

Description	Measured Depth (m)
Ground Surface	0.00
Concrete	
Granular	0.76
Silty Clay Some fine sand, trace gravel, brown, dry.	
Clayey Silt Some fine sand, brown with minor grey mottling, damp. Brown and wet below 1.83 mbgs.	6.10
End of Borehole	

Depth scale: 0–26 ft; 0–8 m.

Monitoring Well Details



Water level measured at 2.66 mbgs on Jan. 12, 2022.

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
88	MW101-1	<5/2	
88	MW101-2	25/1	
71	MW101-3	35/1	
88	MW101-4	<5/1	
71	MW101-5	75/<1	
92	MW101-6	85/<1	
96	MW101-7	90/<1	PHCs, VOCs, PAHs, pH
88	MW101-8	45/<1	

Contractor: Strata Drilling Group

Drilling Method: Split Spoon, Hollow Stem Augers

Well Casing Size: 5.08 cm

Grade Elevation: 194.947 mamsl

Top of Casing Elevation: 194.817 mamsl

Sheet: 1 of 1

Log of Borehole: MW102

Project #: 296202.001 ***Logged By:*** ET

Project: Phase Two Environmental Site Assessment

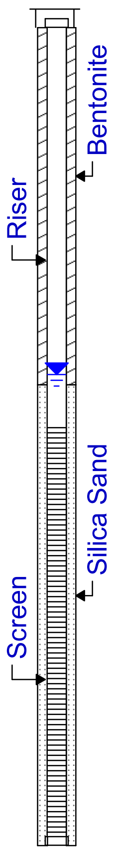
Client: Cassone Dwelling Inc.

Location: North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Drill Date: December 6, 2021

SUBSURFACE PROFILE / SAMPLE

Description	Measured Depth (m)	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
Ground Surface	0.00				
Concrete					
Granular					
Silty Clay Some fine sand, brown with minor grey mottling, damp.	1.52	35	MW102-1	<5/<1	
Clayey Silt Some fine sand, brown, damp. Coarse sand seam from 1.98 to 2.29 mbgs. Moist below 2.29 mbgs. Minor black staining from 2.59 to 2.74 mbgs. Wet below 3.05 mbgs.	6.10	55	MW102-2	<5/<1	
			MW102-3	15/<1	PHCs, VOCs, PAHs
		80	MW102-4	30/<1	
			MW102-5	25/<1	
		100	MW102-6	35/<1	
			MW102-7	30/<1	
End of Borehole					



Water level measured at 2.65 mbgs on Jan. 12, 2022.

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Strata Drilling Group

Grade Elevation: 194.947 mamsl

Drilling Method: Direct Push, Hollow Stem Augers

Top of Casing Elevation: 194.847 mamsl

Well Casing Size: 5.08 cm

Sheet: 1 of 1

PINCHIN

Log of Borehole: BH103

Project #: 296202.001 **Logged By:** ET

Project: Phase Two Environmental Site Assessment

Client: Cassone Dwelling Inc.

Location: North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Drill Date: December 6, 2021

SUBSURFACE PROFILE					SAMPLE			
Depth	Symbol	Description	Measured Depth (m)	Monitoring Well Details	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
ft 0 / m 0		Ground Surface	0.00	No Monitoring Well Installed				
		Concrete						
		Granular						
		Clayey Silt Some fine sand, brown, damp.			15	BH103-1	<5/1	PHCs, VOCs, PAHs
					70	BH103-2	<5/<1	
		Moist below 2.74 mbgs.	3.05			BH103-3	5/<1	
ft 10 / m 3		End of Borehole						

Depth scale: ft 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26; m 0 1 2 3 4 5 6 7 8

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Strata Drilling Group

Grade Elevation: 194.947 mamsl

Drilling Method: Direct Push

Top of Casing Elevation: NA

Well Casing Size: NA

Sheet: 1 of 1

PINCHIN

Log of Borehole: BH104

Project #: 296202.001 **Logged By:** ET

Project: Phase Two Environmental Site Assessment

Client: Cassone Dwelling Inc.

Location: North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Drill Date: December 6, 2021

SUBSURFACE PROFILE					SAMPLE			
Depth (ft / m)	Symbol	Description	Measured Depth (m)	Monitoring Well Details	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
0 / 0		Ground Surface	0.00	No Monitoring Well Installed				
		Concrete						
		Granular						
1		**Silty Clay** Some gravel, brown, damp.	1.52		20	BH104-1	<5/<1	
2		**Clayey Silt** Some fine sand, brown, damp.			80	BH104-2	<5/<1	Grain Size
			3.05			BH104-3, DUP09	20/<1	PHCs,VOCs, PAHs, pH
10 / 3		End of Borehole						

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Strata Drilling Group

Drilling Method: Direct Push

Well Casing Size: NA

Grade Elevation: 194.947 mamsl

Top of Casing Elevation: NA

Sheet: 1 of 1

Log of Borehole: BH105

Project #: 296202.001 **Logged By:** ET

Project: Phase Two Environmental Site Assessment

Client: Cassone Dwelling Inc.

Location: North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Drill Date: December 6, 2021

SUBSURFACE PROFILE					SAMPLE			
Depth	Symbol	Description	Measured Depth (m)	Monitoring Well Details	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
ft 0 m 0		Ground Surface	0.00	No Monitoring Well Installed				
		Concrete						
		Granular						
		Silty Clay Some sand, trace gravel, brown, damp. Grey-brown from 0.61 to 0.76 mbgs.	1.22		60	BH105-1	30/<1	PHCs, VOCs, PAHs
						BH105-2	30/<1	
		Clayey Silt Some fine sand, brown, damp. Moist below 2.44 mbgs.	3.05		70	BH105-3	30/<1	
						BH105-4	25/<1	
ft 10 m 3		End of Borehole						

ft: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

m: 0 1 2 3 4 5 6 7 8

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Strata Drilling Group

Drilling Method: Direct Push

Well Casing Size: NA

Grade Elevation: 194.947 mamsl

Top of Casing Elevation: NA

Sheet: 1 of 1

PINCHIN

Log of Borehole: BH106

Project #: 296202.001 ***Logged By:*** ET

Project: Phase Two Environmental Site Assessment

Client: Cassone Dwelling Inc.

Location: North Portion of 3770 Montrose Road, Niagara Falls, Ontario

Drill Date: December 7, 2021

SUBSURFACE PROFILE					SAMPLE			
Depth	Symbol	Description	Measured Depth (m)	Monitoring Well Details	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
ft 0 / m 0		Ground Surface	0.00					
		Grass Surface		No Monitoring Well Installed	92	BH106-1, DUP16	<5/1	PHCs, PCBs, pH
		Silty Clay Brown, damp.	1.68		100	BH106-2	<5/1	Grain Size
		Clayey Silt Some fine sand, brown, moist. Wet below 1.98 mbgs.	5.18					
		End of Borehole						

Depth scale (ft): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

Depth scale (m): 0 1 2 3 4 5 6 7 8

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Strata Drilling Group

Grade Elevation: 194.986 mamsl

Drilling Method: Split Spoon, Hollow Stem Augers

Top of Casing Elevation: NA

Well Casing Size: NA

Sheet: 1 of 1

APPENDIX D

Laboratory Certificates of Analysis

Your Project #: 291968
Your C.O.C. #: 159039

Attention: David Mignone

Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2021/06/03
Report #: R6660476
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1E4050
Received: 2021/05/27, 16:33

Sample Matrix: Soil
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	6	N/A	2021/06/02	CAM SOP-00301	EPA 8270D m
1,3-Dichloropropene Sum	2	N/A	2021/05/31		EPA 8260C m
1,3-Dichloropropene Sum	4	N/A	2021/06/01		EPA 8260C m
Cyanide (WAD) in Leachates	1	N/A	2021/06/01	CAM SOP-00457	OMOE 3015 m
Petroleum Hydro. CCME F1 & BTEX in Soil (1)	3	N/A	2021/06/01	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (2)	7	2021/05/31	2021/06/01	CAM SOP-00316	CCME CWS m
Fluoride by ISE in Leachates	1	2021/06/01	2021/06/02	CAM SOP-00449	SM 23 4500-F- C m
Acid Extractable Metals by ICPMS	2	2021/05/31	2021/06/01	CAM SOP-00447	EPA 6020B m
Total Metals in TCLP Leachate by ICPMS	1	2021/06/01	2021/06/01	CAM SOP-00447	EPA 6020B m
Moisture	9	N/A	2021/05/28	CAM SOP-00445	Carter 2nd ed 51.2 m
Nitrate(NO3) + Nitrite(NO2) in Leachate	1	N/A	2021/06/01	CAM SOP-00440	SM 23 4500-NO3I/NO2B
PAH Compounds in Leachate by GC/MS (SIM)	1	2021/06/01	2021/06/02	CAM SOP-00318	EPA 8270D m
PAH Compounds in Soil by GC/MS (SIM)	6	2021/05/31	2021/06/01	CAM SOP-00318	EPA 8270D m
Polychlorinated Biphenyl in Soil	1	2021/05/30	2021/06/02	CAM SOP-00309	EPA 8082A m
Polychlorinated Biphenyl in Leachate	1	2021/06/01	2021/06/01	CAM SOP-00309	EPA 8082A m
pH CaCl2 EXTRACT	1	2021/05/31	2021/05/31	CAM SOP-00413	EPA 9045 D m
pH CaCl2 EXTRACT	1	2021/06/01	2021/06/01	CAM SOP-00413	EPA 9045 D m
Sieve, 75um	1	N/A	2021/05/31	CAM SOP-00467	ASTM D1140 -17 m
TCLP - % Solids	1	2021/05/31	2021/07/01	CAM SOP-00401	EPA 1311 Update I m
TCLP - Extraction Fluid	1	N/A	2021/06/01	CAM SOP-00401	EPA 1311 Update I m
TCLP - Initial and final pH	1	N/A	2021/06/01	CAM SOP-00401	EPA 1311 Update I m
TCLP Zero Headspace Extraction	1	2021/05/31	2021/06/01	CAM SOP-00430	EPA 1311 m
Volatile Organic Compounds and F1 PHCs	4	N/A	2021/05/31	CAM SOP-00230	EPA 8260C m
VOCs in ZHE Leachates	1	2021/06/01	2021/06/01	CAM SOP-00228	EPA 8260C m
Volatile Organic Compounds in Soil	2	N/A	2021/05/31	CAM SOP-00228	EPA 8260C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

Your Project #: 291968
Your C.O.C. #: 159039

Attention: David Mignone

Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2021/06/03
Report #: R6660476
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1E4050
Received: 2021/05/27, 16:33

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Antonella Brasil, Senior Project Manager
Email: Antonella.Brasil@bureauveritas.com
Phone# (905)817-5817
==
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

O.REG 153 PAHS (SOIL)

BV Labs ID		PRH812	PRH814	PRH815	PRH816	PRH817	PRH818		
Sampling Date		2021/05/25 13:00	2021/05/25 11:20	2021/05/25 09:00	2021/05/26 10:40	2021/05/26 11:20	2021/05/26 10:00		
COC Number		159039	159039	159039	159039	159039	159039		
	UNITS	**MW01-8**	**MW02-8**	**MW03-2**	**BH04-1**	**BH05-4**	**BH06-1**	**RDL**	**QC Batch**
Calculated Parameters									
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	<0.0071	0.0071	7376212
Polyaromatic Hydrocarbons									
Acenaphthene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Acenaphthylene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Anthracene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Benzo(a)anthracene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0073	0.0050	7380813
Benzo(a)pyrene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0077	0.0050	7380813
Benzo(b/j)fluoranthene	ug/g	<0.0050	<0.0050	<0.0050	0.0076	<0.0050	0.012	0.0050	7380813
Benzo(g,h,i)perylene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0060	0.0050	7380813
Benzo(k)fluoranthene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Chrysene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0080	0.0050	7380813
Dibenzo(a,h)anthracene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Fluoranthene	ug/g	<0.0050	<0.0050	<0.0050	0.0087	<0.0050	0.017	0.0050	7380813
Fluorene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	0.0050	7380813
1-Methylnaphthalene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
2-Methylnaphthalene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Naphthalene	ug/g	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	7380813
Phenanthrene	ug/g	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	0.0077	0.0050	7380813
Pyrene	ug/g	<0.0050	<0.0050	<0.0050	0.0075	<0.0050	0.015	0.0050	7380813
Surrogate Recovery (%)									
D10-Anthracene	%	89	90	89	90	91	91		7380813
D14-Terphenyl (FS)	%	89	93	89	95	92	97		7380813
D8-Acenaphthylene	%	87	87	89	92	87	93		7380813

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 PCBS (SOIL)

BV Labs ID		PRH819		
Sampling Date		2021/05/26 09:40		
COC Number		159039		
	UNITS	**SS-01**	**RDL**	**QC Batch**
PCBs				
Aroclor 1242	ug/g	<0.10	0.10	7379180
Aroclor 1248	ug/g	<0.10	0.10	7379180
Aroclor 1254	ug/g	<0.10	0.10	7379180
Aroclor 1260	ug/g	<0.10	0.10	7379180
Total PCB	ug/g	<0.10	0.10	7379180
Surrogate Recovery (%)				
Decachlorobiphenyl	%	69		7379180

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 PHCS, BTEX/F1-F4 (SOIL)

BV Labs ID		PRH811		PRH813			PRH813		
Sampling Date		2021/05/25 13:00		2021/05/25 11:20			2021/05/25 11:20		
COC Number		159039		159039			159039		
	UNITS	**MW01-6**	**QC Batch**	**MW02-6**	**RDL**	**QC Batch**	**MW02-6 Lab-Dup**	**RDL**	**QC Batch**
Inorganics									
Moisture	%	15	7377762	18	1.0	7377857			
BTEX & F1 Hydrocarbons									
Benzene	ug/g	<0.020	7380881	<0.020	0.020	7380881	<0.020	0.020	7380881
Toluene	ug/g	<0.020	7380881	<0.020	0.020	7380881	<0.020	0.020	7380881
Ethylbenzene	ug/g	<0.020	7380881	<0.020	0.020	7380881	<0.020	0.020	7380881
o-Xylene	ug/g	<0.020	7380881	<0.020	0.020	7380881	<0.020	0.020	7380881
p+m-Xylene	ug/g	<0.040	7380881	<0.040	0.040	7380881	<0.040	0.040	7380881
Total Xylenes	ug/g	<0.040	7380881	<0.040	0.040	7380881	<0.040	0.040	7380881
F1 (C6-C10)	ug/g	<10	7380881	<10	10	7380881	<10	10	7380881
F1 (C6-C10) - BTEX	ug/g	<10	7380881	<10	10	7380881	<10	10	7380881
F2-F4 Hydrocarbons									
F2 (C10-C16 Hydrocarbons)	ug/g	11	7379723	<10	10	7379723			
F3 (C16-C34 Hydrocarbons)	ug/g	<50	7379723	<50	50	7379723			
F4 (C34-C50 Hydrocarbons)	ug/g	<50	7379723	<50	50	7379723			
Reached Baseline at C50	ug/g	Yes	7379723	Yes		7379723			
Surrogate Recovery (%)									
1,4-Difluorobenzene	%	104	7380881	105		7380881	105		7380881
4-Bromofluorobenzene	%	97	7380881	80		7380881	93		7380881
D10-o-Xylene	%	121	7380881	109		7380881	115		7380881
D4-1,2-Dichloroethane	%	107	7380881	100		7380881	104		7380881
o-Terphenyl	%	88	7379723	90		7379723			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 PHCS, BTEX/F1-F4 (SOIL)

BV Labs ID		PRH819		
Sampling Date		2021/05/26 09:40		
COC Number		159039		
	UNITS	**SS-01**	**RDL**	**QC Batch**
Inorganics				
Moisture	%	23	1.0	7377857
BTEX & F1 Hydrocarbons				
Benzene	ug/g	<0.020	0.020	7380881
Toluene	ug/g	<0.020	0.020	7380881
Ethylbenzene	ug/g	<0.020	0.020	7380881
o-Xylene	ug/g	<0.020	0.020	7380881
p+m-Xylene	ug/g	<0.040	0.040	7380881
Total Xylenes	ug/g	<0.040	0.040	7380881
F1 (C6-C10)	ug/g	<10	10	7380881
F1 (C6-C10) - BTEX	ug/g	<10	10	7380881
F2-F4 Hydrocarbons				
F2 (C10-C16 Hydrocarbons)	ug/g	7000	10	7379723
F3 (C16-C34 Hydrocarbons)	ug/g	77000	50	7379723
F4 (C34-C50 Hydrocarbons)	ug/g	250	50	7379723
Reached Baseline at C50	ug/g	Yes		7379723
Surrogate Recovery (%)				
1,4-Difluorobenzene	%	102		7380881
4-Bromofluorobenzene	%	106		7380881
D10-o-Xylene	%	87		7380881
D4-1,2-Dichloroethane	%	102		7380881
o-Terphenyl	%	81		7379723

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

BV Labs ID		PRH815	PRH816	PRH817	PRH818		
Sampling Date		2021/05/25 09:00	2021/05/26 10:40	2021/05/26 11:20	2021/05/26 10:00		
COC Number		159039	159039	159039	159039		
	UNITS	**MW03-2**	**BH04-1**	**BH05-4**	**BH06-1**	**RDL**	**QC Batch**
Inorganics							
Moisture	%	16	17	19	17	1.0	7377857
Calculated Parameters							
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7376251
Volatile Organics							
Acetone (2-Propanone)	ug/g	<0.50	<0.50	<0.50	<0.50	0.50	7378549
Benzene	ug/g	<0.020	<0.020	<0.020	<0.020	0.020	7378549
Bromodichloromethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Bromoform	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Bromomethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Carbon Tetrachloride	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Chlorobenzene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Chloroform	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Dibromochloromethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,2-Dichlorobenzene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,3-Dichlorobenzene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,4-Dichlorobenzene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Dichlorodifluoromethane (FREON 12)	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,1-Dichloroethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,2-Dichloroethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,1-Dichloroethylene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
cis-1,2-Dichloroethylene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
trans-1,2-Dichloroethylene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,2-Dichloropropane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
cis-1,3-Dichloropropene	ug/g	<0.030	<0.030	<0.030	<0.030	0.030	7378549
trans-1,3-Dichloropropene	ug/g	<0.040	<0.040	<0.040	<0.040	0.040	7378549
Ethylbenzene	ug/g	<0.020	<0.020	<0.020	<0.020	0.020	7378549
Ethylene Dibromide	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Hexane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Methylene Chloride(Dichloromethane)	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.50	<0.50	<0.50	<0.50	0.50	7378549
Methyl Isobutyl Ketone	ug/g	<0.50	<0.50	<0.50	<0.50	0.50	7378549
Methyl t-butyl ether (MTBE)	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Styrene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,1,1,2-Tetrachloroethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,1,2,2-Tetrachloroethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

BV Labs ID		PRH815	PRH816	PRH817	PRH818		
Sampling Date		2021/05/25 09:00	2021/05/26 10:40	2021/05/26 11:20	2021/05/26 10:00		
COC Number		159039	159039	159039	159039		
	UNITS	**MW03-2**	**BH04-1**	**BH05-4**	**BH06-1**	**RDL**	**QC Batch**
Tetrachloroethylene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Toluene	ug/g	<0.020	<0.020	<0.020	<0.020	0.020	7378549
1,1,1-Trichloroethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
1,1,2-Trichloroethane	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Trichloroethylene	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Trichlorofluoromethane (FREON 11)	ug/g	<0.050	<0.050	<0.050	<0.050	0.050	7378549
Vinyl Chloride	ug/g	<0.020	<0.020	<0.020	<0.020	0.020	7378549
p+m-Xylene	ug/g	<0.020	<0.020	<0.020	<0.020	0.020	7378549
o-Xylene	ug/g	<0.020	<0.020	<0.020	<0.020	0.020	7378549
Total Xylenes	ug/g	<0.020	<0.020	<0.020	<0.020	0.020	7378549
F1 (C6-C10)	ug/g	<10	<10	<10	<10	10	7378549
F1 (C6-C10) - BTEX	ug/g	<10	<10	<10	<10	10	7378549
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	<10	13	10	7379723
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	<50	440	50	7379723
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	<50	140	50	7379723
Reached Baseline at C50	ug/g	Yes	Yes	Yes	Yes		7379723
Surrogate Recovery (%)							
o-Terphenyl	%	87	88	91	88		7379723
4-Bromofluorobenzene	%	100	102	100	99		7378549
D10-o-Xylene	%	101	96	101	102		7378549
D4-1,2-Dichloroethane	%	104	99	103	102		7378549
D8-Toluene	%	89	91	90	88		7378549

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS (SOIL)

BV Labs ID		PRH812			PRH812			PRH814		
Sampling Date		2021/05/25 13:00			2021/05/25 13:00			2021/05/25 11:20		
COC Number		159039			159039			159039		
	UNITS	**MW01-8**	**RDL**	**QC Batch**	**MW01-8 Lab-Dup**	**RDL**	**QC Batch**	**MW02-8**	**RDL**	**QC Batch**
Inorganics										
Moisture	%	18	1.0	7377857	18	1.0	7377857	18	1.0	7377857
Calculated Parameters										
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	0.050	7376251				<0.050	0.050	7376251
Volatile Organics										
Acetone (2-Propanone)	ug/g	<0.49	0.49	7378625				<0.49	0.49	7378625
Benzene	ug/g	<0.0060	0.0060	7378625				<0.0060	0.0060	7378625
Bromodichloromethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Bromoform	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Bromomethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Carbon Tetrachloride	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Chlorobenzene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Chloroform	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Dibromochloromethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,2-Dichlorobenzene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,3-Dichlorobenzene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,4-Dichlorobenzene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Dichlorodifluoromethane (FREON 12)	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,1-Dichloroethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,2-Dichloroethane	ug/g	<0.049	0.049	7378625				<0.049	0.049	7378625
1,1-Dichloroethylene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
cis-1,2-Dichloroethylene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
trans-1,2-Dichloroethylene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,2-Dichloropropane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
cis-1,3-Dichloropropene	ug/g	<0.030	0.030	7378625				<0.030	0.030	7378625
trans-1,3-Dichloropropene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Ethylbenzene	ug/g	<0.010	0.010	7378625				<0.010	0.010	7378625
Ethylene Dibromide	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Hexane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Methylene Chloride(Dichloromethane)	ug/g	<0.049	0.049	7378625				<0.049	0.049	7378625
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.40	0.40	7378625				<0.40	0.40	7378625
Methyl Isobutyl Ketone	ug/g	<0.40	0.40	7378625				<0.40	0.40	7378625
Methyl t-butyl ether (MTBE)	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Styrene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,1,1,2-Tetrachloroethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 VOCS BY HS (SOIL)

BV Labs ID		PRH812			PRH812			PRH814		
Sampling Date		2021/05/25 13:00			2021/05/25 13:00			2021/05/25 11:20		
COC Number		159039			159039			159039		
	UNITS	**MW01-8**	**RDL**	**QC Batch**	**MW01-8 Lab-Dup**	**RDL**	**QC Batch**	**MW02-8**	**RDL**	**QC Batch**
1,1,2,2-Tetrachloroethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Tetrachloroethylene	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Toluene	ug/g	<0.020	0.020	7378625				<0.020	0.020	7378625
1,1,1-Trichloroethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
1,1,2-Trichloroethane	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Trichloroethylene	ug/g	<0.010	0.010	7378625				<0.010	0.010	7378625
Trichlorofluoromethane (FREON 11)	ug/g	<0.040	0.040	7378625				<0.040	0.040	7378625
Vinyl Chloride	ug/g	<0.019	0.019	7378625				<0.019	0.019	7378625
p+m-Xylene	ug/g	<0.020	0.020	7378625				<0.020	0.020	7378625
o-Xylene	ug/g	<0.020	0.020	7378625				<0.020	0.020	7378625
Total Xylenes	ug/g	<0.020	0.020	7378625				<0.020	0.020	7378625
Surrogate Recovery (%)										
4-Bromofluorobenzene	%	96		7378625				97		7378625
D10-o-Xylene	%	104		7378625				101		7378625
D4-1,2-Dichloroethane	%	98		7378625				100		7378625
D8-Toluene	%	96		7378625				97		7378625

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 558 TCLP BENZO(A)PYRENE

BV Labs ID		PRH820		
Sampling Date		2021/05/25 14:00		
COC Number		159039		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons				
Leachable Benzo(a)pyrene	ug/L	<0.10	0.10	7383194
Surrogate Recovery (%)				
Leachable D10-Anthracene	%	95		7383194
Leachable D14-Terphenyl (FS)	%	82		7383194
Leachable D8-Acenaphthylene	%	93		7383194

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 558 TCLP INORGANICS PACKAGE (SOIL)

BV Labs ID		PRH820		
Sampling Date		2021/05/25 14:00		
COC Number		159039		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Inorganics				
Leachable Fluoride (F-)	mg/L	0.22	0.10	7381987
Leachable WAD Cyanide (Free)	mg/L	<0.010	0.010	7381988
Leachable Nitrite (N)	mg/L	<0.10	0.10	7381989
Leachable Nitrate (N)	mg/L	<1.0	1.0	7381989
Leachable Nitrate + Nitrite (N)	mg/L	<1.0	1.0	7381989
Metals				
Leachable Arsenic (As)	mg/L	<0.2	0.2	7382203
Leachable Barium (Ba)	mg/L	1.3	0.2	7382203
Leachable Boron (B)	mg/L	<0.1	0.1	7382203
Leachable Cadmium (Cd)	mg/L	<0.05	0.05	7382203
Leachable Chromium (Cr)	mg/L	<0.1	0.1	7382203
Leachable Lead (Pb)	mg/L	<0.1	0.1	7382203
Leachable Mercury (Hg)	mg/L	<0.001	0.001	7382203
Leachable Selenium (Se)	mg/L	<0.1	0.1	7382203
Leachable Silver (Ag)	mg/L	<0.01	0.01	7382203
Leachable Uranium (U)	mg/L	<0.01	0.01	7382203

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

TCLP LEACHATE PREPARATION (SOIL)

BV Labs ID		PRH820		
Sampling Date		2021/05/25 14:00		
COC Number		159039		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Inorganics				
Final pH	pH	6.19		7380516
Initial pH	pH	9.60		7380516
TCLP - % Solids	%	100	0.2	7380509
TCLP Extraction Fluid	N/A	FLUID1		7380513

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 558 TCLP PCBS (SOIL)

BV Labs ID		PRH820		
Sampling Date		2021/05/25 14:00		
COC Number		159039		
	UNITS	**TCLP**	**RDL**	**QC Batch**
PCBs				
Leachable Aroclor 1016	ug/L	<3.0	3.0	7382656
Leachable Aroclor 1221	ug/L	<3.0	3.0	7382656
Leachable Aroclor 1242	ug/L	<3.0	3.0	7382656
Leachable Aroclor 1248	ug/L	<3.0	3.0	7382656
Leachable Aroclor 1254	ug/L	<3.0	3.0	7382656
Leachable Aroclor 1260	ug/L	<3.0	3.0	7382656
Leachable Total PCB	ug/L	<3.0	3.0	7382656
Surrogate Recovery (%)				
Leachable Decachlorobiphenyl	%	116		7382656

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 558 TCLP VOCS BY HS (SOIL)

BV Labs ID		PRH820		
Sampling Date		2021/05/25 14:00		
COC Number		159039		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Charge/Prep Analysis				
Amount Extracted (Wet Weight) (g)	N/A	23	N/A	7379912
Volatile Organics				
Leachable Benzene	mg/L	<0.020	0.020	7382004
Leachable Carbon Tetrachloride	mg/L	<0.020	0.020	7382004
Leachable Chlorobenzene	mg/L	<0.020	0.020	7382004
Leachable Chloroform	mg/L	<0.020	0.020	7382004
Leachable 1,2-Dichlorobenzene	mg/L	<0.050	0.050	7382004
Leachable 1,4-Dichlorobenzene	mg/L	<0.050	0.050	7382004
Leachable 1,2-Dichloroethane	mg/L	<0.050	0.050	7382004
Leachable 1,1-Dichloroethylene	mg/L	<0.020	0.020	7382004
Leachable Methylene Chloride(Dichloromethane)	mg/L	<0.20	0.20	7382004
Leachable Methyl Ethyl Ketone (2-Butanone)	mg/L	<1.0	1.0	7382004
Leachable Tetrachloroethylene	mg/L	<0.020	0.020	7382004
Leachable Trichloroethylene	mg/L	<0.020	0.020	7382004
Leachable Vinyl Chloride	mg/L	<0.020	0.020	7382004
Surrogate Recovery (%)				
Leachable 4-Bromofluorobenzene	%	89		7382004
Leachable D4-1,2-Dichloroethane	%	103		7382004
Leachable D8-Toluene	%	94		7382004

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF SOIL

BV Labs ID		PRH813			PRH815	
Sampling Date		2021/05/25 11:20			2021/05/25 09:00	
COC Number		159039			159039	
	UNITS	**MW02-6**	**RDL**	**QC Batch**	**MW03-2**	**QC Batch**
Inorganics						
Available (CaCl2) pH	pH	7.98		7379947	6.42	7381578
Miscellaneous Parameters						
Grain Size	%	FINE	N/A	7378867		
Sieve - #200 (<0.075mm)	%	100	1	7378867		
Sieve - #200 (>0.075mm)	%	<1	1	7378867		

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		PRH811	PRH813		
Sampling Date		2021/05/25 13:00	2021/05/25 11:20		
COC Number		159039	159039		
	UNITS	**MW01-6**	**MW02-6**	**RDL**	**QC Batch**
Metals					
Acid Extractable Lead (Pb)	ug/g	3.6	3.3	1.0	7379553

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

TEST SUMMARY

BV Labs ID: PRH811
Sample ID: MW01-6
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7380881	N/A	2021/06/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7379723	2021/05/31	2021/06/01	Dennis Ngondu
Acid Extractable Metals by ICPMS	ICP/MS	7379553	2021/05/31	2021/06/01	Prempal Bhatti
Moisture	BAL	7377762	N/A	2021/05/28	Kruti Jitesh Patel

BV Labs ID: PRH812
Sample ID: MW01-8
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7376212	N/A	2021/06/02	Automated Statchk
1,3-Dichloropropene Sum	CALC	7376251	N/A	2021/05/31	Automated Statchk
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7380813	2021/05/31	2021/06/01	Jonghan Yoon
Volatile Organic Compounds in Soil	GC/MS	7378625	N/A	2021/05/31	Juan Pangilinan

BV Labs ID: PRH812 Dup
Sample ID: MW01-8
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel

BV Labs ID: PRH813
Sample ID: MW02-6
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7380881	N/A	2021/06/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7379723	2021/05/31	2021/06/01	Dennis Ngondu
Acid Extractable Metals by ICPMS	ICP/MS	7379553	2021/05/31	2021/06/01	Prempal Bhatti
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
pH CaCl2 EXTRACT	AT	7379947	2021/05/31	2021/05/31	Neil Dassanayake
Sieve, 75um	SIEV	7378867	N/A	2021/05/31	Gurpreet Kaur (ONT)

BV Labs ID: PRH813 Dup
Sample ID: MW02-6
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7380881	N/A	2021/05/31	Haibin Wu

TEST SUMMARY

BV Labs ID: PRH814
Sample ID: MW02-8
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7376212	N/A	2021/06/02	Automated Statchk
1,3-Dichloropropene Sum	CALC	7376251	N/A	2021/05/31	Automated Statchk
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7380813	2021/05/31	2021/06/01	Jonghan Yoon
Volatile Organic Compounds in Soil	GC/MS	7378625	N/A	2021/05/31	Juan Pangilinan

BV Labs ID: PRH815
Sample ID: MW03-2
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7376212	N/A	2021/06/02	Automated Statchk
1,3-Dichloropropene Sum	CALC	7376251	N/A	2021/06/01	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7379723	2021/05/31	2021/06/01	Dennis Ngondu
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7380813	2021/05/31	2021/06/01	Jonghan Yoon
pH CaCl2 EXTRACT	AT	7381578	2021/06/01	2021/06/01	Neil Dassanayake
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7378549	N/A	2021/05/31	Denis Reid

BV Labs ID: PRH816
Sample ID: BH04-1
Matrix: Soil

Collected: 2021/05/26
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7376212	N/A	2021/06/02	Automated Statchk
1,3-Dichloropropene Sum	CALC	7376251	N/A	2021/06/01	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7379723	2021/05/31	2021/06/01	Dennis Ngondu
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7380813	2021/05/31	2021/06/01	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7378549	N/A	2021/05/31	Denis Reid

BV Labs ID: PRH817
Sample ID: BH05-4
Matrix: Soil

Collected: 2021/05/26
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7376212	N/A	2021/06/02	Automated Statchk
1,3-Dichloropropene Sum	CALC	7376251	N/A	2021/06/01	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7379723	2021/05/31	2021/06/01	Dennis Ngondu
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7380813	2021/05/31	2021/06/01	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7378549	N/A	2021/05/31	Denis Reid

TEST SUMMARY

BV Labs ID: PRH818
Sample ID: BH06-1
Matrix: Soil

Collected: 2021/05/26
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7376212	N/A	2021/06/02	Automated Statchk
1,3-Dichloropropene Sum	CALC	7376251	N/A	2021/06/01	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7379723	2021/05/31	2021/06/01	Dennis Ngondu
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7380813	2021/05/31	2021/06/01	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7378549	N/A	2021/05/31	Denis Reid

BV Labs ID: PRH819
Sample ID: SS-01
Matrix: Soil

Collected: 2021/05/26
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7380881	N/A	2021/06/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7379723	2021/05/31	2021/06/01	Dennis Ngondu
Moisture	BAL	7377857	N/A	2021/05/28	Kruti Jitesh Patel
Polychlorinated Biphenyl in Soil	GC/ECD	7379180	2021/05/30	2021/06/02	Joy Zhang

BV Labs ID: PRH820
Sample ID: TCLP
Matrix: Soil

Collected: 2021/05/25
Shipped:
Received: 2021/05/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	7381988	N/A	2021/06/01	Aditiben Patel
Fluoride by ISE in Leachates	ISE	7381987	2021/06/01	2021/06/02	Yogesh Patel
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	7382203	2021/06/01	2021/06/01	Azita Fazaeli
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	7381989	N/A	2021/06/01	Chandra Nandlal
PAH Compounds in Leachate by GC/MS (SIM)	GC/MS	7383194	2021/06/01	2021/06/02	Mitesh Raj
Polychlorinated Biphenyl in Leachate	GC/ECD	7382656	2021/06/01	2021/06/01	Farag Mansour
TCLP - % Solids	BAL	7380509	2021/05/31	2021/07/01	Jian (Ken) Wang
TCLP - Extraction Fluid		7380513	N/A	2021/06/01	Jian (Ken) Wang
TCLP - Initial and final pH	PH	7380516	N/A	2021/06/01	Jian (Ken) Wang
TCLP Zero Headspace Extraction		7379912	2021/05/31	2021/06/01	Daruish Karimi
VOCs in ZHE Leachates	GC/MS	7382004	2021/06/01	2021/06/01	Blair Gannon

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.0°C
Package 2	6.7°C

Sample PRH819 [SS-01] : PCB Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS	% Recovery	QC Limits
7378549	4-Bromofluorobenzene	2021/05/31	108	60 - 140	105	60 - 140	103	%						
7378549	D10-o-Xylene	2021/05/31	119	60 - 130	98	60 - 130	100	%						
7378549	D4-1,2-Dichloroethane	2021/05/31	101	60 - 140	102	60 - 140	103	%						
7378549	D8-Toluene	2021/05/31	105	60 - 140	102	60 - 140	93	%						
7378625	4-Bromofluorobenzene	2021/05/30	102	60 - 140	102	60 - 140	98	%						
7378625	D10-o-Xylene	2021/05/30	106	60 - 130	110	60 - 130	100	%						
7378625	D4-1,2-Dichloroethane	2021/05/30	93	60 - 140	99	60 - 140	106	%						
7378625	D8-Toluene	2021/05/30	102	60 - 140	102	60 - 140	95	%						
7379180	Decachlorobiphenyl	2021/05/30	112	60 - 130	100	60 - 130	103	%						
7379723	o-Terphenyl	2021/05/31	84	60 - 130	83	60 - 130	89	%						
7380813	D10-Anthracene	2021/05/31	90	50 - 130	92	50 - 130	94	%						
7380813	D14-Terphenyl (FS)	2021/05/31	95	50 - 130	91	50 - 130	93	%						
7380813	D8-Acenaphthylene	2021/05/31	92	50 - 130	88	50 - 130	93	%						
7380881	1,4-Difluorobenzene	2021/05/31	100	60 - 140	97	60 - 140	102	%						
7380881	4-Bromofluorobenzene	2021/05/31	104	60 - 140	104	60 - 140	102	%						
7380881	D10-o-Xylene	2021/05/31	105	60 - 140	99	60 - 140	100	%						
7380881	D4-1,2-Dichloroethane	2021/05/31	98	60 - 140	103	60 - 140	106	%						
7382004	Leachable 4-Bromofluorobenzene	2021/06/01	100	70 - 130	100	70 - 130	90	%						
7382004	Leachable D4-1,2-Dichloroethane	2021/06/01	98	70 - 130	100	70 - 130	105	%						
7382004	Leachable D8-Toluene	2021/06/01	109	70 - 130	108	70 - 130	93	%						
7382656	Leachable Decachlorobiphenyl	2021/06/01	111	30 - 130	115	30 - 130	114	%						
7383194	Leachable D10-Anthracene	2021/06/02	99	50 - 130	103	50 - 130	102	%						
7383194	Leachable D14-Terphenyl (FS)	2021/06/02	81	50 - 130	97	50 - 130	86	%						
7383194	Leachable D8-Acenaphthylene	2021/06/02	95	50 - 130	101	50 - 130	100	%						
7377762	Moisture	2021/05/28							1.6	20				
7377857	Moisture	2021/05/28							0.55	20				
7378549	1,1,1,2-Tetrachloroethane	2021/05/31	89	60 - 140	85	60 - 130	<0.050	ug/g	NC	50				
7378549	1,1,1-Trichloroethane	2021/05/31	98	60 - 140	90	60 - 130	<0.050	ug/g	NC	50				
7378549	1,1,2,2-Tetrachloroethane	2021/05/31	90	60 - 140	95	60 - 130	<0.050	ug/g	NC	50				
7378549	1,1,2-Trichloroethane	2021/05/31	85	60 - 140	86	60 - 130	<0.050	ug/g	NC	50				

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS	% Recovery	QC Limits
7378549	1,1-Dichloroethane	2021/05/31	93	60 - 140	88	60 - 130	<0.050	ug/g	NC	50				
7378549	1,1-Dichloroethylene	2021/05/31	100	60 - 140	91	60 - 130	<0.050	ug/g	NC	50				
7378549	1,2-Dichlorobenzene	2021/05/31	81	60 - 140	78	60 - 130	<0.050	ug/g	NC	50				
7378549	1,2-Dichloroethane	2021/05/31	90	60 - 140	90	60 - 130	<0.050	ug/g	NC	50				
7378549	1,2-Dichloropropane	2021/05/31	95	60 - 140	92	60 - 130	<0.050	ug/g	NC	50				
7378549	1,3-Dichlorobenzene	2021/05/31	88	60 - 140	82	60 - 130	<0.050	ug/g	NC	50				
7378549	1,4-Dichlorobenzene	2021/05/31	99	60 - 140	92	60 - 130	<0.050	ug/g	NC	50				
7378549	Acetone (2-Propanone)	2021/05/31	88	60 - 140	100	60 - 140	<0.50	ug/g	NC	50				
7378549	Benzene	2021/05/31	92	60 - 140	86	60 - 130	<0.020	ug/g	NC	50				
7378549	Bromodichloromethane	2021/05/31	95	60 - 140	95	60 - 130	<0.050	ug/g	NC	50				
7378549	Bromoform	2021/05/31	85	60 - 140	88	60 - 130	<0.050	ug/g	NC	50				
7378549	Bromomethane	2021/05/31	97	60 - 140	88	60 - 140	<0.050	ug/g	NC	50				
7378549	Carbon Tetrachloride	2021/05/31	102	60 - 140	91	60 - 130	<0.050	ug/g	NC	50				
7378549	Chlorobenzene	2021/05/31	96	60 - 140	92	60 - 130	<0.050	ug/g	NC	50				
7378549	Chloroform	2021/05/31	95	60 - 140	90	60 - 130	<0.050	ug/g	NC	50				
7378549	cis-1,2-Dichloroethylene	2021/05/31	110	60 - 140	102	60 - 130	<0.050	ug/g	NC	50				
7378549	cis-1,3-Dichloropropene	2021/05/31	95	60 - 140	90	60 - 130	<0.030	ug/g	NC	50				
7378549	Dibromochloromethane	2021/05/31	85	60 - 140	85	60 - 130	<0.050	ug/g	NC	50				
7378549	Dichlorodifluoromethane (FREON 12)	2021/05/31	89	60 - 140	82	60 - 140	<0.050	ug/g	NC	50				
7378549	Ethylbenzene	2021/05/31	89	60 - 140	80	60 - 130	<0.020	ug/g	NC	50				
7378549	Ethylene Dibromide	2021/05/31	83	60 - 140	84	60 - 130	<0.050	ug/g	NC	50				
7378549	F1 (C6-C10) - BTEX	2021/05/31					<10	ug/g	NC	30				
7378549	F1 (C6-C10)	2021/05/31	95	60 - 140	99	80 - 120	<10	ug/g	NC	30				
7378549	Hexane	2021/05/31	99	60 - 140	86	60 - 130	<0.050	ug/g	NC	50				
7378549	Methyl Ethyl Ketone (2-Butanone)	2021/05/31	89	60 - 140	101	60 - 140	<0.50	ug/g	NC	50				
7378549	Methyl Isobutyl Ketone	2021/05/31	86	60 - 140	96	60 - 130	<0.50	ug/g	NC	50				
7378549	Methyl t-butyl ether (MTBE)	2021/05/31	89	60 - 140	85	60 - 130	<0.050	ug/g	NC	50				
7378549	Methylene Chloride(Dichloromethane)	2021/05/31	103	60 - 140	98	60 - 130	<0.050	ug/g	NC	50				
7378549	o-Xylene	2021/05/31	90	60 - 140	84	60 - 130	<0.020	ug/g	NC	50				
7378549	p+m-Xylene	2021/05/31	96	60 - 140	87	60 - 130	<0.020	ug/g	NC	50				

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS	% Recovery	QC Limits
7378549	Styrene	2021/05/31	99	60 - 140	94	60 - 130	<0.050	ug/g	NC	50				
7378549	Tetrachloroethylene	2021/05/31	90	60 - 140	82	60 - 130	<0.050	ug/g	NC	50				
7378549	Toluene	2021/05/31	90	60 - 140	84	60 - 130	<0.020	ug/g	NC	50				
7378549	Total Xylenes	2021/05/31					<0.020	ug/g	NC	50				
7378549	trans-1,2-Dichloroethylene	2021/05/31	95	60 - 140	86	60 - 130	<0.050	ug/g	NC	50				
7378549	trans-1,3-Dichloropropene	2021/05/31	98	60 - 140	91	60 - 130	<0.040	ug/g	NC	50				
7378549	Trichloroethylene	2021/05/31	107	60 - 140	98	60 - 130	<0.050	ug/g	NC	50				
7378549	Trichlorofluoromethane (FREON 11)	2021/05/31	95	60 - 140	86	60 - 130	<0.050	ug/g	NC	50				
7378549	Vinyl Chloride	2021/05/31	91	60 - 140	84	60 - 130	<0.020	ug/g	NC	50				
7378625	1,1,1,2-Tetrachloroethane	2021/05/30	96	60 - 140	100	60 - 130	<0.040	ug/g						
7378625	1,1,1-Trichloroethane	2021/05/30	101	60 - 140	102	60 - 130	<0.040	ug/g						
7378625	1,1,2,2-Tetrachloroethane	2021/05/30	92	60 - 140	101	60 - 130	<0.040	ug/g						
7378625	1,1,2-Trichloroethane	2021/05/30	97	60 - 140	105	60 - 130	<0.040	ug/g						
7378625	1,1-Dichloroethane	2021/05/30	97	60 - 140	99	60 - 130	<0.040	ug/g						
7378625	1,1-Dichloroethylene	2021/05/30	102	60 - 140	100	60 - 130	<0.040	ug/g						
7378625	1,2-Dichlorobenzene	2021/05/30	93	60 - 140	95	60 - 130	<0.040	ug/g						
7378625	1,2-Dichloroethane	2021/05/30	90	60 - 140	95	60 - 130	<0.049	ug/g						
7378625	1,2-Dichloropropane	2021/05/30	106	60 - 140	108	60 - 130	<0.040	ug/g						
7378625	1,3-Dichlorobenzene	2021/05/30	94	60 - 140	92	60 - 130	<0.040	ug/g						
7378625	1,4-Dichlorobenzene	2021/05/30	107	60 - 140	106	60 - 130	<0.040	ug/g						
7378625	Acetone (2-Propanone)	2021/05/31	102	60 - 140	112	60 - 140	<0.49	ug/g	NC	50				
7378625	Benzene	2021/05/30	94	60 - 140	95	60 - 130	<0.0060	ug/g						
7378625	Bromodichloromethane	2021/05/30	99	60 - 140	104	60 - 130	<0.040	ug/g						
7378625	Bromoform	2021/05/30	91	60 - 140	100	60 - 130	<0.040	ug/g						
7378625	Bromomethane	2021/05/30	91	60 - 140	94	60 - 140	<0.040	ug/g						
7378625	Carbon Tetrachloride	2021/05/30	100	60 - 140	99	60 - 130	<0.040	ug/g						
7378625	Chlorobenzene	2021/05/30	97	60 - 140	97	60 - 130	<0.040	ug/g						
7378625	Chloroform	2021/05/30	98	60 - 140	100	60 - 130	<0.040	ug/g						
7378625	cis-1,2-Dichloroethylene	2021/05/30	102	60 - 140	102	60 - 130	<0.040	ug/g						
7378625	cis-1,3-Dichloropropene	2021/05/30	95	60 - 140	99	60 - 130	<0.030	ug/g						

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS	% Recovery	QC Limits
7378625	Dibromochloromethane	2021/05/30	91	60 - 140	97	60 - 130	<0.040	ug/g						
7378625	Dichlorodifluoromethane (FREON 12)	2021/05/30	89	60 - 140	88	60 - 140	<0.040	ug/g						
7378625	Ethylbenzene	2021/05/30	97	60 - 140	93	60 - 130	<0.010	ug/g						
7378625	Ethylene Dibromide	2021/05/30	89	60 - 140	97	60 - 130	<0.040	ug/g						
7378625	Hexane	2021/05/31	109	60 - 140	106	60 - 130	<0.040	ug/g	0.14	50				
7378625	Methyl Ethyl Ketone (2-Butanone)	2021/05/31	102	60 - 140	114	60 - 140	<0.40	ug/g	NC	50				
7378625	Methyl Isobutyl Ketone	2021/05/31	104	60 - 140	116	60 - 130	<0.40	ug/g	NC	50				
7378625	Methyl t-butyl ether (MTBE)	2021/05/30	92	60 - 140	94	60 - 130	<0.040	ug/g						
7378625	Methylene Chloride(Dichloromethane)	2021/05/30	95	60 - 140	98	60 - 130	<0.049	ug/g						
7378625	o-Xylene	2021/05/30	95	60 - 140	94	60 - 130	<0.020	ug/g						
7378625	p+m-Xylene	2021/05/30	99	60 - 140	96	60 - 130	<0.020	ug/g						
7378625	Styrene	2021/05/30	104	60 - 140	104	60 - 130	<0.040	ug/g						
7378625	Tetrachloroethylene	2021/05/30	92	60 - 140	91	60 - 130	<0.040	ug/g						
7378625	Toluene	2021/05/30	93	60 - 140	93	60 - 130	<0.020	ug/g						
7378625	Total Xylenes	2021/05/30					<0.020	ug/g						
7378625	trans-1,2-Dichloroethylene	2021/05/30	103	60 - 140	103	60 - 130	<0.040	ug/g						
7378625	trans-1,3-Dichloropropene	2021/05/30	99	60 - 140	106	60 - 130	<0.040	ug/g						
7378625	Trichloroethylene	2021/05/30	102	60 - 140	102	60 - 130	<0.010	ug/g						
7378625	Trichlorofluoromethane (FREON 11)	2021/05/30	94	60 - 140	91	60 - 130	<0.040	ug/g						
7378625	Vinyl Chloride	2021/05/30	94	60 - 140	92	60 - 130	<0.019	ug/g						
7378867	Sieve - #200 (<0.075mm)	2021/05/31							6.6	20			56	53 - 58
7378867	Sieve - #200 (>0.075mm)	2021/05/31							6.0	20			44	42 - 47
7379180	Aroclor 1242	2021/05/30					<0.010	ug/g	NC	50				
7379180	Aroclor 1248	2021/05/30					<0.010	ug/g	NC	50				
7379180	Aroclor 1254	2021/05/30					<0.010	ug/g	19	50				
7379180	Aroclor 1260	2021/05/30	130 (1)	30 - 130	121	30 - 130	<0.010	ug/g	NC	50				
7379180	Total PCB	2021/05/30	130	30 - 130	121	30 - 130	<0.010	ug/g	19	50				
7379553	Acid Extractable Lead (Pb)	2021/06/01	93	75 - 125	99	80 - 120	<1.0	ug/g	0.78	30				
7379723	F2 (C10-C16 Hydrocarbons)	2021/05/31	93	50 - 130	94	80 - 120	<10	ug/g	NC	30				
7379723	F3 (C16-C34 Hydrocarbons)	2021/05/31	99	50 - 130	98	80 - 120	<50	ug/g	NC	30				

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS	% Recovery	QC Limits
7379723	F4 (C34-C50 Hydrocarbons)	2021/05/31	101	50 - 130	100	80 - 120	<50	ug/g	NC	30				
7379947	Available (CaCl2) pH	2021/05/31			100	97 - 103			0.10	N/A				
7380813	1-Methylnaphthalene	2021/05/31	86	50 - 130	98	50 - 130	<0.0050	ug/g	4.9	40				
7380813	2-Methylnaphthalene	2021/05/31	85	50 - 130	93	50 - 130	<0.0050	ug/g	NC	40				
7380813	Acenaphthene	2021/05/31	82	50 - 130	93	50 - 130	<0.0050	ug/g	NC	40				
7380813	Acenaphthylene	2021/05/31	82	50 - 130	87	50 - 130	<0.0050	ug/g	NC	40				
7380813	Anthracene	2021/05/31	82	50 - 130	89	50 - 130	<0.0050	ug/g	NC	40				
7380813	Benzo(a)anthracene	2021/05/31	84	50 - 130	90	50 - 130	<0.0050	ug/g	6.9	40				
7380813	Benzo(a)pyrene	2021/05/31	85	50 - 130	91	50 - 130	<0.0050	ug/g	2.2	40				
7380813	Benzo(b/j)fluoranthene	2021/05/31	93	50 - 130	109	50 - 130	<0.0050	ug/g	6.2	40				
7380813	Benzo(g,h,i)perylene	2021/05/31	86	50 - 130	103	50 - 130	<0.0050	ug/g	4.1	40				
7380813	Benzo(k)fluoranthene	2021/05/31	88	50 - 130	102	50 - 130	<0.0050	ug/g	24	40				
7380813	Chrysene	2021/05/31	90	50 - 130	101	50 - 130	<0.0050	ug/g	1.1	40				
7380813	Dibenzo(a,h)anthracene	2021/05/31	94	50 - 130	98	50 - 130	<0.0050	ug/g	NC	40				
7380813	Fluoranthene	2021/05/31	91	50 - 130	96	50 - 130	<0.0050	ug/g	14	40				
7380813	Fluorene	2021/05/31	88	50 - 130	94	50 - 130	<0.0050	ug/g	NC	40				
7380813	Indeno(1,2,3-cd)pyrene	2021/05/31	88	50 - 130	100	50 - 130	<0.0050	ug/g	1.6	40				
7380813	Naphthalene	2021/05/31	76	50 - 130	88	50 - 130	<0.0050	ug/g	NC	40				
7380813	Phenanthrene	2021/05/31	89	50 - 130	94	50 - 130	<0.0050	ug/g	0.037	40				
7380813	Pyrene	2021/05/31	90	50 - 130	96	50 - 130	<0.0050	ug/g	22	40				
7380881	Benzene	2021/05/31	114	50 - 140	102	50 - 140	<0.020	ug/g	NC	50				
7380881	Ethylbenzene	2021/05/31	125	50 - 140	110	50 - 140	<0.020	ug/g	NC	50				
7380881	F1 (C6-C10) - BTEX	2021/05/31					<10	ug/g	NC	30				
7380881	F1 (C6-C10)	2021/05/31	105	60 - 140	94	80 - 120	<10	ug/g	NC	30				
7380881	o-Xylene	2021/05/31	118	50 - 140	106	50 - 140	<0.020	ug/g	NC	50				
7380881	p+m-Xylene	2021/05/31	118	50 - 140	104	50 - 140	<0.040	ug/g	NC	50				
7380881	Toluene	2021/05/31	111	50 - 140	99	50 - 140	<0.020	ug/g	NC	50				
7380881	Total Xylenes	2021/05/31					<0.040	ug/g	NC	50				
7381578	Available (CaCl2) pH	2021/06/01			100	97 - 103			0.34	N/A				
7381987	Leachable Fluoride (F-)	2021/06/02	95	80 - 120	95	80 - 120	<0.10	mg/L	5.7	25	<0.10	mg/L		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS	% Recovery	QC Limits
7381988	Leachable WAD Cyanide (Free)	2021/06/01	91	80 - 120	97	80 - 120	<0.0020	mg/L	NC	20	<0.010	mg/L		
7381989	Leachable Nitrate (N)	2021/06/01	92	80 - 120	101	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L		
7381989	Leachable Nitrate + Nitrite (N)	2021/06/01	96	80 - 120	101	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L		
7381989	Leachable Nitrite (N)	2021/06/01	110	80 - 120	105	80 - 120	<0.10	mg/L	NC	25	<0.10	mg/L		
7382004	Leachable 1,1-Dichloroethylene	2021/06/01	97	70 - 130	98	70 - 130	<0.020	mg/L						
7382004	Leachable 1,2-Dichlorobenzene	2021/06/01	95	70 - 130	96	70 - 130	<0.050	mg/L						
7382004	Leachable 1,2-Dichloroethane	2021/06/01	90	70 - 130	92	70 - 130	<0.050	mg/L						
7382004	Leachable 1,4-Dichlorobenzene	2021/06/01	110	70 - 130	111	70 - 130	<0.050	mg/L						
7382004	Leachable Benzene	2021/06/01	92	70 - 130	93	70 - 130	<0.020	mg/L	NC	30				
7382004	Leachable Carbon Tetrachloride	2021/06/01	97	70 - 130	97	70 - 130	<0.020	mg/L						
7382004	Leachable Chlorobenzene	2021/06/01	96	70 - 130	97	70 - 130	<0.020	mg/L						
7382004	Leachable Chloroform	2021/06/01	96	70 - 130	96	70 - 130	<0.020	mg/L						
7382004	Leachable Methyl Ethyl Ketone (2-Butanone)	2021/06/01	101	60 - 140	102	60 - 140	<1.0	mg/L						
7382004	Leachable Methylene Chloride (Dichloromethane)	2021/06/01	107	70 - 130	109	70 - 130	<0.20	mg/L						
7382004	Leachable Tetrachloroethylene	2021/06/01	93	70 - 130	92	70 - 130	<0.020	mg/L						
7382004	Leachable Trichloroethylene	2021/06/01	99	70 - 130	99	70 - 130	<0.020	mg/L						
7382004	Leachable Vinyl Chloride	2021/06/01	96	70 - 130	97	70 - 130	<0.020	mg/L						
7382203	Leachable Arsenic (As)	2021/06/01	99	80 - 120	100	80 - 120	<0.2	mg/L	NC	35	<0.2	mg/L		
7382203	Leachable Barium (Ba)	2021/06/01	102	80 - 120	102	80 - 120	<0.2	mg/L	0.81	35	<0.2	mg/L		
7382203	Leachable Boron (B)	2021/06/01	97	80 - 120	93	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L		
7382203	Leachable Cadmium (Cd)	2021/06/01	98	80 - 120	99	80 - 120	<0.05	mg/L	NC	35	<0.05	mg/L		
7382203	Leachable Chromium (Cr)	2021/06/01	97	80 - 120	97	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L		
7382203	Leachable Lead (Pb)	2021/06/01	90	80 - 120	94	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L		
7382203	Leachable Mercury (Hg)	2021/06/01	95	80 - 120	96	80 - 120	<0.001	mg/L	NC	35	<0.001	mg/L		
7382203	Leachable Selenium (Se)	2021/06/01	96	80 - 120	96	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L		
7382203	Leachable Silver (Ag)	2021/06/01	94	80 - 120	96	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L		
7382203	Leachable Uranium (U)	2021/06/01	95	80 - 120	98	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L		
7382656	Leachable Aroclor 1016	2021/06/01					<3.0	ug/L						

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS	% Recovery	QC Limits
7382656	Leachable Aroclor 1221	2021/06/01					<3.0	ug/L						
7382656	Leachable Aroclor 1242	2021/06/01					<3.0	ug/L						
7382656	Leachable Aroclor 1248	2021/06/01					<3.0	ug/L						
7382656	Leachable Aroclor 1254	2021/06/01					<3.0	ug/L						
7382656	Leachable Aroclor 1260	2021/06/01	114	30 - 130	119	30 - 130	<3.0	ug/L						
7382656	Leachable Total PCB	2021/06/01	114	30 - 130	119	30 - 130	<3.0	ug/L	NC	40				
7383194	Leachable Benzo(a)pyrene	2021/06/02	95	50 - 130	96	50 - 130	<0.10	ug/L	NC	40				

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) The recovery was above the upper control limit. This may represent a high bias in some results for flagged analytes. For results that were not detected (ND), this potential bias has no impact.This may be due to sample heterogeneity.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU VERITAS

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/6

CHAIN OF CUSTODY RECORD 159039

Page 1 of 2

Invoice Information

Company Name: Pinchin Ltd.
Contact Name:
Address:
Phone: 289-308-6236
Email: ap@pinchin.com

Report Information (if differs from invoice)

Company Name: Pinchin
Contact Name: David Mignone,
Address: Erin Tracey
Phone: dmignone@pinchin.com
Email: etracey@pinchin.com

Project Information (where applicable)

Quotation #:
P.O. #/ AFE#:
Project #: 291968
Site Location:
Site #:
Site Location Province:
Sampled By: ET

Turnaround Time (TAT) Required

☒ Regular TAT (5-7 days) Most analyses

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)

☐ 1 Day ☐ 2 Days ☐ 3-4 Days

Date Required:
Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS LABORATORIES' DRINKING WATER CHAIN OF CUSTODY

Regulation 153

☐ Table 1 ☐ Res/Park ☐ Med/ Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/ Other
☐ Table ____
FOR RSC (PLEASE CIRCLE) Y [✓ N]

Other Regulations

☐ CCME ☐ Sanitary Sewer Bylaw
☐ MISA ☐ Storm Sewer Bylaw
☐ PWQO Region ____
☐ Other (Specify) ____
☐ REG 558 (MIN. 3 DAY TAT REQUIRED)
☐ REG 406 Table ____

Include Criteria on Certificate of Analysis: Y / [✓ N]

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	PAHs	Lead	Grain Size 0.075mm	pH	PCBs	TCLP VOCs	TCLP PCBs	TCLP Inorganics	TCLP benzo(a)pyrene			HOLD- DO NOT ANALYZE	COMMENTS
1	MW01-6	2021/05/25	13:00	SOIL	4		X	X			X											
2	MW01-8	↓	13:00	↓	4				X	X												
3	MW02-6		11:20		4		X	X			X	X	X									
4	MW02-8		11:20		4				X	X												
5	MW03-2		09:00		4		X	X	X	X			X									
6	BH04-1	2021/05/26	10:40		3		X	X	X	X												Limited Sample Volume
7	BH05-4	↓	11:20		4		X	X	X	X												
8	BH06-1		10:00		4		X	X	X	X												
9	SS-01		9:40		4		X	X						X								
10	TCLP	2021/05/25	14:00		2										X	X	X	X				

LABORATORY USE ONLY

CUSTODY SEAL Y / N Present	Intact	COOLER TEMPERATURES
Y	Y	4/5/3
Y	Y	6/7/7

COOLING MEDIA PRESENT: [✓ Y] / N

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
E-TRACEY	2021/05/27	09:00	DIP MA SINGH	2021/05/27	16:33

27-May-21 16:33
Antonella Brasil
C1E4050
VBV ENV 780

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas Laboratories' standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgment and accept and-conditions

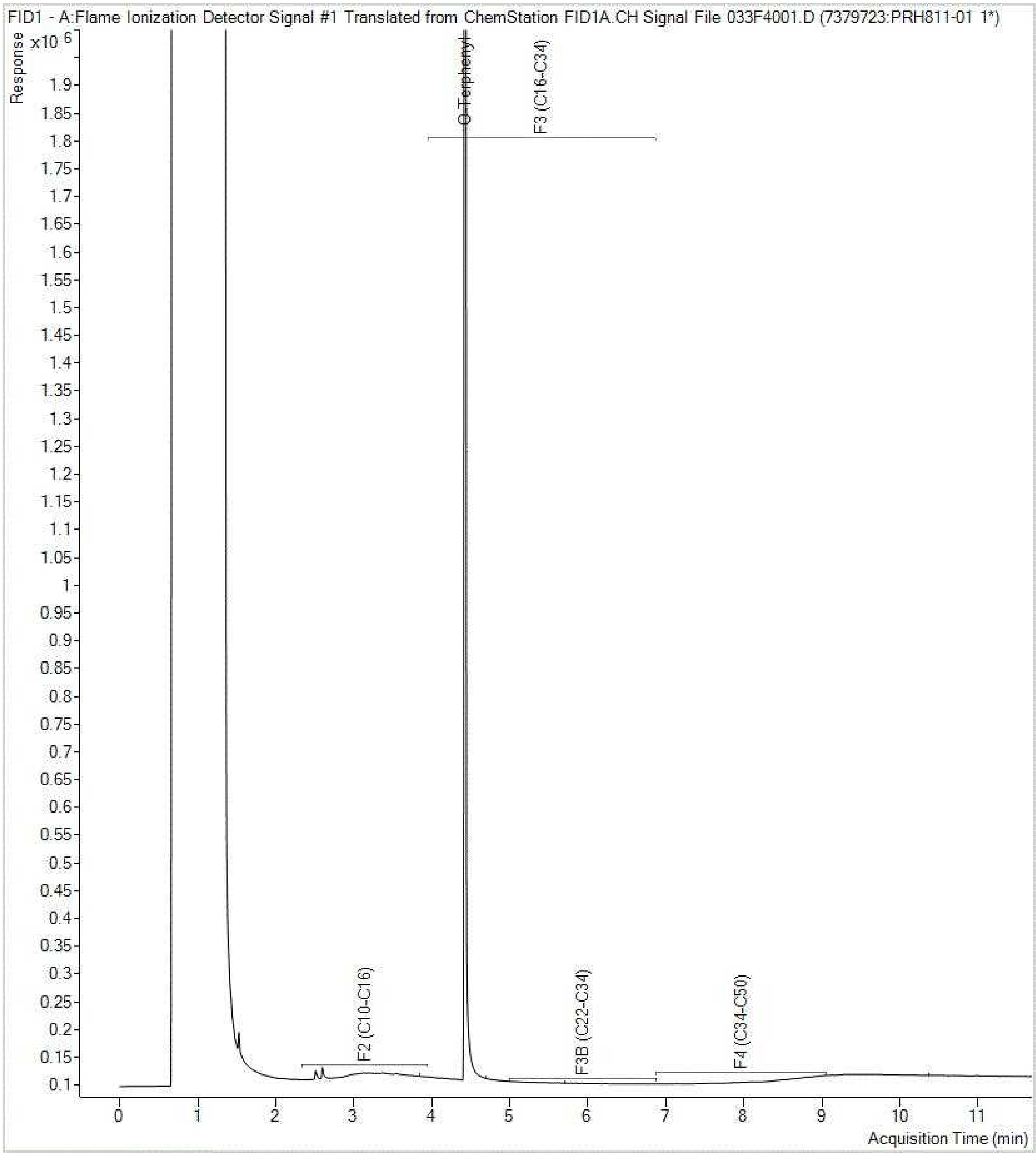
COC-1004 (06/19)

White: BV Labs - Yellow: Client

BV Labs Job #: C1E4050
Report Date: 2021/06/03
BV Labs Sample: PRH811

Pinchin Ltd
Client Project #: 291968
Client ID: MW01-6

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

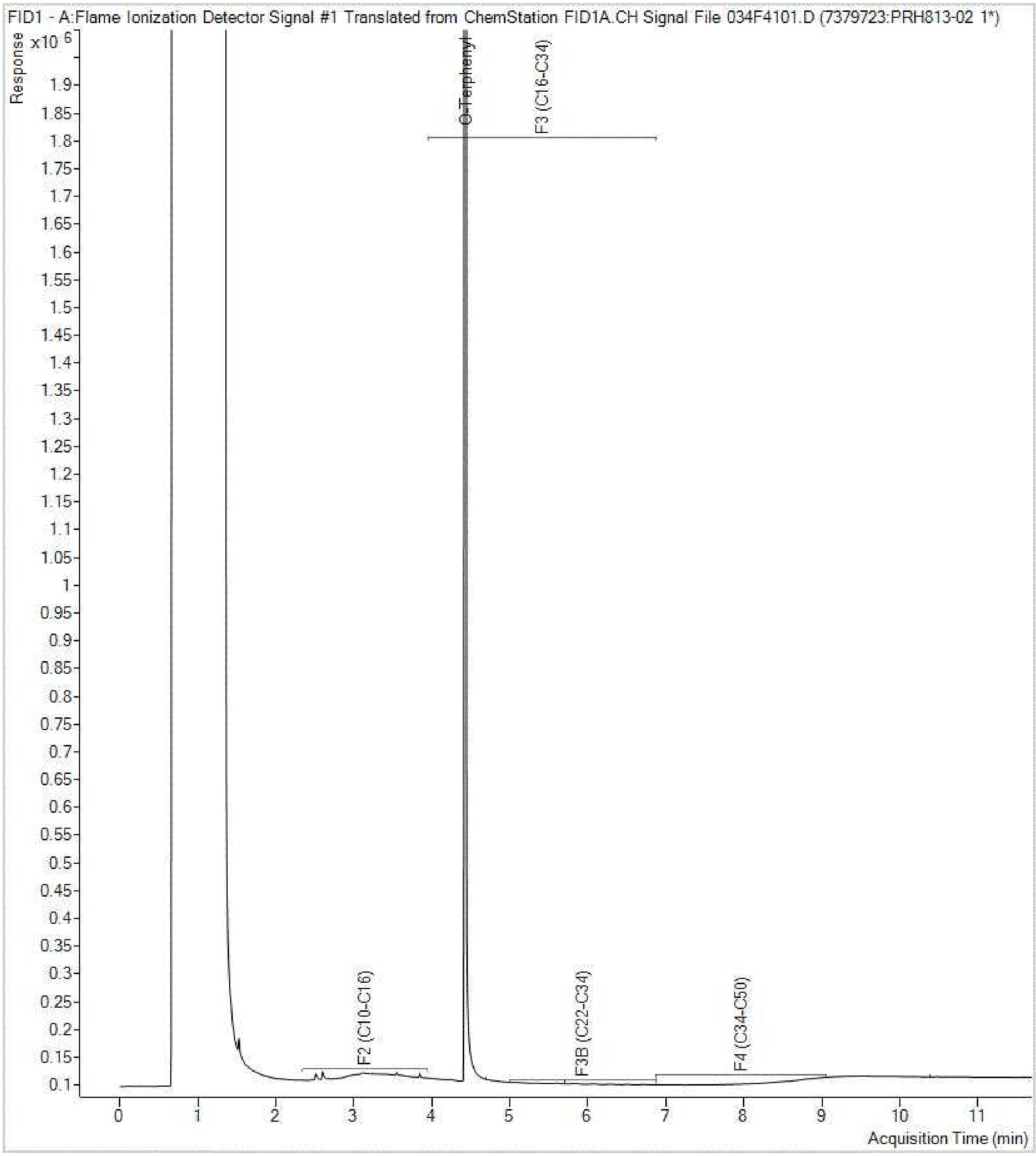


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1E4050
Report Date: 2021/06/03
BV Labs Sample: PRH813

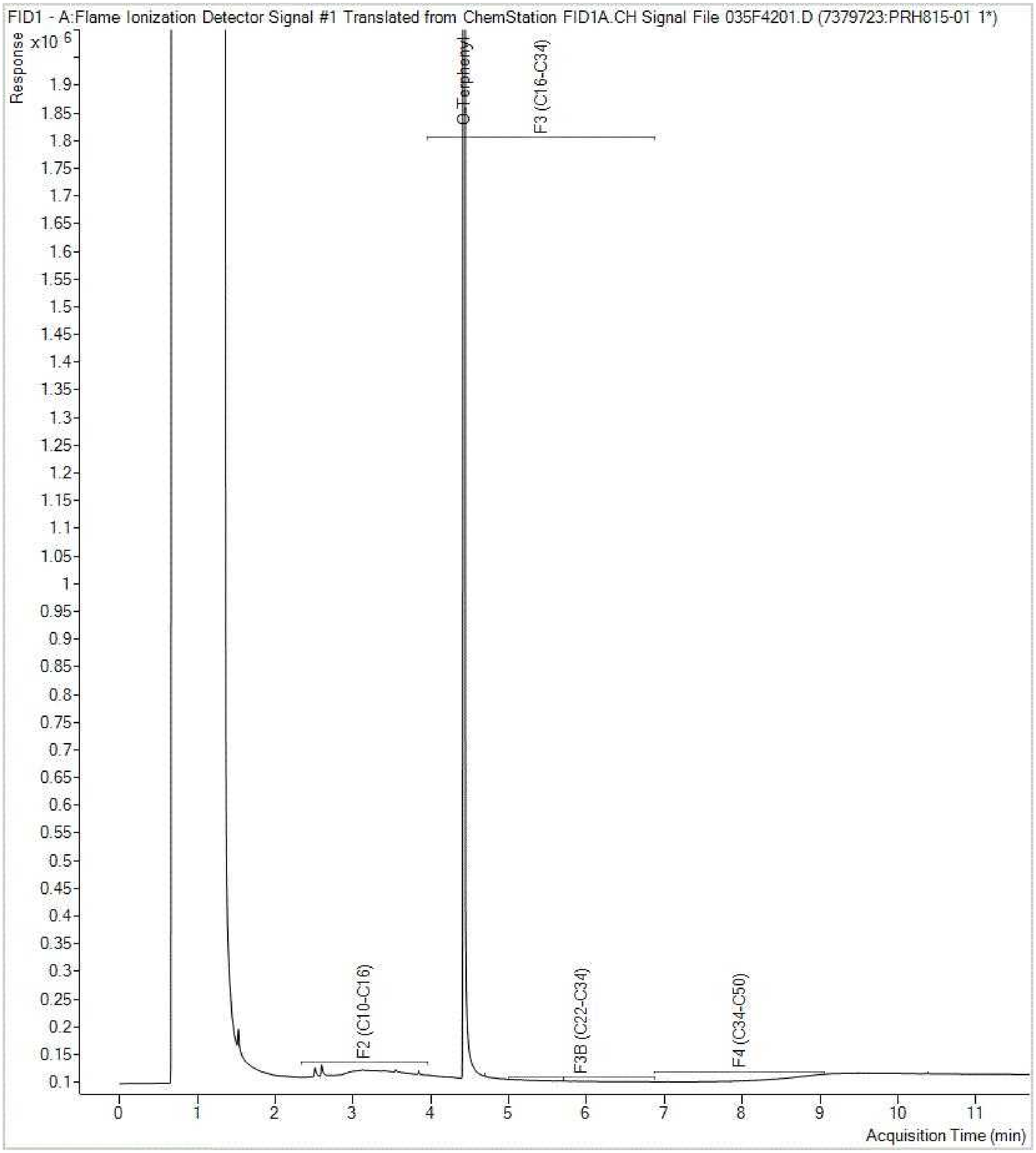
Pinchin Ltd
Client Project #: 291968
Client ID: MW02-6

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



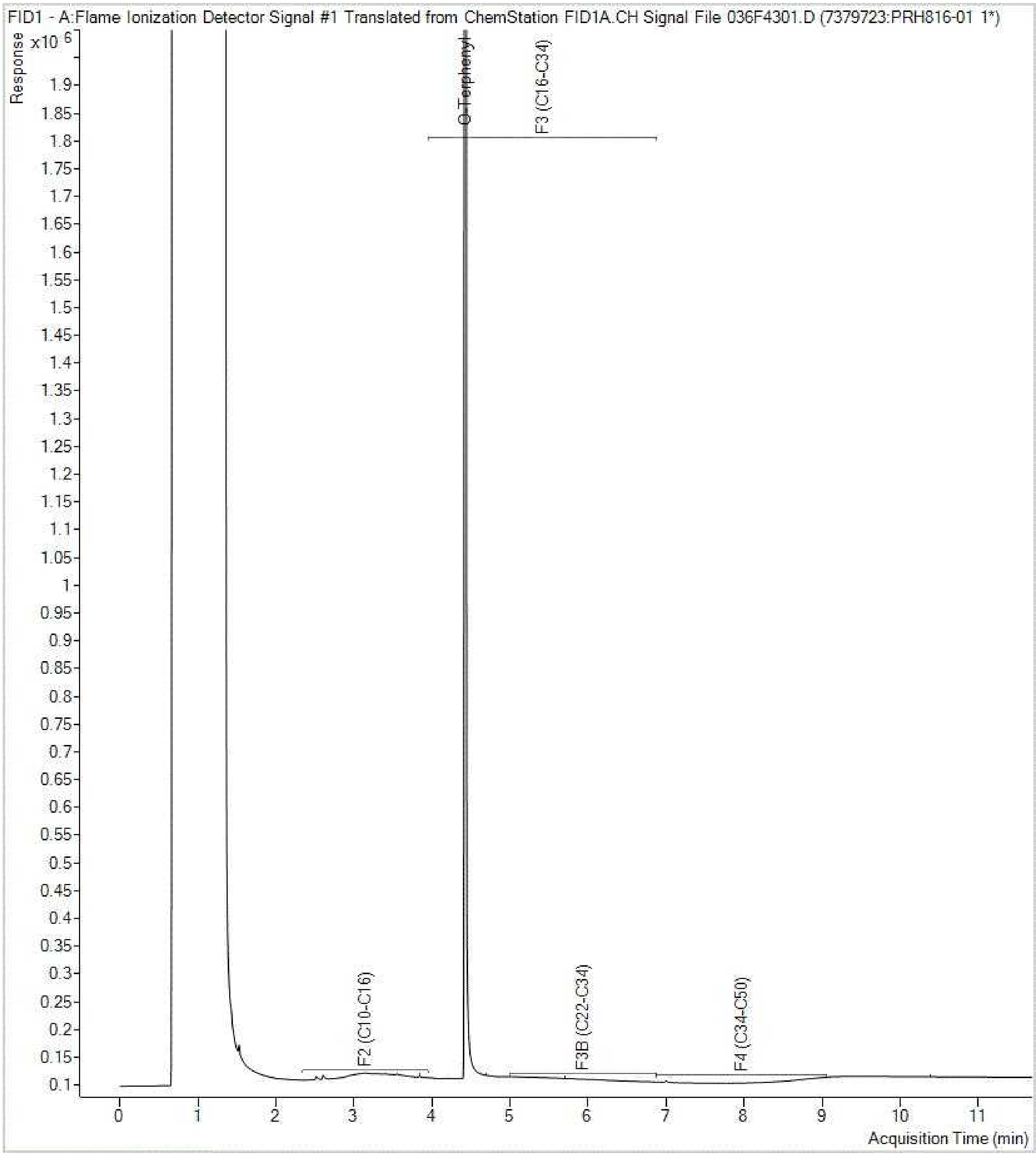
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



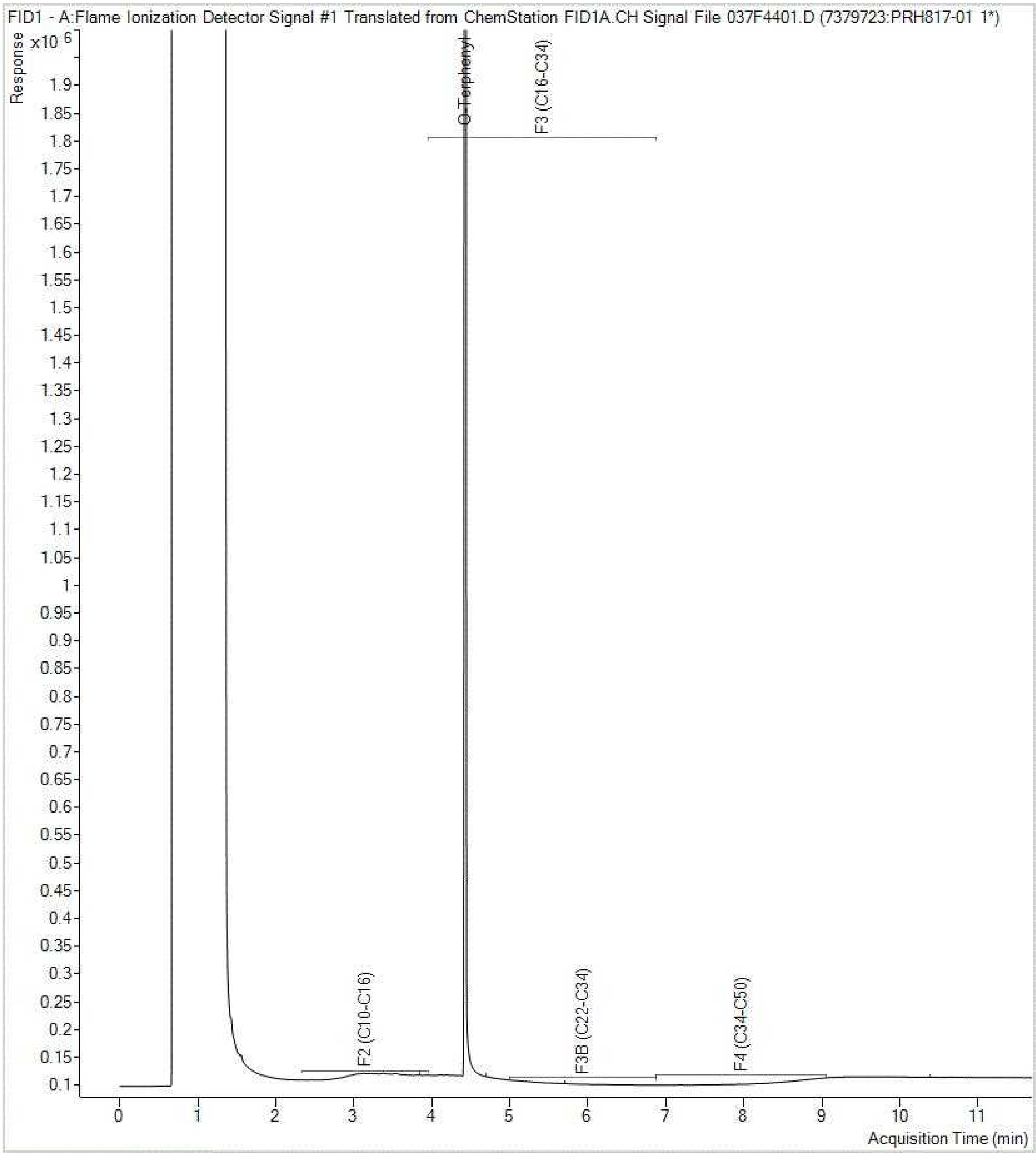
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

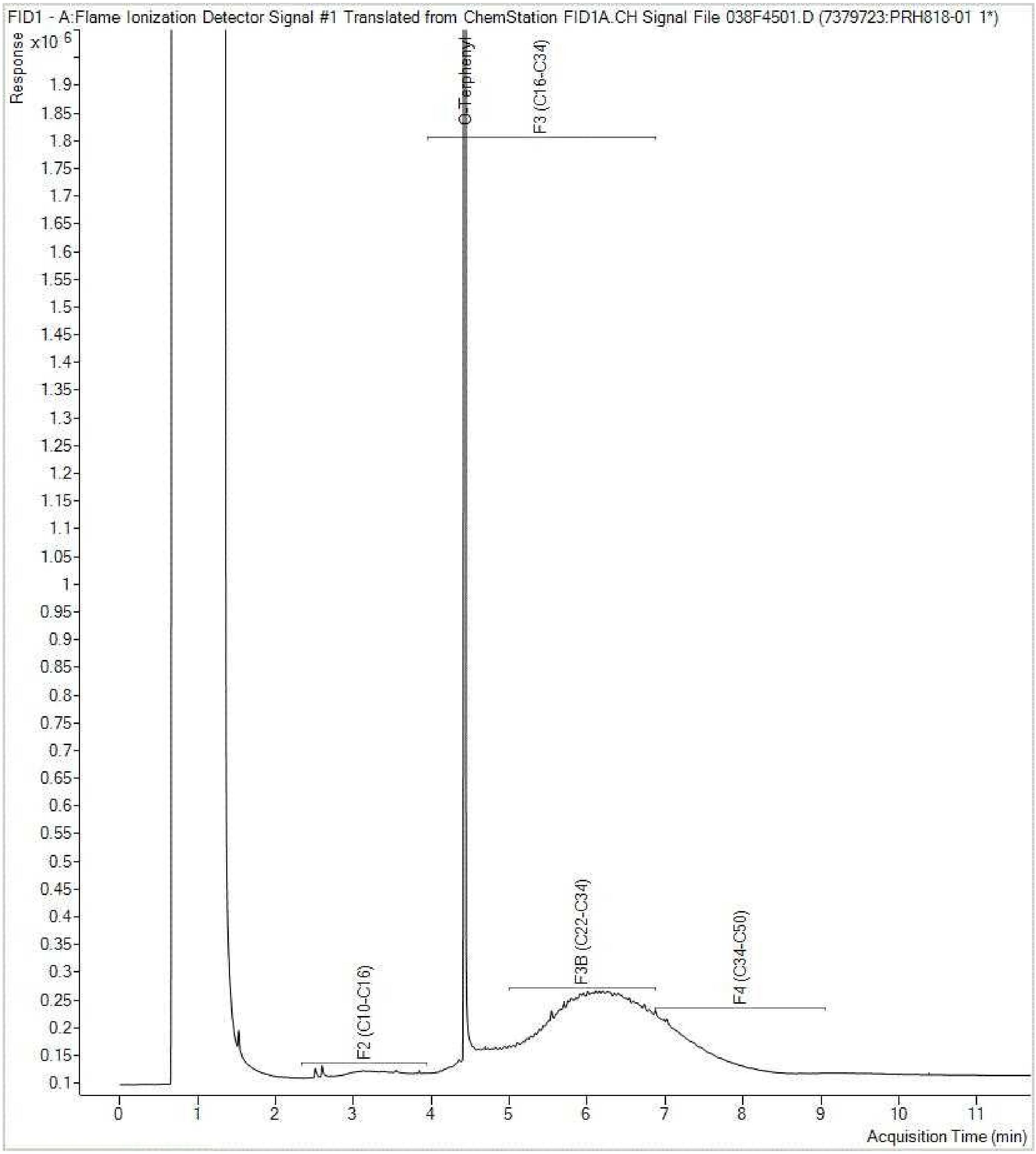


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1E4050
Report Date: 2021/06/03
BV Labs Sample: PRH818

Pinchin Ltd
Client Project #: 291968
Client ID: BH06-1

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

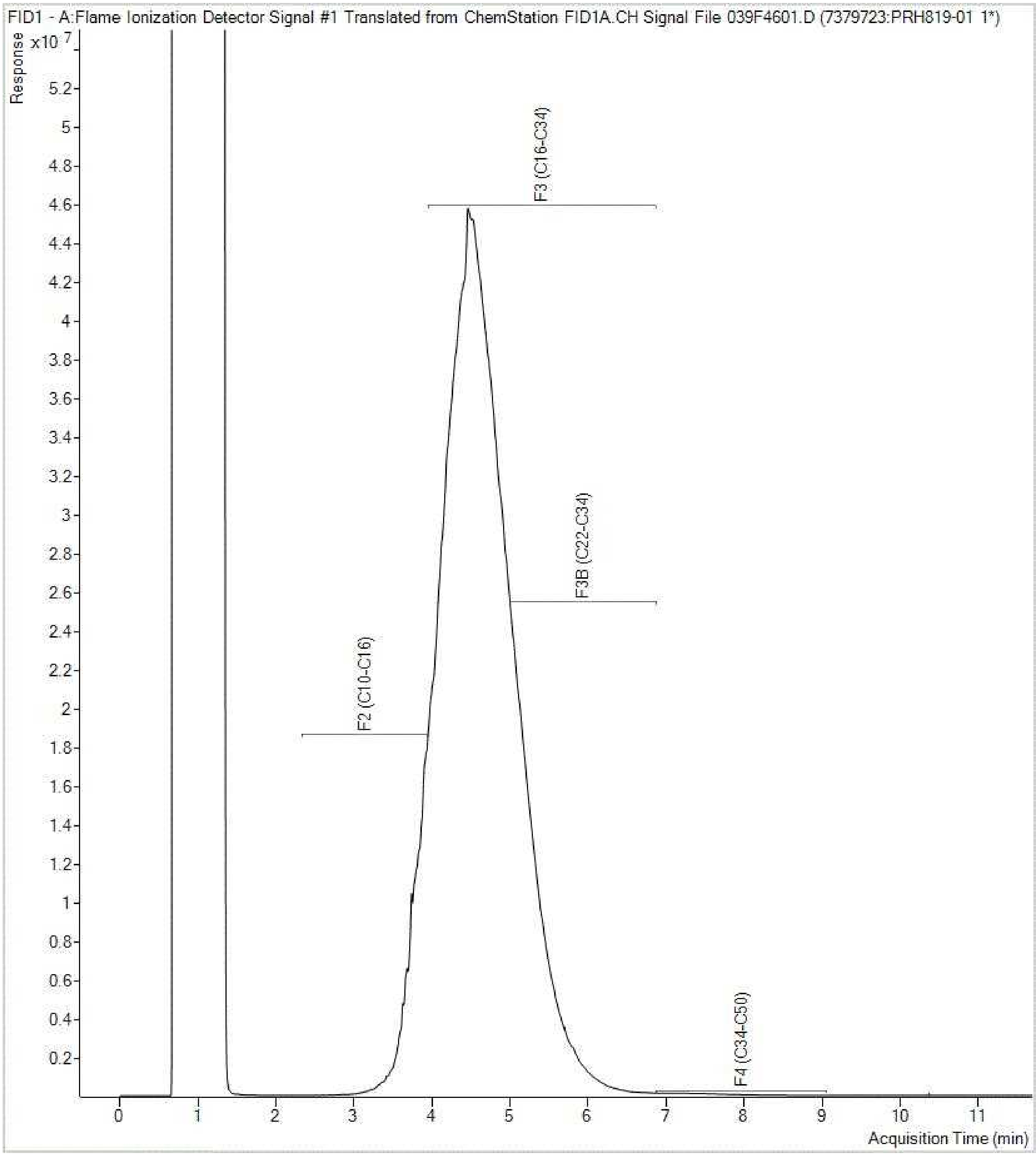


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1E4050
Report Date: 2021/06/03
BV Labs Sample: PRH819

Pinchin Ltd
Client Project #: 291968
Client ID: SS-01

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: 291968
Your C.O.C. #: 827579-01-01

Attention: David Mignone

Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2021/06/08
Report #: R6667488
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1F4823
Received: 2021/06/07, 16:55

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	4	N/A	2021/06/08	CAM SOP-00301	EPA 8270D m
1,3-Dichloropropene Sum	4	N/A	2021/06/08		EPA 8260C m
Petroleum Hydrocarbons F2-F4 in Water (1)	4	2021/06/07	2021/06/08	CAM SOP-00316	CCME PHC-CWS m
Dissolved Metals by ICPMS	3	N/A	2021/06/08	CAM SOP-00447	EPA 6020B m
PAH Compounds in Water by GC/MS (SIM)	4	2021/06/07	2021/06/08	CAM SOP-00318	EPA 8270D m
Volatile Organic Compounds and F1 PHCs	4	N/A	2021/06/08	CAM SOP-00230	EPA 8260C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1

Your Project #: 291968
Your C.O.C. #: 827579-01-01

Attention: David Mignone

Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2021/06/08
Report #: R6667488
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1F4823
Received: 2021/06/07, 16:55
Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Antonella Brasil, Senior Project Manager
Email: Antonella.Brasil@bureauveritas.com
Phone# (905)817-5817
==
This report has been generated and distributed using a secure automated process.
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Total Cover Pages : 2

O.REG 153 DISSOLVED ICPMS METALS (WATER)

BV Labs ID		PTP792	PTP792	PTP793	PTP795		
Sampling Date		2021/06/04 12:50	2021/06/04 12:50	2021/06/04 13:15	2021/06/04 13:50		
COC Number		827579-01-01	827579-01-01	827579-01-01	827579-01-01		
	UNITS	**MW01**	**MW01 Lab-Dup**	**MW02**	**MW103**	**RDL**	**QC Batch**
Metals							
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7394667

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 PAHS (WATER)

BV Labs ID		PTP792	PTP793	PTP794	PTP795		
Sampling Date		2021/06/04 12:50	2021/06/04 13:15	2021/06/04 14:30	2021/06/04 13:50		
COC Number		827579-01-01	827579-01-01	827579-01-01	827579-01-01		
	UNITS	**MW01**	**MW02**	**MW03**	**MW103**	**RDL**	**QC Batch**
Calculated Parameters							
Methylnaphthalene, 2-(1-)	ug/L	<0.071	<0.071	<0.071	<0.071	0.071	7392762
Polyaromatic Hydrocarbons							
Acenaphthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Acenaphthylene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Benzo(a)anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Benzo(a)pyrene	ug/L	<0.0090	<0.0090	<0.0090	<0.0090	0.0090	7393476
Benzo(b/j)fluoranthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Benzo(g,h,i)perylene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Benzo(k)fluoranthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Chrysene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Dibenzo(a,h)anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Fluoranthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Indeno(1,2,3-cd)pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
1-Methylnaphthalene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
2-Methylnaphthalene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Naphthalene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Phenanthrene	ug/L	<0.030	<0.030	0.089	<0.030	0.030	7393476
Pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7393476
Surrogate Recovery (%)							
D10-Anthracene	%	124	112	120	125		7393476
D14-Terphenyl (FS)	%	107	94	98	106		7393476
D8-Acenaphthylene	%	107	97	103	108		7393476

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (WATER)

BV Labs ID		PTP792	PTP793	PTP794	PTP795		
Sampling Date		2021/06/04 12:50	2021/06/04 13:15	2021/06/04 14:30	2021/06/04 13:50		
COC Number		827579-01-01	827579-01-01	827579-01-01	827579-01-01		
	UNITS	**MW01**	**MW02**	**MW03**	**MW103**	**RDL**	**QC Batch**
Calculated Parameters							
1,3-Dichloropropene (cis+trans)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7394075
Volatile Organics							
Acetone (2-Propanone)	ug/L	<10	<10	14	<10	10	7391553
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Bromodichloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
Bromoform	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7391553
Bromomethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
Carbon Tetrachloride	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Chlorobenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Chloroform	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Dibromochloromethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
1,2-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
1,3-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
Dichlorodifluoromethane (FREON 12)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7391553
1,1-Dichloroethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
1,2-Dichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
1,1-Dichloroethylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
cis-1,2-Dichloroethylene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
trans-1,2-Dichloroethylene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
1,2-Dichloropropane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
cis-1,3-Dichloropropene	ug/L	<0.30	<0.30	<0.30	<0.30	0.30	7391553
trans-1,3-Dichloropropene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	7391553
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Ethylene Dibromide	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Hexane	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7391553
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	7391553
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	<10	<10	<10	10	7391553
Methyl Isobutyl Ketone	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7391553
Methyl t-butyl ether (MTBE)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
Styrene	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
1,1,1,2-Tetrachloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
1,1,2,2-Tetrachloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
Tetrachloroethylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Toluene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (WATER)

BV Labs ID		PTP792	PTP793	PTP794	PTP795		
Sampling Date		2021/06/04 12:50	2021/06/04 13:15	2021/06/04 14:30	2021/06/04 13:50		
COC Number		827579-01-01	827579-01-01	827579-01-01	827579-01-01		
	UNITS	**MW01**	**MW02**	**MW03**	**MW103**	**RDL**	**QC Batch**
1,1,1-Trichloroethane	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
1,1,2-Trichloroethane	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
Trichloroethylene	ug/L	0.59	0.61	0.72	0.61	0.20	7391553
Trichlorofluoromethane (FREON 11)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7391553
Vinyl Chloride	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
p+m-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
Total Xylenes	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7391553
F1 (C6-C10)	ug/L	<25	<25	<25	<25	25	7391553
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	25	7391553
F2-F4 Hydrocarbons							
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	7393482
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	7393482
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	7393482
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes		7393482
Surrogate Recovery (%)							
o-Terphenyl	%	92	92	92	90		7393482
4-Bromofluorobenzene	%	88	90	86	89		7391553
D4-1,2-Dichloroethane	%	112	114	109	113		7391553
D8-Toluene	%	92	92	94	92		7391553

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

TEST SUMMARY

BV Labs ID: PTP792
Sample ID: MW01
Matrix: Water

Collected: 2021/06/04
Shipped:
Received: 2021/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7392762	N/A	2021/06/08	Automated Statchk
1,3-Dichloropropene Sum	CALC	7394075	N/A	2021/06/08	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7393482	2021/06/07	2021/06/08	(Kent) Maolin Li
Dissolved Metals by ICPMS	ICP/MS	7394667	N/A	2021/06/08	Arefa Dabhad
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7393476	2021/06/07	2021/06/08	Mitesh Raj
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7391553	N/A	2021/06/08	Yang (Philip) Yu

BV Labs ID: PTP792 Dup
Sample ID: MW01
Matrix: Water

Collected: 2021/06/04
Shipped:
Received: 2021/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	7394667	N/A	2021/06/08	Arefa Dabhad

BV Labs ID: PTP793
Sample ID: MW02
Matrix: Water

Collected: 2021/06/04
Shipped:
Received: 2021/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7392762	N/A	2021/06/08	Automated Statchk
1,3-Dichloropropene Sum	CALC	7394075	N/A	2021/06/08	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7393482	2021/06/07	2021/06/08	(Kent) Maolin Li
Dissolved Metals by ICPMS	ICP/MS	7394667	N/A	2021/06/08	Arefa Dabhad
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7393476	2021/06/07	2021/06/08	Mitesh Raj
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7391553	N/A	2021/06/08	Yang (Philip) Yu

BV Labs ID: PTP794
Sample ID: MW03
Matrix: Water

Collected: 2021/06/04
Shipped:
Received: 2021/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7392762	N/A	2021/06/08	Automated Statchk
1,3-Dichloropropene Sum	CALC	7394075	N/A	2021/06/08	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7393482	2021/06/07	2021/06/08	(Kent) Maolin Li
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7393476	2021/06/07	2021/06/08	Mitesh Raj
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7391553	N/A	2021/06/08	Yang (Philip) Yu

BV Labs ID: PTP795
Sample ID: MW103
Matrix: Water

Collected: 2021/06/04
Shipped:
Received: 2021/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7392762	N/A	2021/06/08	Automated Statchk
1,3-Dichloropropene Sum	CALC	7394075	N/A	2021/06/08	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7393482	2021/06/07	2021/06/08	(Kent) Maolin Li
Dissolved Metals by ICPMS	ICP/MS	7394667	N/A	2021/06/08	Arefa Dabhad

TEST SUMMARY

BV Labs ID: PTP795
Sample ID: MW103
Matrix: Water

Collected: 2021/06/04
Shipped:
Received: 2021/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7393476	2021/06/07	2021/06/08	Mitesh Raj
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7391553	N/A	2021/06/08	Yang (Philip) Yu

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.7°C

All 40 ml vials for F1BTEX and VOC analyses contained visible sediment.
All 100 ml amber glass bottles for F2-F4 and PAH analyses contained visible sediment, which was included in the extraction.
All 120mL plastic bottle for dissolved metals analysis contained visible sediment.

Results relate only to the items tested.

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
7391553	4-Bromofluorobenzene	2021/06/08	101	70 - 130	103	70 - 130	92	%		
7391553	D4-1,2-Dichloroethane	2021/06/08	101	70 - 130	101	70 - 130	103	%		
7391553	D8-Toluene	2021/06/08	108	70 - 130	106	70 - 130	94	%		
7393476	D10-Anthracene	2021/06/08	114	50 - 130	127	50 - 130	121	%		
7393476	D14-Terphenyl (FS)	2021/06/08	100	50 - 130	111	50 - 130	107	%		
7393476	D8-Acenaphthylene	2021/06/08	101	50 - 130	111	50 - 130	106	%		
7393482	o-Terphenyl	2021/06/08	92	60 - 130	92	60 - 130	92	%		
7391553	1,1,1,2-Tetrachloroethane	2021/06/08	94	70 - 130	89	70 - 130	<0.50	ug/L	NC	30
7391553	1,1,1-Trichloroethane	2021/06/08	102	70 - 130	96	70 - 130	<0.20	ug/L	NC	30
7391553	1,1,2,2-Tetrachloroethane	2021/06/08	84	70 - 130	84	70 - 130	<0.50	ug/L	NC	30
7391553	1,1,2-Trichloroethane	2021/06/08	97	70 - 130	92	70 - 130	<0.50	ug/L	NC	30
7391553	1,1-Dichloroethane	2021/06/08	93	70 - 130	89	70 - 130	<0.20	ug/L	NC	30
7391553	1,1-Dichloroethylene	2021/06/08	100	70 - 130	94	70 - 130	<0.20	ug/L	NC	30
7391553	1,2-Dichlorobenzene	2021/06/08	90	70 - 130	85	70 - 130	<0.50	ug/L	NC	30
7391553	1,2-Dichloroethane	2021/06/08	93	70 - 130	89	70 - 130	<0.50	ug/L	NC	30
7391553	1,2-Dichloropropane	2021/06/08	95	70 - 130	90	70 - 130	<0.20	ug/L	NC	30
7391553	1,3-Dichlorobenzene	2021/06/08	94	70 - 130	87	70 - 130	<0.50	ug/L	NC	30
7391553	1,4-Dichlorobenzene	2021/06/08	112	70 - 130	103	70 - 130	<0.50	ug/L	NC	30
7391553	Acetone (2-Propanone)	2021/06/08	92	60 - 140	94	60 - 140	<10	ug/L	10	30
7391553	Benzene	2021/06/08	91	70 - 130	86	70 - 130	<0.20	ug/L	NC	30
7391553	Bromodichloromethane	2021/06/08	95	70 - 130	92	70 - 130	<0.50	ug/L	NC	30
7391553	Bromoform	2021/06/08	84	70 - 130	84	70 - 130	<1.0	ug/L	NC	30
7391553	Bromomethane	2021/06/08	85	60 - 140	87	60 - 140	<0.50	ug/L	NC	30
7391553	Carbon Tetrachloride	2021/06/08	98	70 - 130	93	70 - 130	<0.20	ug/L	NC	30
7391553	Chlorobenzene	2021/06/08	94	70 - 130	88	70 - 130	<0.20	ug/L	NC	30
7391553	Chloroform	2021/06/08	95	70 - 130	90	70 - 130	<0.20	ug/L	NC	30
7391553	cis-1,2-Dichloroethylene	2021/06/08	97	70 - 130	92	70 - 130	<0.50	ug/L	NC	30
7391553	cis-1,3-Dichloropropene	2021/06/08	88	70 - 130	89	70 - 130	<0.30	ug/L	NC	30
7391553	Dibromochloromethane	2021/06/08	81	70 - 130	100	70 - 130	<0.50	ug/L	NC	30
7391553	Dichlorodifluoromethane (FREON 12)	2021/06/08	82	60 - 140	94	60 - 140	<1.0	ug/L	NC	30
7391553	Ethylbenzene	2021/06/08	95	70 - 130	88	70 - 130	<0.20	ug/L	NC	30

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7391553	Ethylene Dibromide	2021/06/08	87	70 - 130	84	70 - 130	<0.20	ug/L	NC	30
7391553	F1 (C6-C10) - BTEX	2021/06/08					<25	ug/L	NC	30
7391553	F1 (C6-C10)	2021/06/08	95	60 - 140	95	60 - 140	<25	ug/L	NC	30
7391553	Hexane	2021/06/08	107	70 - 130	101	70 - 130	<1.0	ug/L	NC	30
7391553	Methyl Ethyl Ketone (2-Butanone)	2021/06/08	99	60 - 140	104	60 - 140	<10	ug/L	NC	30
7391553	Methyl Isobutyl Ketone	2021/06/08	96	70 - 130	102	70 - 130	<5.0	ug/L	NC	30
7391553	Methyl t-butyl ether (MTBE)	2021/06/08	89	70 - 130	88	70 - 130	<0.50	ug/L	NC	30
7391553	Methylene Chloride(Dichloromethane)	2021/06/08	111	70 - 130	105	70 - 130	<2.0	ug/L	NC	30
7391553	o-Xylene	2021/06/08	96	70 - 130	89	70 - 130	<0.20	ug/L	NC	30
7391553	p+m-Xylene	2021/06/08	99	70 - 130	92	70 - 130	<0.20	ug/L	NC	30
7391553	Styrene	2021/06/08	103	70 - 130	98	70 - 130	<0.50	ug/L	NC	30
7391553	Tetrachloroethylene	2021/06/08	92	70 - 130	85	70 - 130	<0.20	ug/L	NC	30
7391553	Toluene	2021/06/08	98	70 - 130	91	70 - 130	<0.20	ug/L	NC	30
7391553	Total Xylenes	2021/06/08					<0.20	ug/L	NC	30
7391553	trans-1,2-Dichloroethylene	2021/06/08	95	70 - 130	90	70 - 130	<0.50	ug/L	NC	30
7391553	trans-1,3-Dichloropropene	2021/06/08	90	70 - 130	93	70 - 130	<0.40	ug/L	NC	30
7391553	Trichloroethylene	2021/06/08	98	70 - 130	93	70 - 130	<0.20	ug/L	NC	30
7391553	Trichlorofluoromethane (FREON 11)	2021/06/08	96	70 - 130	92	70 - 130	<0.50	ug/L	NC	30
7391553	Vinyl Chloride	2021/06/08	114	70 - 130	111	70 - 130	<0.20	ug/L	NC	30
7393476	1-Methylnaphthalene	2021/06/08	90	50 - 130	90	50 - 130	<0.050	ug/L	0.78	30
7393476	2-Methylnaphthalene	2021/06/08	90	50 - 130	88	50 - 130	<0.050	ug/L	1.9	30
7393476	Acenaphthene	2021/06/08	103	50 - 130	104	50 - 130	<0.050	ug/L	0	30
7393476	Acenaphthylene	2021/06/08	103	50 - 130	102	50 - 130	<0.050	ug/L	NC	30
7393476	Anthracene	2021/06/08	108	50 - 130	109	50 - 130	<0.050	ug/L	NC	30
7393476	Benzo(a)anthracene	2021/06/08	103	50 - 130	107	50 - 130	<0.050	ug/L	NC	30
7393476	Benzo(a)pyrene	2021/06/08	85	50 - 130	89	50 - 130	<0.0090	ug/L	NC	30
7393476	Benzo(b/j)fluoranthene	2021/06/08	94	50 - 130	99	50 - 130	<0.050	ug/L	NC	30
7393476	Benzo(g,h,i)perylene	2021/06/08	98	50 - 130	101	50 - 130	<0.050	ug/L	NC	30
7393476	Benzo(k)fluoranthene	2021/06/08	86	50 - 130	91	50 - 130	<0.050	ug/L	NC	30
7393476	Chrysene	2021/06/08	103	50 - 130	107	50 - 130	<0.050	ug/L	NC	30
7393476	Dibenzo(a,h)anthracene	2021/06/08	92	50 - 130	95	50 - 130	<0.050	ug/L	NC	30

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7393476	Fluoranthene	2021/06/08	110	50 - 130	111	50 - 130	<0.050	ug/L	NC	30
7393476	Fluorene	2021/06/08	107	50 - 130	105	50 - 130	<0.050	ug/L	8.9	30
7393476	Indeno(1,2,3-cd)pyrene	2021/06/08	108	50 - 130	111	50 - 130	<0.050	ug/L	NC	30
7393476	Naphthalene	2021/06/08	93	50 - 130	94	50 - 130	<0.050	ug/L	1.1	30
7393476	Phenanthrene	2021/06/08	109	50 - 130	109	50 - 130	<0.030	ug/L	6.5	30
7393476	Pyrene	2021/06/08	108	50 - 130	109	50 - 130	<0.050	ug/L	NC	30
7393482	F2 (C10-C16 Hydrocarbons)	2021/06/08	83	60 - 130	101	60 - 130	<100	ug/L	NC	30
7393482	F3 (C16-C34 Hydrocarbons)	2021/06/08	81	60 - 130	101	60 - 130	<200	ug/L	NC	30
7393482	F4 (C34-C50 Hydrocarbons)	2021/06/08	83	60 - 130	106	60 - 130	<200	ug/L	NC	30
7394667	Dissolved Lead (Pb)	2021/06/08	97	80 - 120	101	80 - 120	<0.50	ug/L	NC	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

07-Jun-21 16:55
Antonella Brasil
C1F4823
VBV ENV-1086

Maxxam Analytics
CAM FCD-01013/5
Page 1 of 1

Presence of Visible Particulate/Sediment

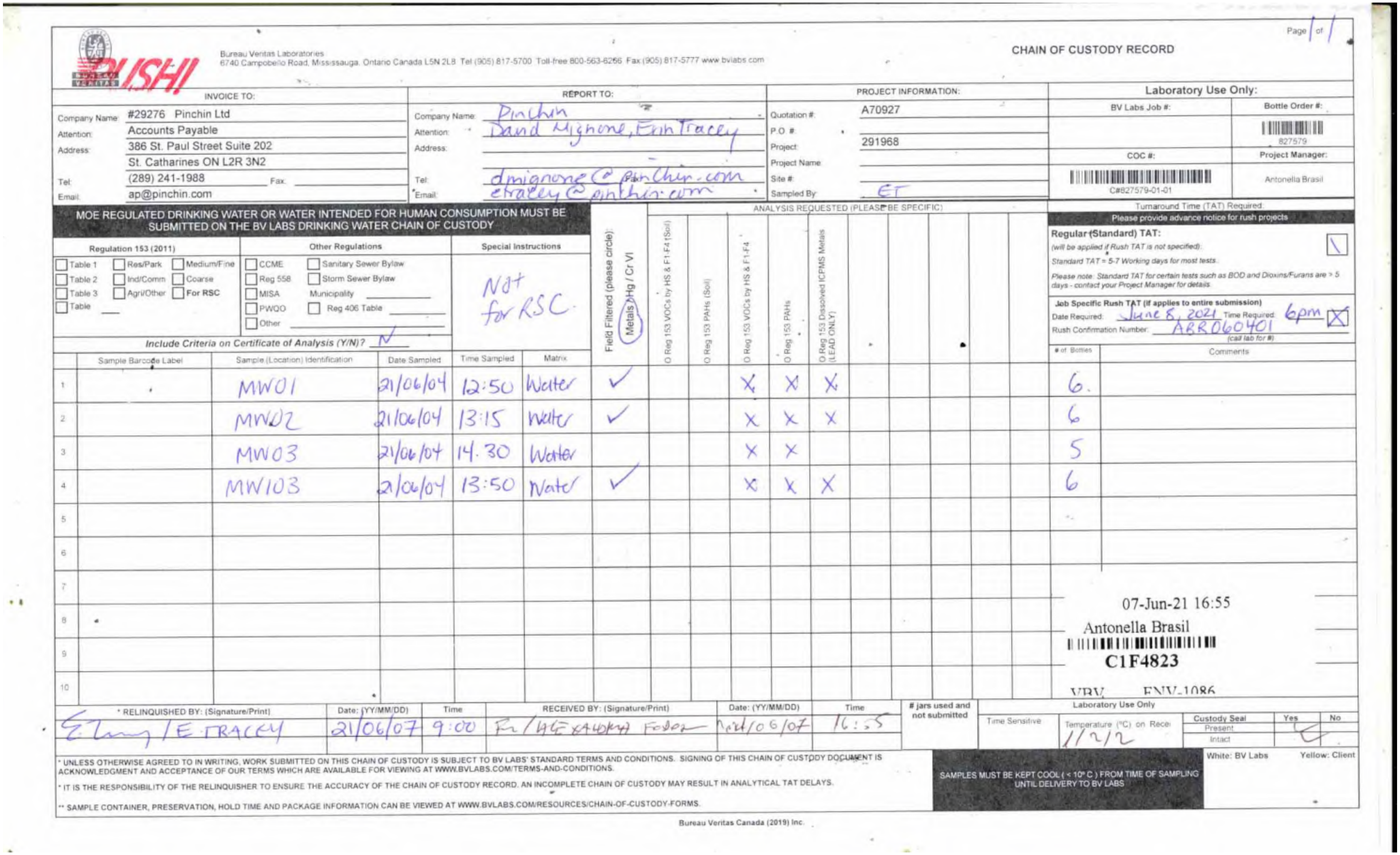
When there is >1cm of visible particulate/sediment, the amount will be recorded in the field below

			Bottle Types																											
			Inorganics					Organics											Hydrocarbons							Volatiles				Other
	Sample ID	All	CrVI	CN	General	Hg	Metals (Diss.)	Organic 1 of 2	Organic 2 of 2	PCB 1 of 2	PCB 2 of 2	Pest/ Herb 1 of 2	Pest/ Herb 2 of 2	SVOC/ ABN 1 of 2	SVOC/ ABN 2 of 2	PAH 1 of 2	PAH 2 of 2	Dioxin /Furan	F1 Vial 1	F1 Vial 2	F1 Vial 3	F1 Vial 4	F2-F4 1 of 2	F2-F4 2 of 2	F4G	VOC Vial 1	VOC Vial 2	VOC Vial 3	VOC Vial 4	
1	mw01																										TS	TS	TS	
2	mw02																										TS	TS	TS	
3	mw03																										TS	TS	TS	
4	mw 103																										TS	TS	TS	
5																														
6																														
7																														
8																														
9																														
10																														

Comments:

Legend:	
P	Suspended Particulate
TS	Trace Settled Sediment (just covers bottom of container or less)
S	Sediment greater than (>) Trace, but less than (<) 1 cm

Recorded By: (signature/print) VIDHI BHATIA



RUSH!

Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel (905) 817-5700 Toll-free 800-563-6266 Fax (905) 817-5777 www bvlabs com

CHAIN OF COUSTODY RECORD

Page 1 of 1

INVOICE TO:

Company Name: #29276 Pinchin Ltd
Attention: Accounts Payable
Address: 386 St. Paul Street Suite 202
St. Catharines ON L2R 3N2
Tel: (289) 241-1988 Fax:
Email: ap@pinchin.com

REPORT TO:

Company Name: Pinchin
Attention: David Mignone, Erin Tracey
Address:
Tel: dmignone@pinchin.com
Email: etracey@pinchin.com

PROJECT INFORMATION:

Quotation #: A70927
P.O. #:
Project: 291968
Project Name:
Site #:
Sampled By: ET

Laboratory Use Only:

BV Labs Job #:
Bottle Order #: 827579
COC #: C#827579-01-01
Project Manager: Antonella Brasil

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)

☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ **For RSC**
☐ Table ___

Other Regulations

☐ CCME ☐ Sanitary Sewer Bylaw
☐ Reg 558 ☐ Storm Sewer Bylaw
☐ MISA Municipality ______
☐ PWQO ☐ Reg 406 Table ______
☐ Other ______

Special Instructions

Not for RSC.

Include Criteria on Certificate of Analysis (Y/N)? N

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☐
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission) ☒
Date Required: June 8, 2021 Time Required: 6pm
Rush Confirmation Number: ABR060401 *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): [✓ Metals] / Hg / Cr VI	O Reg 153 VOCs by HS & F1-F4 (Soil)	O Reg 153 PAHs (Soil)	O Reg 153 VOCs by HS & F1-F4	O Reg 153 PAHs	O Reg 153 Dissolved ICPMS Metals (LEAD ONLY)						# of Bottles	Comments
1		MW01	21/06/04	12:50	Water	✓			X	X	X						6.	
2		MW02	21/06/04	13:15	Water	✓			X	X	X						6	
3		MW03	21/06/04	14.30	Water				X	X							5	
4		MW103	21/06/04	13:50	Water	✓			X	X	X						6	
5																		
6																		
7																		
8																		
9																		
10																		

07-Jun-21 16:55
Antonella Brasil
C1F4823
VBV ENV-1086

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
E. Tracey / E. TRACEY	21/06/07	9:00	Fr / ALEXANDRA Fodor	21/06/07	16:55	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	1/2/2	Present	✓	
		Intact	✓	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

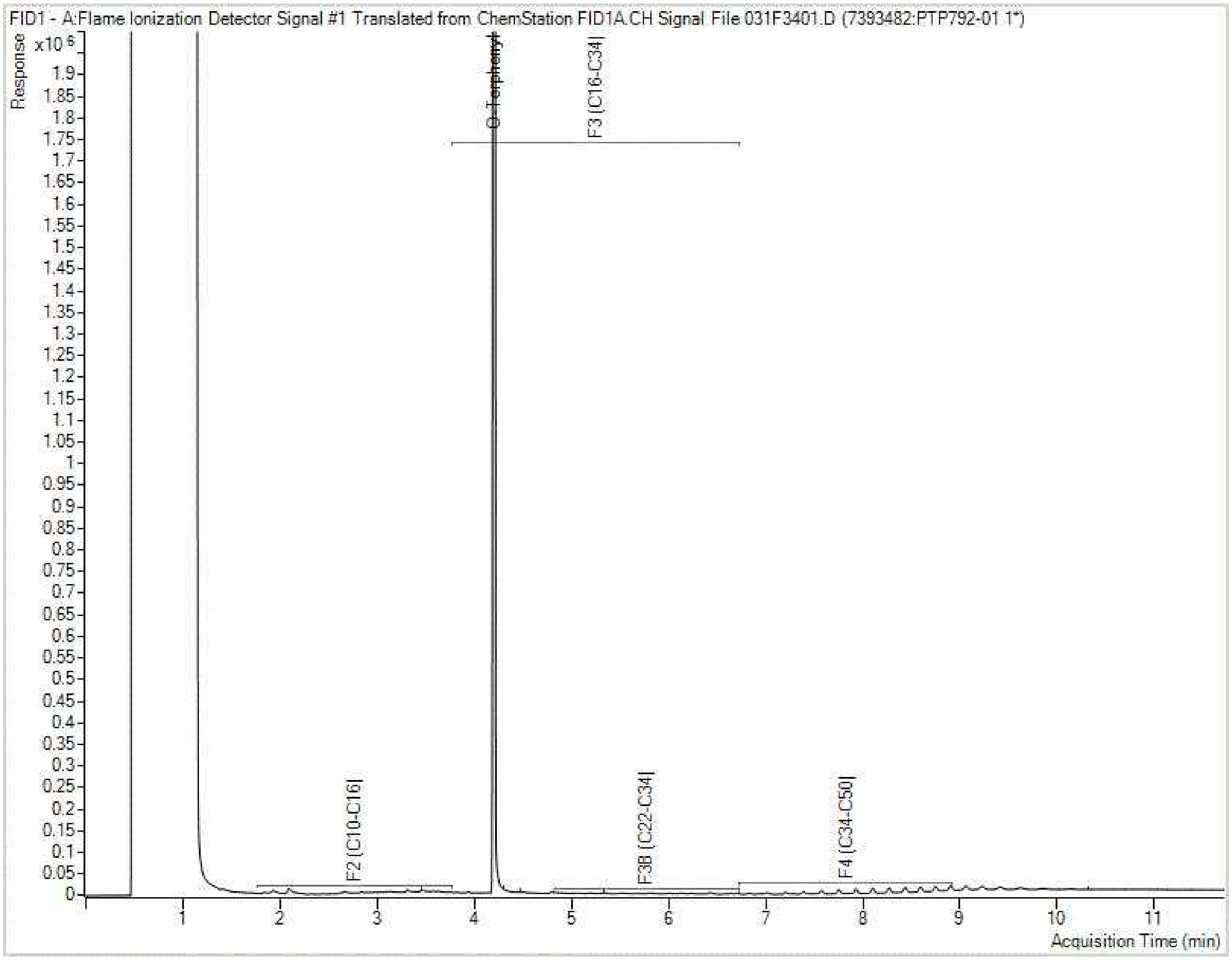
White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

BV Labs Job #: C1F4823
Report Date: 2021/06/08
BV Labs Sample: PTP792

Pinchin Ltd
Client Project #: 291968
Client ID: MW01

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

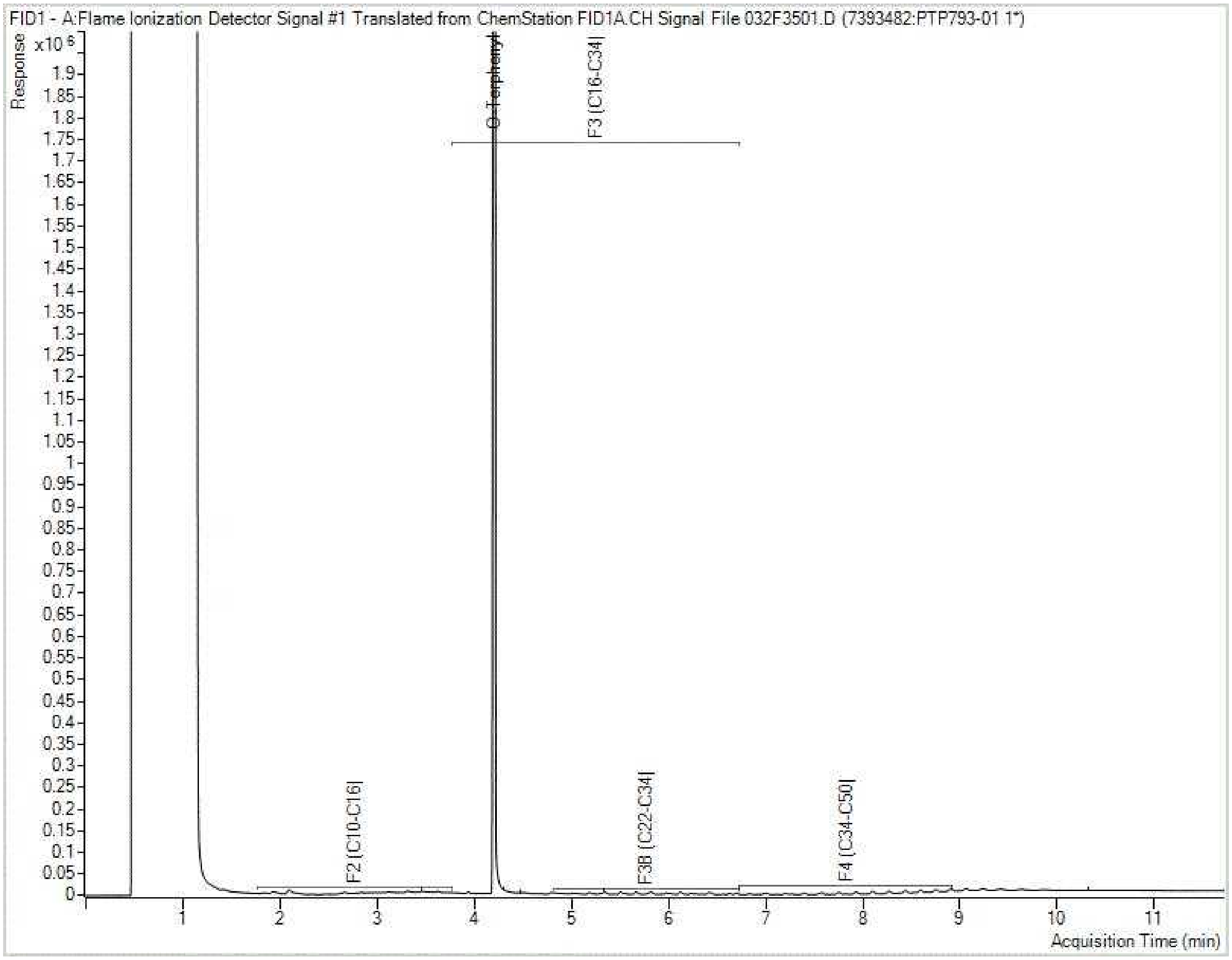


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1F4823
Report Date: 2021/06/08
BV Labs Sample: PTP793

Pinchin Ltd
Client Project #: 291968
Client ID: MW02

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

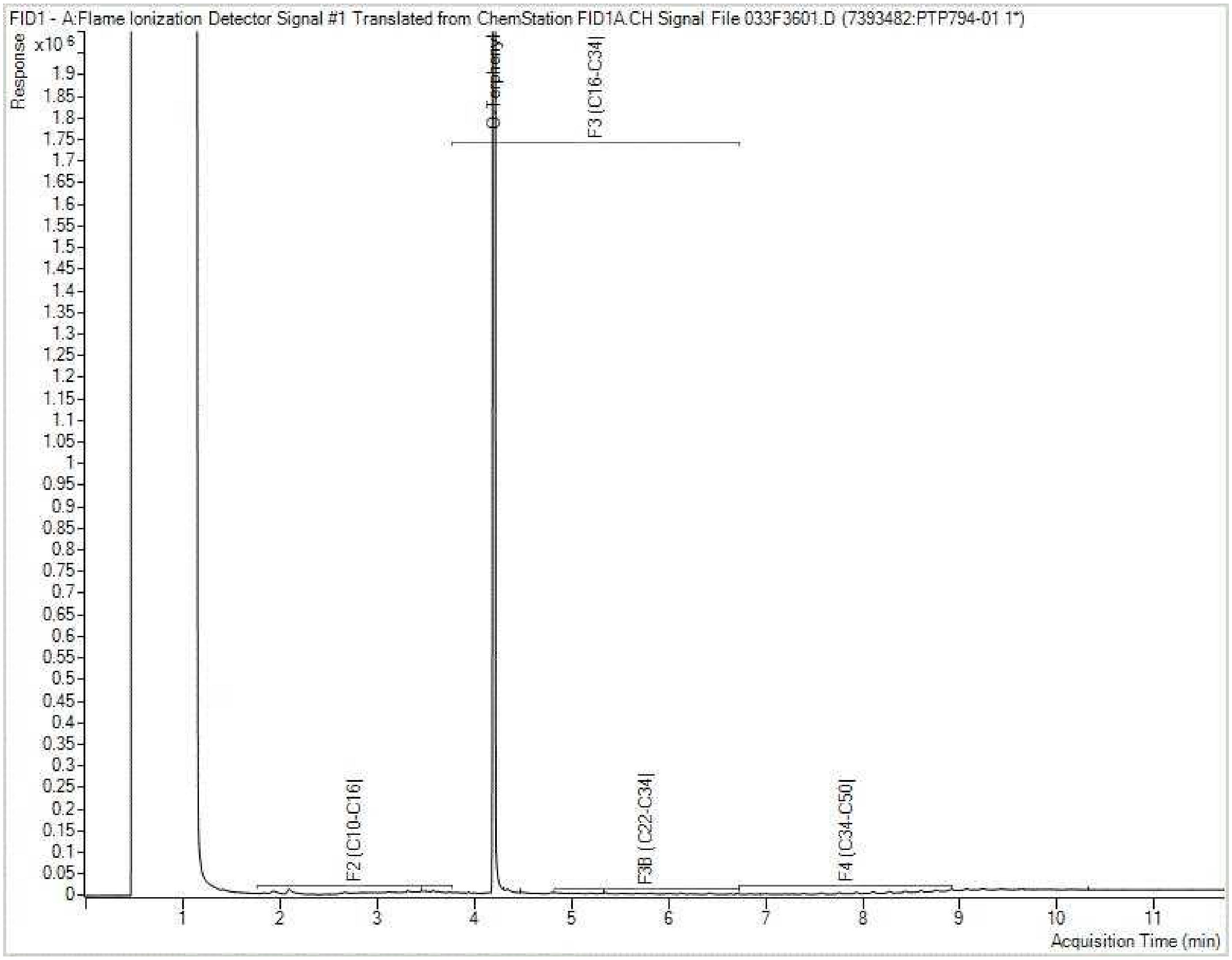


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

BV Labs Job #: C1F4823
Report Date: 2021/06/08
BV Labs Sample: PTP794

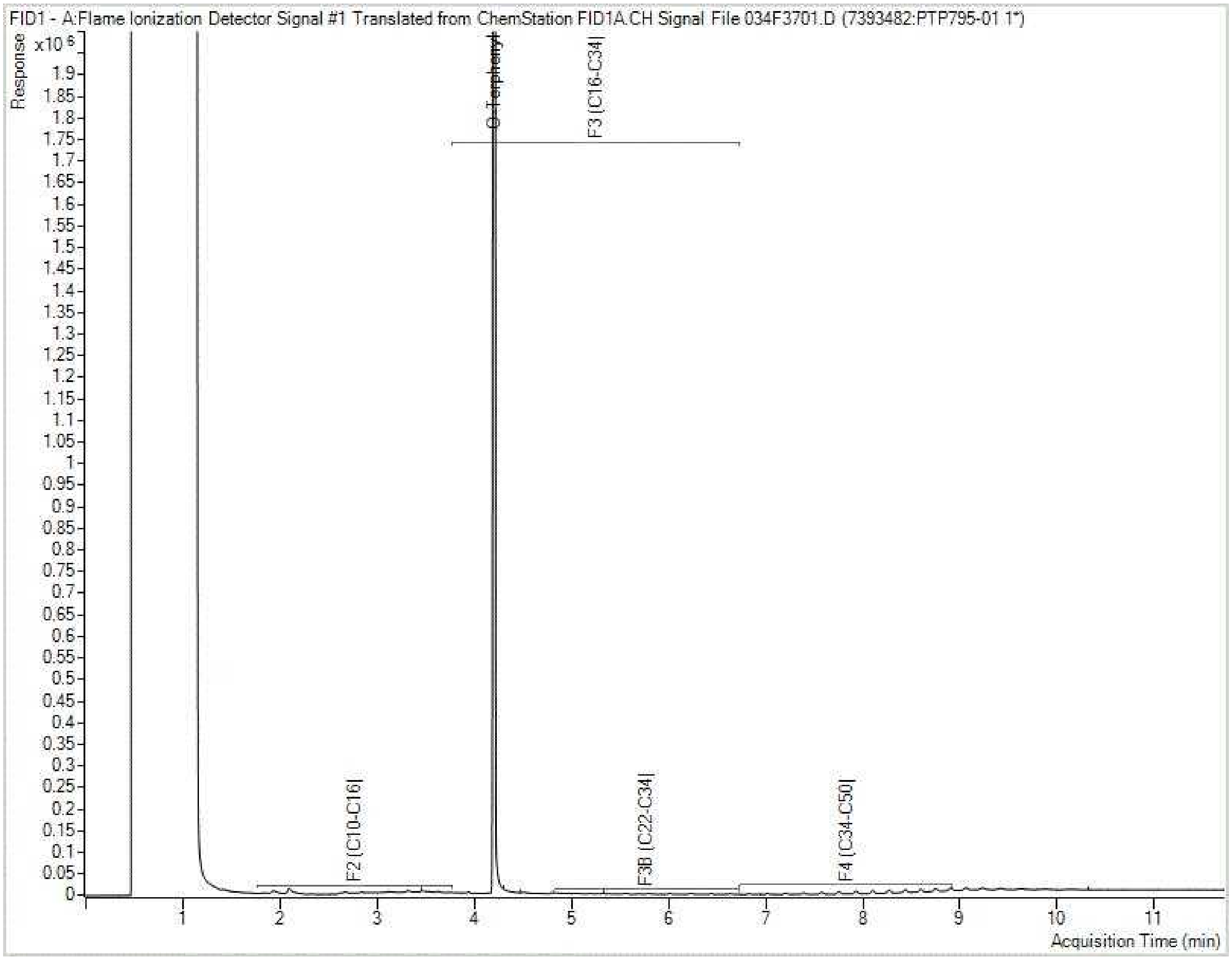
Pinchin Ltd
Client Project #: 291968
Client ID: MW03

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: 296202.001
Your C.O.C. #: 837213-01-01

Attention: David Mignone

Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2022/01/04
Report #: R6948411
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1Y4340
Received: 2021/12/09, 15:42

Sample Matrix: Soil
Samples Received: 11

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	4	N/A	2021/12/13	CAM SOP-00301	EPA 8270D m
Methylnaphthalene Sum	2	N/A	2021/12/21	CAM SOP-00301	EPA 8270D m
1,3-Dichloropropene Sum	1	N/A	2021/12/13		EPA 8260C m
1,3-Dichloropropene Sum	5	N/A	2021/12/14		EPA 8260C m
1,3-Dichloropropene Sum	1	N/A	2021/12/30		EPA 8260C m
Cyanide (WAD) in Leachates	1	N/A	2021/12/15	CAM SOP-00457	OMOE 3015 m
Petroleum Hydro. CCME F1 & BTEX in Soil (1)	2	N/A	2021/12/12	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (2)	8	2021/12/11	2021/12/12	CAM SOP-00316	CCME CWS m
Fluoride by ISE in Leachates	1	2021/12/14	2021/12/15	CAM SOP-00449	SM 23 4500-F- C m
Total Metals in TCLP Leachate by ICPMS	1	2021/12/14	2021/12/15	CAM SOP-00447	EPA 6020B m
Moisture	9	N/A	2021/12/11	CAM SOP-00445	Carter 2nd ed 51.2 m
Nitrate& Nitrite as Nitrogen in Leachate	1	N/A	2021/12/15	CAM SOP-00440	SM 23 4500-NO3I/NO2B
PAH Compounds in Leachate by GC/MS (SIM)	1	2021/12/14	2021/12/15	CAM SOP-00318	EPA 8270D m
PAH Compounds in Soil by GC/MS (SIM)	4	2021/12/11	2021/12/12	CAM SOP-00318	EPA 8270D m
PAH Compounds in Soil by GC/MS (SIM)	2	2021/12/18	2021/12/18	CAM SOP-00318	EPA 8270D m
Polychlorinated Biphenyl in Soil	3	2021/12/13	2021/12/14	CAM SOP-00309	EPA 8082A m
Polychlorinated Biphenyl in Leachate	1	2021/12/14	2021/12/14	CAM SOP-00309	EPA 8082A m
pH CaCl2 EXTRACT	4	2021/12/13	2021/12/13	CAM SOP-00413	EPA 9045 D m
TCLP - % Solids	1	2021/12/13	2021/12/14	CAM SOP-00401	EPA 1311 Update I m
TCLP - Extraction Fluid	1	N/A	2021/12/14	CAM SOP-00401	EPA 1311 Update I m
TCLP - Initial and final pH	1	N/A	2021/12/14	CAM SOP-00401	EPA 1311 Update I m
TCLP Zero Headspace Extraction	1	2021/12/13	2021/12/14	CAM SOP-00430	EPA 1311 m
Volatile Organic Compounds and F1 PHCs	6	N/A	2021/12/13	CAM SOP-00230	EPA 8260C m
VOCs in ZHE Leachates	1	2021/12/14	2021/12/14	CAM SOP-00228	EPA 8260C m
Volatile Organic Compounds in Soil	1	N/A	2021/12/15	CAM SOP-00228	EPA 8260C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

Your Project #: 296202.001
Your C.O.C. #: 837213-01-01

Attention: David Mignone

Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2022/01/04
Report #: R6948411
Version: 2 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1Y4340
Received: 2021/12/09, 15:42

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Antonella Brasil, Senior Project Manager
Email: Antonella.Brasil@bureauveritas.com
Phone# (905)817-5817
==
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

O.REG 153 PAHS (SOIL)

Bureau Veritas ID		RHO489	RHO490		RHO491	RHO492		
Sampling Date		2021/12/06 10:15	2021/12/06 14:00		2021/12/06 16:30	2021/12/06 15:30		
COC Number		837213-01-01	837213-01-01		837213-01-01	837213-01-01		
	UNITS	**MW101-7**	**MW102-3**	**QC Batch**	**BH103-1**	**BH104-3**	**RDL**	**QC Batch**
Calculated Parameters								
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	<0.0071	7718616	<0.0071	<0.0071	0.0071	7734792
Polyaromatic Hydrocarbons								
Acenaphthene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Acenaphthylene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Anthracene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Benzo(a)anthracene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Benzo(a)pyrene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Benzo(b/j)fluoranthene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Benzo(g,h,i)perylene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Benzo(k)fluoranthene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Chrysene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Dibenzo(a,h)anthracene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Fluoranthene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Fluorene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
1-Methylnaphthalene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
2-Methylnaphthalene	ug/g	<0.0050	<0.0050	7719714	0.0053	<0.0050	0.0050	7738076
Naphthalene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Phenanthrene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Pyrene	ug/g	<0.0050	<0.0050	7719714	<0.0050	<0.0050	0.0050	7738076
Surrogate Recovery (%)								
D10-Anthracene	%	113	109	7719714	93	94		7738076
D14-Terphenyl (FS)	%	97	100	7719714	102	104		7738076
D8-Acenaphthylene	%	77	80	7719714	91	89		7738076

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 PAHS (SOIL)

Bureau Veritas ID		RHO493	RHO494		
Sampling Date		2021/12/06 15:30	2021/12/06 15:45		
COC Number		837213-01-01	837213-01-01		
	UNITS	**DUP09**	**BH105-1**	**RDL**	**QC Batch**
Calculated Parameters					
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	<0.0071	0.0071	7718616
Polyaromatic Hydrocarbons					
Acenaphthene	ug/g	<0.0050	<0.0050	0.0050	7719714
Acenaphthylene	ug/g	<0.0050	<0.0050	0.0050	7719714
Anthracene	ug/g	<0.0050	<0.0050	0.0050	7719714
Benzo(a)anthracene	ug/g	<0.0050	<0.0050	0.0050	7719714
Benzo(a)pyrene	ug/g	<0.0050	<0.0050	0.0050	7719714
Benzo(b/j)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	7719714
Benzo(g,h,i)perylene	ug/g	<0.0050	<0.0050	0.0050	7719714
Benzo(k)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	7719714
Chrysene	ug/g	<0.0050	<0.0050	0.0050	7719714
Dibenzo(a,h)anthracene	ug/g	<0.0050	<0.0050	0.0050	7719714
Fluoranthene	ug/g	<0.0050	<0.0050	0.0050	7719714
Fluorene	ug/g	<0.0050	<0.0050	0.0050	7719714
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	<0.0050	0.0050	7719714
1-Methylnaphthalene	ug/g	<0.0050	<0.0050	0.0050	7719714
2-Methylnaphthalene	ug/g	<0.0050	<0.0050	0.0050	7719714
Naphthalene	ug/g	<0.0050	<0.0050	0.0050	7719714
Phenanthrene	ug/g	<0.0050	<0.0050	0.0050	7719714
Pyrene	ug/g	<0.0050	<0.0050	0.0050	7719714
Surrogate Recovery (%)					
D10-Anthracene	%	110	106		7719714
D14-Terphenyl (FS)	%	95	92		7719714
D8-Acenaphthylene	%	76	78		7719714

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 PCBS (SOIL)

Bureau Veritas ID		RHO488	RHO495			RHO496			RHO496		
Sampling Date		2021/12/06 13:00	2021/12/07 08:30			2021/12/07 08:30			2021/12/07 08:30		
COC Number		837213-01-01	837213-01-01			837213-01-01			837213-01-01		
	UNITS	**SS01**	**BH106-1**	**RDL**	**QC Batch**	**DUP16**	**RDL**	**QC Batch**	**DUP16 Lab-Dup**	**RDL**	**QC Batch**
Inorganics											
Moisture	%					18	1.0	7719855			
PCBs											
Aroclor 1242	ug/g	<0.010	<0.010	0.010	7722521	<0.010	0.010	7722521	<0.010	0.010	7722521
Aroclor 1248	ug/g	<0.010	<0.010	0.010	7722521	<0.010	0.010	7722521	<0.010	0.010	7722521
Aroclor 1254	ug/g	<0.010	<0.010	0.010	7722521	0.014	0.010	7722521	<0.010	0.010	7722521
Aroclor 1260	ug/g	<0.010	<0.010	0.010	7722521	<0.010	0.010	7722521	<0.010	0.010	7722521
Total PCB	ug/g	<0.010	<0.010	0.010	7722521	0.014	0.010	7722521	<0.010	0.010	7722521
Surrogate Recovery (%)											
Decachlorobiphenyl	%	100	105		7722521	97		7722521	94		7722521

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 PHCS, BTEX/F1-F4 (SOIL)

Bureau Veritas ID		RHO488	RHO495		
Sampling Date		2021/12/06 13:00	2021/12/07 08:30		
COC Number		837213-01-01	837213-01-01		
	UNITS	**SS01**	**BH106-1**	**RDL**	**QC Batch**
Inorganics					
Moisture	%	23	19	1.0	7719644
BTEX & F1 Hydrocarbons					
F1 (C6-C10)	ug/g	<10	<10	10	7720566
F1 (C6-C10) - BTEX	ug/g	<10	<10	10	7720566
F2-F4 Hydrocarbons					
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	10	7719627
F3 (C16-C34 Hydrocarbons)	ug/g	55	<50	50	7719627
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	50	7719627
Reached Baseline at C50	ug/g	Yes	Yes		7719627
Surrogate Recovery (%)					
1,4-Difluorobenzene	%	108	110		7720566
4-Bromofluorobenzene	%	88	80		7720566
D10-o-Xylene	%	116	106		7720566
D4-1,2-Dichloroethane	%	103	105		7720566
o-Terphenyl	%	106	107		7719627

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		RHO489			RHO489			RHO490		
Sampling Date		2021/12/06 10:15			2021/12/06 10:15			2021/12/06 14:00		
COC Number		837213-01-01			837213-01-01			837213-01-01		
	UNITS	**MW101-7**	**RDL**	**QC Batch**	**MW101-7 Lab-Dup**	**RDL**	**QC Batch**	**MW102-3**	**RDL**	**QC Batch**
Inorganics										
Moisture	%	18	1.0	7719644	18	1.0	7719644	16	1.0	7719644
Calculated Parameters										
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	0.050	7718939				<0.050	0.050	7718939
Volatile Organics										
Acetone (2-Propanone)	ug/g	<0.49	0.49	7720335	<0.49	0.49	7720335	<0.49	0.49	7720335
Benzene	ug/g	<0.0060	0.0060	7720335	<0.0060	0.0060	7720335	<0.0060	0.0060	7720335
Bromodichloromethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Bromoform	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Bromomethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Carbon Tetrachloride	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Chlorobenzene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Chloroform	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Dibromochloromethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,2-Dichlorobenzene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,3-Dichlorobenzene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,4-Dichlorobenzene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Dichlorodifluoromethane (FREON 12)	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,1-Dichloroethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,2-Dichloroethane	ug/g	<0.049	0.049	7720335	<0.049	0.049	7720335	<0.049	0.049	7720335
1,1-Dichloroethylene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
cis-1,2-Dichloroethylene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
trans-1,2-Dichloroethylene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,2-Dichloropropane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
cis-1,3-Dichloropropene	ug/g	<0.030	0.030	7720335	<0.030	0.030	7720335	<0.030	0.030	7720335
trans-1,3-Dichloropropene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Ethylbenzene	ug/g	<0.010	0.010	7720335	<0.010	0.010	7720335	<0.010	0.010	7720335
Ethylene Dibromide	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Hexane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Methylene Chloride(Dichloromethane)	ug/g	<0.049	0.049	7720335	<0.049	0.049	7720335	<0.049	0.049	7720335
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.40	0.40	7720335	<0.40	0.40	7720335	<0.40	0.40	7720335
Methyl Isobutyl Ketone	ug/g	<0.40	0.40	7720335	<0.40	0.40	7720335	<0.40	0.40	7720335
Methyl t-butyl ether (MTBE)	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Styrene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,1,1,2-Tetrachloroethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		RHO489			RHO489			RHO490		
Sampling Date		2021/12/06 10:15			2021/12/06 10:15			2021/12/06 14:00		
COC Number		837213-01-01			837213-01-01			837213-01-01		
	UNITS	**MW101-7**	**RDL**	**QC Batch**	**MW101-7 Lab-Dup**	**RDL**	**QC Batch**	**MW102-3**	**RDL**	**QC Batch**
1,1,2,2-Tetrachloroethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Tetrachloroethylene	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Toluene	ug/g	<0.020	0.020	7720335	<0.020	0.020	7720335	<0.020	0.020	7720335
1,1,1-Trichloroethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
1,1,2-Trichloroethane	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Trichloroethylene	ug/g	<0.010	0.010	7720335	<0.010	0.010	7720335	<0.010	0.010	7720335
Trichlorofluoromethane (FREON 11)	ug/g	<0.040	0.040	7720335	<0.040	0.040	7720335	<0.040	0.040	7720335
Vinyl Chloride	ug/g	<0.019	0.019	7720335	<0.019	0.019	7720335	<0.019	0.019	7720335
p+m-Xylene	ug/g	<0.020	0.020	7720335	<0.020	0.020	7720335	<0.020	0.020	7720335
o-Xylene	ug/g	<0.020	0.020	7720335	<0.020	0.020	7720335	<0.020	0.020	7720335
Total Xylenes	ug/g	<0.020	0.020	7720335	<0.020	0.020	7720335	<0.020	0.020	7720335
F1 (C6-C10)	ug/g	<10	10	7720335	<10	10	7720335	<10	10	7720335
F1 (C6-C10) - BTEX	ug/g	<10	10	7720335	<10	10	7720335	<10	10	7720335
F2-F4 Hydrocarbons										
F2 (C10-C16 Hydrocarbons)	ug/g	<10	10	7719627				<10	10	7719627
F3 (C16-C34 Hydrocarbons)	ug/g	<50	50	7719627				<50	50	7719627
F4 (C34-C50 Hydrocarbons)	ug/g	<50	50	7719627				<50	50	7719627
Reached Baseline at C50	ug/g	Yes		7719627				Yes		7719627
Surrogate Recovery (%)										
o-Terphenyl	%	110		7719627				112		7719627
4-Bromofluorobenzene	%	92		7720335	91		7720335	91		7720335
D10-o-Xylene	%	95		7720335	95		7720335	92		7720335
D4-1,2-Dichloroethane	%	104		7720335	101		7720335	115		7720335
D8-Toluene	%	100		7720335	102		7720335	99		7720335

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		RHO491	RHO492		RHO493		RHO494		
Sampling Date		2021/12/06 16:30	2021/12/06 15:30		2021/12/06 15:30		2021/12/06 15:45		
COC Number		837213-01-01	837213-01-01		837213-01-01		837213-01-01		
	UNITS	**BH103-1**	**BH104-3**	**RDL**	**DUP09**	**RDL**	**BH105-1**	**RDL**	**QC Batch**
Inorganics									
Moisture	%	7.7	16	1.0	17	1.0	18	1.0	7719644
Calculated Parameters									
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	<0.050	0.050	<0.10	0.10	<0.050	0.050	7718939
Volatile Organics									
Acetone (2-Propanone)	ug/g	<0.49	<0.49	0.49	<0.98	0.98	<0.49	0.49	7720335
Benzene	ug/g	0.0062	<0.0060	0.0060	<0.012	0.012	<0.0060	0.0060	7720335
Bromodichloromethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Bromoform	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Bromomethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Carbon Tetrachloride	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Chlorobenzene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Chloroform	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Dibromochloromethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,2-Dichlorobenzene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,3-Dichlorobenzene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,4-Dichlorobenzene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Dichlorodifluoromethane (FREON 12)	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,1-Dichloroethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,2-Dichloroethane	ug/g	<0.049	<0.049	0.049	<0.098	0.098	<0.049	0.049	7720335
1,1-Dichloroethylene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
cis-1,2-Dichloroethylene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
trans-1,2-Dichloroethylene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,2-Dichloropropane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
cis-1,3-Dichloropropene	ug/g	<0.030	<0.030	0.030	<0.060	0.060	<0.030	0.030	7720335
trans-1,3-Dichloropropene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Ethylbenzene	ug/g	<0.010	<0.010	0.010	<0.020	0.020	<0.010	0.010	7720335
Ethylene Dibromide	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Hexane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Methylene Chloride(Dichloromethane)	ug/g	<0.049	<0.049	0.049	<0.098	0.098	<0.049	0.049	7720335
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.40	<0.40	0.40	<0.80	0.80	<0.40	0.40	7720335
Methyl Isobutyl Ketone	ug/g	<0.40	<0.40	0.40	<0.80	0.80	<0.40	0.40	7720335
Methyl t-butyl ether (MTBE)	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Styrene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,1,1,2-Tetrachloroethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,1,2,2-Tetrachloroethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		RHO491	RHO492		RHO493		RHO494		
Sampling Date		2021/12/06 16:30	2021/12/06 15:30		2021/12/06 15:30		2021/12/06 15:45		
COC Number		837213-01-01	837213-01-01		837213-01-01		837213-01-01		
	UNITS	**BH103-1**	**BH104-3**	**RDL**	**DUP09**	**RDL**	**BH105-1**	**RDL**	**QC Batch**
Tetrachloroethylene	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Toluene	ug/g	<0.020	<0.020	0.020	<0.040	0.040	<0.020	0.020	7720335
1,1,1-Trichloroethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
1,1,2-Trichloroethane	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Trichloroethylene	ug/g	<0.010	<0.010	0.010	<0.020	0.020	<0.010	0.010	7720335
Trichlorofluoromethane (FREON 11)	ug/g	<0.040	<0.040	0.040	<0.080	0.080	<0.040	0.040	7720335
Vinyl Chloride	ug/g	<0.019	<0.019	0.019	<0.038	0.038	<0.019	0.019	7720335
p+m-Xylene	ug/g	<0.020	<0.020	0.020	<0.040	0.040	<0.020	0.020	7720335
o-Xylene	ug/g	<0.020	<0.020	0.020	<0.040	0.040	<0.020	0.020	7720335
Total Xylenes	ug/g	<0.020	<0.020	0.020	<0.040	0.040	<0.020	0.020	7720335
F1 (C6-C10)	ug/g	<10	<10	10	<20	20	<10	10	7720335
F1 (C6-C10) - BTEX	ug/g	<10	<10	10	<20	20	<10	10	7720335
F2-F4 Hydrocarbons									
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	10	<10	10	<10	10	7719627
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	50	<50	50	<50	50	7719627
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	50	<50	50	<50	50	7719627
Reached Baseline at C50	ug/g	Yes	Yes		Yes		Yes		7719627
Surrogate Recovery (%)									
o-Terphenyl	%	113	111		111		107		7719627
4-Bromofluorobenzene	%	92	91		91		91		7720335
D10-o-Xylene	%	86	94		101		85		7720335
D4-1,2-Dichloroethane	%	100	104		99		105		7720335
D8-Toluene	%	102	100		101		99		7720335

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS (SOIL)

Bureau Veritas ID		RHO498		
Sampling Date		2021/12/06		
COC Number		837213-01-01		
	UNITS	**TRIP BLANK #1**	**RDL**	**QC Batch**
Calculated Parameters				
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	0.050	7718939
Volatile Organics				
Acetone (2-Propanone)	ug/g	<0.49	0.49	7727700
Benzene	ug/g	<0.0060	0.0060	7727700
Bromodichloromethane	ug/g	<0.040	0.040	7727700
Bromoform	ug/g	<0.040	0.040	7727700
Bromomethane	ug/g	<0.040	0.040	7727700
Carbon Tetrachloride	ug/g	<0.040	0.040	7727700
Chlorobenzene	ug/g	<0.040	0.040	7727700
Chloroform	ug/g	<0.040	0.040	7727700
Dibromochloromethane	ug/g	<0.040	0.040	7727700
1,2-Dichlorobenzene	ug/g	<0.040	0.040	7727700
1,3-Dichlorobenzene	ug/g	<0.040	0.040	7727700
1,4-Dichlorobenzene	ug/g	<0.040	0.040	7727700
Dichlorodifluoromethane (FREON 12)	ug/g	<0.040	0.040	7727700
1,1-Dichloroethane	ug/g	<0.040	0.040	7727700
1,2-Dichloroethane	ug/g	<0.049	0.049	7727700
1,1-Dichloroethylene	ug/g	<0.040	0.040	7727700
cis-1,2-Dichloroethylene	ug/g	<0.040	0.040	7727700
trans-1,2-Dichloroethylene	ug/g	<0.040	0.040	7727700
1,2-Dichloropropane	ug/g	<0.040	0.040	7727700
cis-1,3-Dichloropropene	ug/g	<0.030	0.030	7727700
trans-1,3-Dichloropropene	ug/g	<0.040	0.040	7727700
Ethylbenzene	ug/g	<0.010	0.010	7727700
Ethylene Dibromide	ug/g	<0.040	0.040	7727700
Hexane	ug/g	<0.040	0.040	7727700
Methylene Chloride(Dichloromethane)	ug/g	<0.049	0.049	7727700
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.40	0.40	7727700
Methyl Isobutyl Ketone	ug/g	<0.40	0.40	7727700
Methyl t-butyl ether (MTBE)	ug/g	<0.040	0.040	7727700
Styrene	ug/g	<0.040	0.040	7727700
1,1,1,2-Tetrachloroethane	ug/g	<0.040	0.040	7727700
1,1,2,2-Tetrachloroethane	ug/g	<0.040	0.040	7727700
Tetrachloroethylene	ug/g	<0.040	0.040	7727700
Toluene	ug/g	<0.020	0.020	7727700

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS (SOIL)

Bureau Veritas ID		RHO498		
Sampling Date		2021/12/06		
COC Number		837213-01-01		
	UNITS	**TRIP BLANK #1**	**RDL**	**QC Batch**
1,1,1-Trichloroethane	ug/g	<0.040	0.040	7727700
1,1,2-Trichloroethane	ug/g	<0.040	0.040	7727700
Trichloroethylene	ug/g	0.027	0.010	7727700
Trichlorofluoromethane (FREON 11)	ug/g	<0.040	0.040	7727700
Vinyl Chloride	ug/g	<0.019	0.019	7727700
p+m-Xylene	ug/g	<0.020	0.020	7727700
o-Xylene	ug/g	<0.020	0.020	7727700
Total Xylenes	ug/g	<0.020	0.020	7727700
Surrogate Recovery (%)				
4-Bromofluorobenzene	%	99		7727700
D10-o-Xylene	%	115		7727700
D4-1,2-Dichloroethane	%	102		7727700
D8-Toluene	%	101		7727700

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 558 TCLP BENZO(A)PYRENE

Bureau Veritas ID		RHO497		
Sampling Date		2021/12/06 15:00		
COC Number		837213-01-01		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons				
Leachable Benzo(a)pyrene	ug/L	<0.10	0.10	7725870
Surrogate Recovery (%)				
Leachable D10-Anthracene	%	105		7725870
Leachable D14-Terphenyl (FS)	%	112		7725870
Leachable D8-Acenaphthylene	%	104		7725870

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 558 TCLP INORGANICS PACKAGE (SOIL)

Bureau Veritas ID		RHO497		
Sampling Date		2021/12/06 15:00		
COC Number		837213-01-01		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Inorganics				
Leachable Fluoride (F-)	mg/L	0.22	0.10	7724960
Leachable WAD Cyanide (Free)	mg/L	<0.010	0.010	7724972
Leachable Nitrite (N)	mg/L	<0.10	0.10	7724980
Leachable Nitrate (N)	mg/L	<1.0	1.0	7724980
Leachable Nitrate + Nitrite (N)	mg/L	<1.0	1.0	7724980
Metals				
Leachable Arsenic (As)	mg/L	<0.2	0.2	7724858
Leachable Barium (Ba)	mg/L	1.4	0.2	7724858
Leachable Boron (B)	mg/L	0.2	0.1	7724858
Leachable Cadmium (Cd)	mg/L	<0.05	0.05	7724858
Leachable Chromium (Cr)	mg/L	<0.1	0.1	7724858
Leachable Lead (Pb)	mg/L	<0.1	0.1	7724858
Leachable Mercury (Hg)	mg/L	<0.001	0.001	7724858
Leachable Selenium (Se)	mg/L	<0.1	0.1	7724858
Leachable Silver (Ag)	mg/L	<0.01	0.01	7724858
Leachable Uranium (U)	mg/L	<0.01	0.01	7724858

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

TCLP LEACHATE PREPARATION (SOIL)

Bureau Veritas ID		RHO497		
Sampling Date		2021/12/06 15:00		
COC Number		837213-01-01		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Inorganics				
Final pH	pH	6.07		7724966
Initial pH	pH	9.26		7724966
TCLP - % Solids	%	100	0.2	7721922
TCLP Extraction Fluid	N/A	FLUID 2		7721946

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 558 TCLP PCBS (SOIL)

Bureau Veritas ID		RHO497		
Sampling Date		2021/12/06 15:00		
COC Number		837213-01-01		
	UNITS	**TCLP**	**RDL**	**QC Batch**
PCBs				
Leachable Aroclor 1016	ug/L	<3.0	3.0	7724545
Leachable Aroclor 1221	ug/L	<3.0	3.0	7724545
Leachable Aroclor 1242	ug/L	<3.0	3.0	7724545
Leachable Aroclor 1248	ug/L	<3.0	3.0	7724545
Leachable Aroclor 1254	ug/L	<3.0	3.0	7724545
Leachable Aroclor 1260	ug/L	<3.0	3.0	7724545
Leachable Total PCB	ug/L	<3.0	3.0	7724545
Surrogate Recovery (%)				
Leachable Decachlorobiphenyl	%	98		7724545

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 558 TCLP VOCS BY HS (SOIL)

Bureau Veritas ID		RHO497		
Sampling Date		2021/12/06 15:00		
COC Number		837213-01-01		
	UNITS	**TCLP**	**RDL**	**QC Batch**
Charge/Prep Analysis				
Amount Extracted (Wet Weight) (g)	N/A	25	N/A	7721413
Volatile Organics				
Leachable Benzene	mg/L	<0.020	0.020	7724415
Leachable Carbon Tetrachloride	mg/L	<0.020	0.020	7724415
Leachable Chlorobenzene	mg/L	<0.020	0.020	7724415
Leachable Chloroform	mg/L	<0.020	0.020	7724415
Leachable 1,2-Dichlorobenzene	mg/L	<0.050	0.050	7724415
Leachable 1,4-Dichlorobenzene	mg/L	<0.050	0.050	7724415
Leachable 1,2-Dichloroethane	mg/L	<0.050	0.050	7724415
Leachable 1,1-Dichloroethylene	mg/L	<0.020	0.020	7724415
Leachable Methylene Chloride(Dichloromethane)	mg/L	<0.20	0.20	7724415
Leachable Methyl Ethyl Ketone (2-Butanone)	mg/L	<1.0	1.0	7724415
Leachable Tetrachloroethylene	mg/L	<0.020	0.020	7724415
Leachable Trichloroethylene	mg/L	<0.020	0.020	7724415
Leachable Vinyl Chloride	mg/L	<0.020	0.020	7724415
Surrogate Recovery (%)				
Leachable 4-Bromofluorobenzene	%	91		7724415
Leachable D4-1,2-Dichloroethane	%	105		7724415
Leachable D8-Toluene	%	92		7724415

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

RESULTS OF ANALYSES OF SOIL

Bureau Veritas ID		RHO488	RHO489	RHO492	RHO495	
Sampling Date		2021/12/06 13:00	2021/12/06 10:15	2021/12/06 15:30	2021/12/07 08:30	
COC Number		837213-01-01	837213-01-01	837213-01-01	837213-01-01	
	UNITS	**SS01**	**MW101-7**	**BH104-3**	**BH106-1**	**QC Batch**
Inorganics						
Available (CaCl2) pH	pH	7.18	7.94	7.90	7.35	7721341

QC Batch = Quality Control Batch

TEST SUMMARY

Bureau Veritas ID: RHO488
Sample ID: SS01
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7720566	N/A	2021/12/12	Domnica Andronescu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
Polychlorinated Biphenyl in Soil	GC/ECD	7722521	2021/12/13	2021/12/14	Farag Mansour
pH CaCl2 EXTRACT	AT	7721341	2021/12/13	2021/12/13	Taslima Aktar

Bureau Veritas ID: RHO489
Sample ID: MW101-7
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7718616	N/A	2021/12/13	Automated Statchk
1,3-Dichloropropene Sum	CALC	7718939	N/A	2021/12/13	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7719714	2021/12/11	2021/12/12	Jonghan Yoon
pH CaCl2 EXTRACT	AT	7721341	2021/12/13	2021/12/13	Taslima Aktar
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7720335	N/A	2021/12/13	Blair Gannon

Bureau Veritas ID: RHO489 Dup
Sample ID: MW101-7
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7720335	N/A	2021/12/13	Blair Gannon

Bureau Veritas ID: RHO490
Sample ID: MW102-3
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7718616	N/A	2021/12/13	Automated Statchk
1,3-Dichloropropene Sum	CALC	7718939	N/A	2021/12/14	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7719714	2021/12/11	2021/12/12	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7720335	N/A	2021/12/13	Blair Gannon

Bureau Veritas ID: RHO491
Sample ID: BH103-1
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7734792	N/A	2021/12/21	Automated Statchk
1,3-Dichloropropene Sum	CALC	7718939	N/A	2021/12/14	Automated Statchk

TEST SUMMARY

Bureau Veritas ID: RHO491
Sample ID: BH103-1
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7738076	2021/12/18	2021/12/18	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7720335	N/A	2021/12/13	Blair Gannon

Bureau Veritas ID: RHO492
Sample ID: BH104-3
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7734792	N/A	2021/12/21	Automated Statchk
1,3-Dichloropropene Sum	CALC	7718939	N/A	2021/12/14	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7738076	2021/12/18	2021/12/18	Jonghan Yoon
pH CaCl2 EXTRACT	AT	7721341	2021/12/13	2021/12/13	Taslima Aktar
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7720335	N/A	2021/12/13	Blair Gannon

Bureau Veritas ID: RHO493
Sample ID: DUP09
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7718616	N/A	2021/12/13	Automated Statchk
1,3-Dichloropropene Sum	CALC	7718939	N/A	2021/12/14	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7719714	2021/12/11	2021/12/12	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7720335	N/A	2021/12/13	Blair Gannon

Bureau Veritas ID: RHO494
Sample ID: BH105-1
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7718616	N/A	2021/12/13	Automated Statchk
1,3-Dichloropropene Sum	CALC	7718939	N/A	2021/12/14	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	7719714	2021/12/11	2021/12/12	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7720335	N/A	2021/12/13	Blair Gannon

TEST SUMMARY

Bureau Veritas ID: RHO495
Sample ID: BH106-1
Matrix: Soil

Collected: 2021/12/07
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7720566	N/A	2021/12/12	Domnica Andronescu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7719627	2021/12/11	2021/12/12	Dennis Ngondu
Moisture	BAL	7719644	N/A	2021/12/11	Prgya Panchal
Polychlorinated Biphenyl in Soil	GC/ECD	7722521	2021/12/13	2021/12/14	Farag Mansour
pH CaCl2 EXTRACT	AT	7721341	2021/12/13	2021/12/13	Taslima Aktar

Bureau Veritas ID: RHO496
Sample ID: DUP16
Matrix: Soil

Collected: 2021/12/07
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	7719855	N/A	2021/12/11	Prgya Panchal
Polychlorinated Biphenyl in Soil	GC/ECD	7722521	2021/12/13	2021/12/14	Farag Mansour

Bureau Veritas ID: RHO496 Dup
Sample ID: DUP16
Matrix: Soil

Collected: 2021/12/07
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Polychlorinated Biphenyl in Soil	GC/ECD	7722521	2021/12/13	2021/12/14	Farag Mansour

Bureau Veritas ID: RHO497
Sample ID: TCLP
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	7724972	N/A	2021/12/15	Aditiben Patel
Fluoride by ISE in Leachates	ISE	7724960	2021/12/14	2021/12/15	Surinder Rai
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	7724858	2021/12/14	2021/12/15	Arefa Dabhad
Nitrate& Nitrite as Nitrogen in Leachate	LACH	7724980	N/A	2021/12/15	Chandra Nandlal
PAH Compounds in Leachate by GC/MS (SIM)	GC/MS	7725870	2021/12/14	2021/12/15	Mitesh Raj
Polychlorinated Biphenyl in Leachate	GC/ECD	7724545	2021/12/14	2021/12/14	Farag Mansour
TCLP - % Solids	BAL	7721922	2021/12/13	2021/12/14	Jian (Ken) Wang
TCLP - Extraction Fluid		7721946	N/A	2021/12/14	Jian (Ken) Wang
TCLP - Initial and final pH	PH	7724966	N/A	2021/12/14	Jian (Ken) Wang
TCLP Zero Headspace Extraction		7721413	2021/12/13	2021/12/14	Johan Mato
VOCs in ZHE Leachates	GC/MS	7724415	2021/12/14	2021/12/14	Manpreet Sarao

Bureau Veritas ID: RHO498
Sample ID: TRIP BLANK #1
Matrix: Soil

Collected: 2021/12/06
Shipped:
Received: 2021/12/09

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	7718939	N/A	2021/12/30	Automated Statchk
Volatile Organic Compounds in Soil	GC/MS	7727700	N/A	2021/12/15	Ancheol Jeong

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.3°C

Sample RHO493 [DUP09] : VOCF1 Analysis: Detection limits were raised due to high moisture content and/or low weight of soil provided.

Results relate only to the items tested.

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**	**Value**	**UNITS**
7719627	o-Terphenyl	2021/12/12	111	60 - 130	111	60 - 130	109	%				
7719714	D10-Anthracene	2021/12/12	119	50 - 130	107	50 - 130	111	%				
7719714	D14-Terphenyl (FS)	2021/12/12	88	50 - 130	96	50 - 130	96	%				
7719714	D8-Acenaphthylene	2021/12/12	85	50 - 130	88	50 - 130	80	%				
7720335	4-Bromofluorobenzene	2021/12/13	102	60 - 140	104	60 - 140	92	%				
7720335	D10-o-Xylene	2021/12/13	98	60 - 130	92	60 - 130	94	%				
7720335	D4-1,2-Dichloroethane	2021/12/13	100	60 - 140	104	60 - 140	103	%				
7720335	D8-Toluene	2021/12/13	103	60 - 140	102	60 - 140	102	%				
7720566	1,4-Difluorobenzene	2021/12/12	99	60 - 140	100	60 - 140	108	%				
7720566	4-Bromofluorobenzene	2021/12/12	96	60 - 140	100	60 - 140	77	%				
7720566	D10-o-Xylene	2021/12/12	103	60 - 140	104	60 - 140	108	%				
7720566	D4-1,2-Dichloroethane	2021/12/12	96	60 - 140	93	60 - 140	102	%				
7722521	Decachlorobiphenyl	2021/12/13	97	60 - 130	83	60 - 130	91	%				
7724415	Leachable 4-Bromofluorobenzene	2021/12/14	102	70 - 130	102	70 - 130	91	%				
7724415	Leachable D4-1,2-Dichloroethane	2021/12/14	98	70 - 130	97	70 - 130	103	%				
7724415	Leachable D8-Toluene	2021/12/14	108	70 - 130	107	70 - 130	93	%				
7724545	Leachable Decachlorobiphenyl	2021/12/14	105	30 - 130	106	30 - 130	101	%				
7725870	Leachable D10-Anthracene	2021/12/15	102	50 - 130	100	50 - 130	95	%				
7725870	Leachable D14-Terphenyl (FS)	2021/12/15	107	50 - 130	107	50 - 130	105	%				
7725870	Leachable D8-Acenaphthylene	2021/12/15	101	50 - 130	100	50 - 130	98	%				
7727700	4-Bromofluorobenzene	2021/12/14	100	60 - 140	101	60 - 140	99	%				
7727700	D10-o-Xylene	2021/12/14	103	60 - 130	103	60 - 130	107	%				
7727700	D4-1,2-Dichloroethane	2021/12/14	101	60 - 140	104	60 - 140	106	%				
7727700	D8-Toluene	2021/12/14	104	60 - 140	102	60 - 140	100	%				
7738076	D10-Anthracene	2021/12/18	92	50 - 130	97	50 - 130	96	%				
7738076	D14-Terphenyl (FS)	2021/12/18	100	50 - 130	103	50 - 130	104	%				
7738076	D8-Acenaphthylene	2021/12/18	90	50 - 130	96	50 - 130	97	%				
7719627	F2 (C10-C16 Hydrocarbons)	2021/12/13	116	50 - 130	113	80 - 120	<10	ug/g	NC	30		
7719627	F3 (C16-C34 Hydrocarbons)	2021/12/13	113	50 - 130	111	80 - 120	<50	ug/g	NC	30		
7719627	F4 (C34-C50 Hydrocarbons)	2021/12/13	113	50 - 130	110	80 - 120	<50	ug/g	NC	30		
7719644	Moisture	2021/12/11							1.1	20		

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7719714	1-Methylnaphthalene	2021/12/12	84	50 - 130	104	50 - 130	<0.0050	ug/g				
7719714	2-Methylnaphthalene	2021/12/12	81	50 - 130	93	50 - 130	<0.0050	ug/g				
7719714	Acenaphthene	2021/12/12	111	50 - 130	92	50 - 130	<0.0050	ug/g				
7719714	Acenaphthylene	2021/12/12	NC	50 - 130	85	50 - 130	<0.0050	ug/g				
7719714	Anthracene	2021/12/12	NC	50 - 130	99	50 - 130	<0.0050	ug/g				
7719714	Benzo(a)anthracene	2021/12/12	NC	50 - 130	95	50 - 130	<0.0050	ug/g				
7719714	Benzo(a)pyrene	2021/12/12	NC	50 - 130	94	50 - 130	<0.0050	ug/g				
7719714	Benzo(b/j)fluoranthene	2021/12/12	NC	50 - 130	98	50 - 130	<0.0050	ug/g	18	40		
7719714	Benzo(g,h,i)perylene	2021/12/12	NC	50 - 130	97	50 - 130	<0.0050	ug/g				
7719714	Benzo(k)fluoranthene	2021/12/12	NC	50 - 130	95	50 - 130	<0.0050	ug/g				
7719714	Chrysene	2021/12/12	NC	50 - 130	97	50 - 130	<0.0050	ug/g				
7719714	Dibenzo(a,h)anthracene	2021/12/12	NC	50 - 130	95	50 - 130	<0.0050	ug/g				
7719714	Fluoranthene	2021/12/12	NC	50 - 130	101	50 - 130	<0.0050	ug/g				
7719714	Fluorene	2021/12/12	NC	50 - 130	93	50 - 130	<0.0050	ug/g				
7719714	Indeno(1,2,3-cd)pyrene	2021/12/12	NC	50 - 130	101	50 - 130	<0.0050	ug/g	15	40		
7719714	Naphthalene	2021/12/12	66	50 - 130	87	50 - 130	<0.0050	ug/g				
7719714	Phenanthrene	2021/12/12	85	50 - 130	94	50 - 130	<0.0050	ug/g				
7719714	Pyrene	2021/12/12	NC	50 - 130	102	50 - 130	<0.0050	ug/g				
7719855	Moisture	2021/12/11							1.0	20		
7720335	1,1,1,2-Tetrachloroethane	2021/12/13	95	60 - 140	95	60 - 130	<0.040	ug/g	NC	50		
7720335	1,1,1-Trichloroethane	2021/12/13	94	60 - 140	92	60 - 130	<0.040	ug/g	NC	50		
7720335	1,1,2,2-Tetrachloroethane	2021/12/13	88	60 - 140	93	60 - 130	<0.040	ug/g	NC	50		
7720335	1,1,2-Trichloroethane	2021/12/13	97	60 - 140	102	60 - 130	<0.040	ug/g	NC	50		
7720335	1,1-Dichloroethane	2021/12/13	90	60 - 140	89	60 - 130	<0.040	ug/g	NC	50		
7720335	1,1-Dichloroethylene	2021/12/13	92	60 - 140	90	60 - 130	<0.040	ug/g	NC	50		
7720335	1,2-Dichlorobenzene	2021/12/13	94	60 - 140	92	60 - 130	<0.040	ug/g	NC	50		
7720335	1,2-Dichloroethane	2021/12/13	90	60 - 140	93	60 - 130	<0.049	ug/g	NC	50		
7720335	1,2-Dichloropropane	2021/12/13	89	60 - 140	91	60 - 130	<0.040	ug/g	NC	50		
7720335	1,3-Dichlorobenzene	2021/12/13	105	60 - 140	102	60 - 130	<0.040	ug/g	NC	50		
7720335	1,4-Dichlorobenzene	2021/12/13	101	60 - 140	98	60 - 130	<0.040	ug/g	NC	50		
7720335	Acetone (2-Propanone)	2021/12/13	88	60 - 140	92	60 - 140	<0.49	ug/g	NC	50		

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7720335	Benzene	2021/12/13	85	60 - 140	85	60 - 130	<0.0060	ug/g	NC	50		
7720335	Bromodichloromethane	2021/12/13	95	60 - 140	97	60 - 130	<0.040	ug/g	NC	50		
7720335	Bromoform	2021/12/13	92	60 - 140	96	60 - 130	<0.040	ug/g	NC	50		
7720335	Bromomethane	2021/12/13	87	60 - 140	87	60 - 140	<0.040	ug/g	NC	50		
7720335	Carbon Tetrachloride	2021/12/13	91	60 - 140	89	60 - 130	<0.040	ug/g	NC	50		
7720335	Chlorobenzene	2021/12/13	95	60 - 140	94	60 - 130	<0.040	ug/g	NC	50		
7720335	Chloroform	2021/12/13	93	60 - 140	93	60 - 130	<0.040	ug/g	NC	50		
7720335	cis-1,2-Dichloroethylene	2021/12/13	95	60 - 140	95	60 - 130	<0.040	ug/g	NC	50		
7720335	cis-1,3-Dichloropropene	2021/12/13	92	60 - 140	95	60 - 130	<0.030	ug/g	NC	50		
7720335	Dibromochloromethane	2021/12/13	92	60 - 140	95	60 - 130	<0.040	ug/g	NC	50		
7720335	Dichlorodifluoromethane (FREON 12)	2021/12/13	62	60 - 140	63	60 - 140	<0.040	ug/g	NC	50		
7720335	Ethylbenzene	2021/12/13	88	60 - 140	87	60 - 130	<0.010	ug/g	NC	50		
7720335	Ethylene Dibromide	2021/12/13	88	60 - 140	92	60 - 130	<0.040	ug/g	NC	50		
7720335	F1 (C6-C10) - BTEX	2021/12/13					<10	ug/g	NC	30		
7720335	F1 (C6-C10)	2021/12/13	99	60 - 140	96	80 - 120	<10	ug/g	NC	30		
7720335	Hexane	2021/12/13	94	60 - 140	91	60 - 130	<0.040	ug/g	NC	50		
7720335	Methyl Ethyl Ketone (2-Butanone)	2021/12/13	91	60 - 140	98	60 - 140	<0.40	ug/g	NC	50		
7720335	Methyl Isobutyl Ketone	2021/12/13	95	60 - 140	106	60 - 130	<0.40	ug/g	NC	50		
7720335	Methyl t-butyl ether (MTBE)	2021/12/13	83	60 - 140	86	60 - 130	<0.040	ug/g	NC	50		
7720335	Methylene Chloride(Dichloromethane)	2021/12/13	93	60 - 140	94	60 - 130	<0.049	ug/g	NC	50		
7720335	o-Xylene	2021/12/13	86	60 - 140	85	60 - 130	<0.020	ug/g	NC	50		
7720335	p+m-Xylene	2021/12/13	91	60 - 140	90	60 - 130	<0.020	ug/g	NC	50		
7720335	Styrene	2021/12/13	102	60 - 140	103	60 - 130	<0.040	ug/g	NC	50		
7720335	Tetrachloroethylene	2021/12/13	87	60 - 140	85	60 - 130	<0.040	ug/g	NC	50		
7720335	Toluene	2021/12/13	96	60 - 140	94	60 - 130	<0.020	ug/g	NC	50		
7720335	Total Xylenes	2021/12/13					<0.020	ug/g	NC	50		
7720335	trans-1,2-Dichloroethylene	2021/12/13	93	60 - 140	92	60 - 130	<0.040	ug/g	NC	50		
7720335	trans-1,3-Dichloropropene	2021/12/13	104	60 - 140	109	60 - 130	<0.040	ug/g	NC	50		
7720335	Trichloroethylene	2021/12/13	98	60 - 140	97	60 - 130	<0.010	ug/g	NC	50		
7720335	Trichlorofluoromethane (FREON 11)	2021/12/13	89	60 - 140	86	60 - 130	<0.040	ug/g	NC	50		
7720335	Vinyl Chloride	2021/12/13	85	60 - 140	84	60 - 130	<0.019	ug/g	NC	50		

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**	**Value**	**UNITS**
7720566	F1 (C6-C10) - BTEX	2021/12/12					<10	ug/g	NC	30		
7720566	F1 (C6-C10)	2021/12/12	93	60 - 140	90	80 - 120	<10	ug/g	NC	30		
7721341	Available (CaCl2) pH	2021/12/13			100	97 - 103			0.13	N/A		
7722521	Aroclor 1242	2021/12/14					<0.010	ug/g	NC	50		
7722521	Aroclor 1248	2021/12/14					<0.010	ug/g	NC	50		
7722521	Aroclor 1254	2021/12/14					<0.010	ug/g	36	50		
7722521	Aroclor 1260	2021/12/14	123	30 - 130	110	30 - 130	<0.010	ug/g	NC	50		
7722521	Total PCB	2021/12/14	123	30 - 130	110	30 - 130	<0.010	ug/g	36	50		
7724415	Leachable 1,1-Dichloroethylene	2021/12/14	101	70 - 130	95	70 - 130	<0.020	mg/L	NC	30		
7724415	Leachable 1,2-Dichlorobenzene	2021/12/14	96	70 - 130	90	70 - 130	<0.050	mg/L	NC	30		
7724415	Leachable 1,2-Dichloroethane	2021/12/14	95	70 - 130	89	70 - 130	<0.050	mg/L	NC	30		
7724415	Leachable 1,4-Dichlorobenzene	2021/12/14	114	70 - 130	107	70 - 130	<0.050	mg/L	NC	30		
7724415	Leachable Benzene	2021/12/14	95	70 - 130	89	70 - 130	<0.020	mg/L	NC	30		
7724415	Leachable Carbon Tetrachloride	2021/12/14	101	70 - 130	95	70 - 130	<0.020	mg/L	NC	30		
7724415	Leachable Chlorobenzene	2021/12/14	102	70 - 130	95	70 - 130	<0.020	mg/L	NC	30		
7724415	Leachable Chloroform	2021/12/14	96	70 - 130	90	70 - 130	<0.020	mg/L	NC	30		
7724415	Leachable Methyl Ethyl Ketone (2-Butanone)	2021/12/14	105	60 - 140	100	60 - 140	<1.0	mg/L	NC	30		
7724415	Leachable Methylene Chloride (Dichloromethane)	2021/12/14	99	70 - 130	93	70 - 130	<0.20	mg/L	NC	30		
7724415	Leachable Tetrachloroethylene	2021/12/14	96	70 - 130	90	70 - 130	<0.020	mg/L	NC	30		
7724415	Leachable Trichloroethylene	2021/12/14	105	70 - 130	99	70 - 130	<0.020	mg/L	NC	30		
7724415	Leachable Vinyl Chloride	2021/12/14	100	70 - 130	95	70 - 130	<0.020	mg/L	NC	30		
7724545	Leachable Aroclor 1016	2021/12/14					<3.0	ug/L				
7724545	Leachable Aroclor 1221	2021/12/14					<3.0	ug/L				
7724545	Leachable Aroclor 1242	2021/12/14					<3.0	ug/L				
7724545	Leachable Aroclor 1248	2021/12/14					<3.0	ug/L				
7724545	Leachable Aroclor 1254	2021/12/14					<3.0	ug/L				
7724545	Leachable Aroclor 1260	2021/12/14	123	30 - 130	127	30 - 130	<3.0	ug/L				
7724545	Leachable Total PCB	2021/12/14	123	30 - 130	127 (1)	30 - 130	<3.0	ug/L	NC	40		
7724858	Leachable Arsenic (As)	2021/12/15	103	80 - 120	100	80 - 120	<0.2	mg/L	NC	35	<0.2	mg/L
7724858	Leachable Barium (Ba)	2021/12/15	103	80 - 120	102	80 - 120	<0.2	mg/L	1.8	35	<0.2	mg/L

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7724858	Leachable Boron (B)	2021/12/15	NC	80 - 120	101	80 - 120	<0.1	mg/L	1.4	35	<0.1	mg/L
7724858	Leachable Cadmium (Cd)	2021/12/15	100	80 - 120	101	80 - 120	<0.05	mg/L	3.2	35	<0.05	mg/L
7724858	Leachable Chromium (Cr)	2021/12/15	99	80 - 120	97	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7724858	Leachable Lead (Pb)	2021/12/15	90	80 - 120	95	80 - 120	<0.1	mg/L	0.68	35	<0.1	mg/L
7724858	Leachable Mercury (Hg)	2021/12/15	101	80 - 120	104	80 - 120	<0.001	mg/L	NC	35	<0.001	mg/L
7724858	Leachable Selenium (Se)	2021/12/15	100	80 - 120	102	80 - 120	<0.1	mg/L	NC	35	<0.1	mg/L
7724858	Leachable Silver (Ag)	2021/12/15	95	80 - 120	98	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L
7724858	Leachable Uranium (U)	2021/12/15	95	80 - 120	96	80 - 120	<0.01	mg/L	NC	35	<0.01	mg/L
7724960	Leachable Fluoride (F-)	2021/12/15	4.5 (2)	80 - 120	102	80 - 120	<0.10	mg/L	4.2	25	<0.10	mg/L
7724972	Leachable WAD Cyanide (Free)	2021/12/15	69 (2)	80 - 120	99	80 - 120	<0.0020	mg/L	7.6	20	<0.010	mg/L
7724980	Leachable Nitrate (N)	2021/12/15	79 (2)	80 - 120	100	80 - 120	<1.0	mg/L	3.9	25	<1.0	mg/L
7724980	Leachable Nitrate + Nitrite (N)	2021/12/15	NC	80 - 120	102	80 - 120	<1.0	mg/L	3.5	25	<1.0	mg/L
7724980	Leachable Nitrite (N)	2021/12/15	110	80 - 120	110	80 - 120	<0.10	mg/L	5.5	25	<0.10	mg/L
7725870	Leachable Benzo(a)pyrene	2021/12/15	90	50 - 130	95	50 - 130	<0.10	ug/L				
7727700	1,1,1,2-Tetrachloroethane	2021/12/14	96	60 - 140	99	60 - 130	<0.040	ug/g				
7727700	1,1,1-Trichloroethane	2021/12/14	101	60 - 140	101	60 - 130	<0.040	ug/g				
7727700	1,1,2,2-Tetrachloroethane	2021/12/14	87	60 - 140	95	60 - 130	<0.040	ug/g				
7727700	1,1,2-Trichloroethane	2021/12/14	97	60 - 140	102	60 - 130	<0.040	ug/g				
7727700	1,1-Dichloroethane	2021/12/14	92	60 - 140	93	60 - 130	<0.040	ug/g				
7727700	1,1-Dichloroethylene	2021/12/14	99	60 - 140	97	60 - 130	<0.040	ug/g				
7727700	1,2-Dichlorobenzene	2021/12/14	93	60 - 140	95	60 - 130	<0.040	ug/g				
7727700	1,2-Dichloroethane	2021/12/14	91	60 - 140	96	60 - 130	<0.049	ug/g				
7727700	1,2-Dichloropropane	2021/12/14	91	60 - 140	95	60 - 130	<0.040	ug/g				
7727700	1,3-Dichlorobenzene	2021/12/14	96	60 - 140	96	60 - 130	<0.040	ug/g				
7727700	1,4-Dichlorobenzene	2021/12/14	110	60 - 140	111	60 - 130	<0.040	ug/g				
7727700	Acetone (2-Propanone)	2021/12/14	87	60 - 140	97	60 - 140	<0.49	ug/g				
7727700	Benzene	2021/12/14	85	60 - 140	86	60 - 130	<0.0060	ug/g				
7727700	Bromodichloromethane	2021/12/14	96	60 - 140	100	60 - 130	<0.040	ug/g				
7727700	Bromoform	2021/12/14	91	60 - 140	99	60 - 130	<0.040	ug/g				
7727700	Bromomethane	2021/12/14	93	60 - 140	93	60 - 140	<0.040	ug/g				
7727700	Carbon Tetrachloride	2021/12/14	101	60 - 140	101	60 - 130	<0.040	ug/g				

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7727700	Chlorobenzene	2021/12/14	94	60 - 140	95	60 - 130	<0.040	ug/g				
7727700	Chloroform	2021/12/14	95	60 - 140	96	60 - 130	<0.040	ug/g				
7727700	cis-1,2-Dichloroethylene	2021/12/14	95	60 - 140	96	60 - 130	<0.040	ug/g				
7727700	cis-1,3-Dichloropropene	2021/12/14	86	60 - 140	88	60 - 130	<0.030	ug/g				
7727700	Dibromochloromethane	2021/12/14	92	60 - 140	97	60 - 130	<0.040	ug/g				
7727700	Dichlorodifluoromethane (FREON 12)	2021/12/14	92	60 - 140	90	60 - 140	<0.040	ug/g				
7727700	Ethylbenzene	2021/12/14	89	60 - 140	90	60 - 130	<0.010	ug/g				
7727700	Ethylene Dibromide	2021/12/14	88	60 - 140	94	60 - 130	<0.040	ug/g				
7727700	Hexane	2021/12/14	98	60 - 140	95	60 - 130	<0.040	ug/g				
7727700	Methyl Ethyl Ketone (2-Butanone)	2021/12/14	91	60 - 140	104	60 - 140	<0.40	ug/g				
7727700	Methyl Isobutyl Ketone	2021/12/14	88	60 - 140	102	60 - 130	<0.40	ug/g				
7727700	Methyl t-butyl ether (MTBE)	2021/12/14	85	60 - 140	88	60 - 130	<0.040	ug/g				
7727700	Methylene Chloride(Dichloromethane)	2021/12/14	102	60 - 140	104	60 - 130	<0.049	ug/g				
7727700	o-Xylene	2021/12/14	88	60 - 140	90	60 - 130	<0.020	ug/g				
7727700	p+m-Xylene	2021/12/14	95	60 - 140	96	60 - 130	<0.020	ug/g				
7727700	Styrene	2021/12/14	98	60 - 140	101	60 - 130	<0.040	ug/g				
7727700	Tetrachloroethylene	2021/12/14	91	60 - 140	90	60 - 130	<0.040	ug/g				
7727700	Toluene	2021/12/14	90	60 - 140	90	60 - 130	<0.020	ug/g				
7727700	Total Xylenes	2021/12/14					<0.020	ug/g				
7727700	trans-1,2-Dichloroethylene	2021/12/14	97	60 - 140	96	60 - 130	<0.040	ug/g				
7727700	trans-1,3-Dichloropropene	2021/12/14	94	60 - 140	95	60 - 130	<0.040	ug/g				
7727700	Trichloroethylene	2021/12/14	100	60 - 140	101	60 - 130	<0.010	ug/g				
7727700	Trichlorofluoromethane (FREON 11)	2021/12/14	100	60 - 140	98	60 - 130	<0.040	ug/g				
7727700	Vinyl Chloride	2021/12/14	96	60 - 140	94	60 - 130	<0.019	ug/g				
7738076	1-Methylnaphthalene	2021/12/18	96	50 - 130	105	50 - 130	<0.0050	ug/g	NC	40		
7738076	2-Methylnaphthalene	2021/12/18	97	50 - 130	106	50 - 130	<0.0050	ug/g	NC	40		
7738076	Acenaphthene	2021/12/18	89	50 - 130	95	50 - 130	<0.0050	ug/g	NC	40		
7738076	Acenaphthylene	2021/12/18	84	50 - 130	91	50 - 130	<0.0050	ug/g	NC	40		
7738076	Anthracene	2021/12/18	88	50 - 130	92	50 - 130	<0.0050	ug/g	NC	40		
7738076	Benzo(a)anthracene	2021/12/18	91	50 - 130	94	50 - 130	<0.0050	ug/g	NC	40		
7738076	Benzo(a)pyrene	2021/12/18	91	50 - 130	96	50 - 130	<0.0050	ug/g	NC	40		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
7738076	Benzo(b/j)fluoranthene	2021/12/18	93	50 - 130	99	50 - 130	<0.0050	ug/g	NC	40		
7738076	Benzo(g,h,i)perylene	2021/12/18	90	50 - 130	96	50 - 130	<0.0050	ug/g	NC	40		
7738076	Benzo(k)fluoranthene	2021/12/18	86	50 - 130	91	50 - 130	<0.0050	ug/g	NC	40		
7738076	Chrysene	2021/12/18	96	50 - 130	102	50 - 130	<0.0050	ug/g	NC	40		
7738076	Dibenzo(a,h)anthracene	2021/12/18	86	50 - 130	90	50 - 130	<0.0050	ug/g	NC	40		
7738076	Fluoranthene	2021/12/18	99	50 - 130	104	50 - 130	<0.0050	ug/g	NC	40		
7738076	Fluorene	2021/12/18	95	50 - 130	101	50 - 130	<0.0050	ug/g	NC	40		
7738076	Indeno(1,2,3-cd)pyrene	2021/12/18	93	50 - 130	99	50 - 130	<0.0050	ug/g	NC	40		
7738076	Naphthalene	2021/12/18	80	50 - 130	90	50 - 130	<0.0050	ug/g	NC	40		
7738076	Phenanthrene	2021/12/18	94	50 - 130	99	50 - 130	<0.0050	ug/g	NC	40		
7738076	Pyrene	2021/12/18	98	50 - 130	102	50 - 130	<0.0050	ug/g	NC	40		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) The recovery was above the upper control limit. This may represent a high bias in some results for flagged analytes. For results that were not detected (ND), this potential bias has no impact.

(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

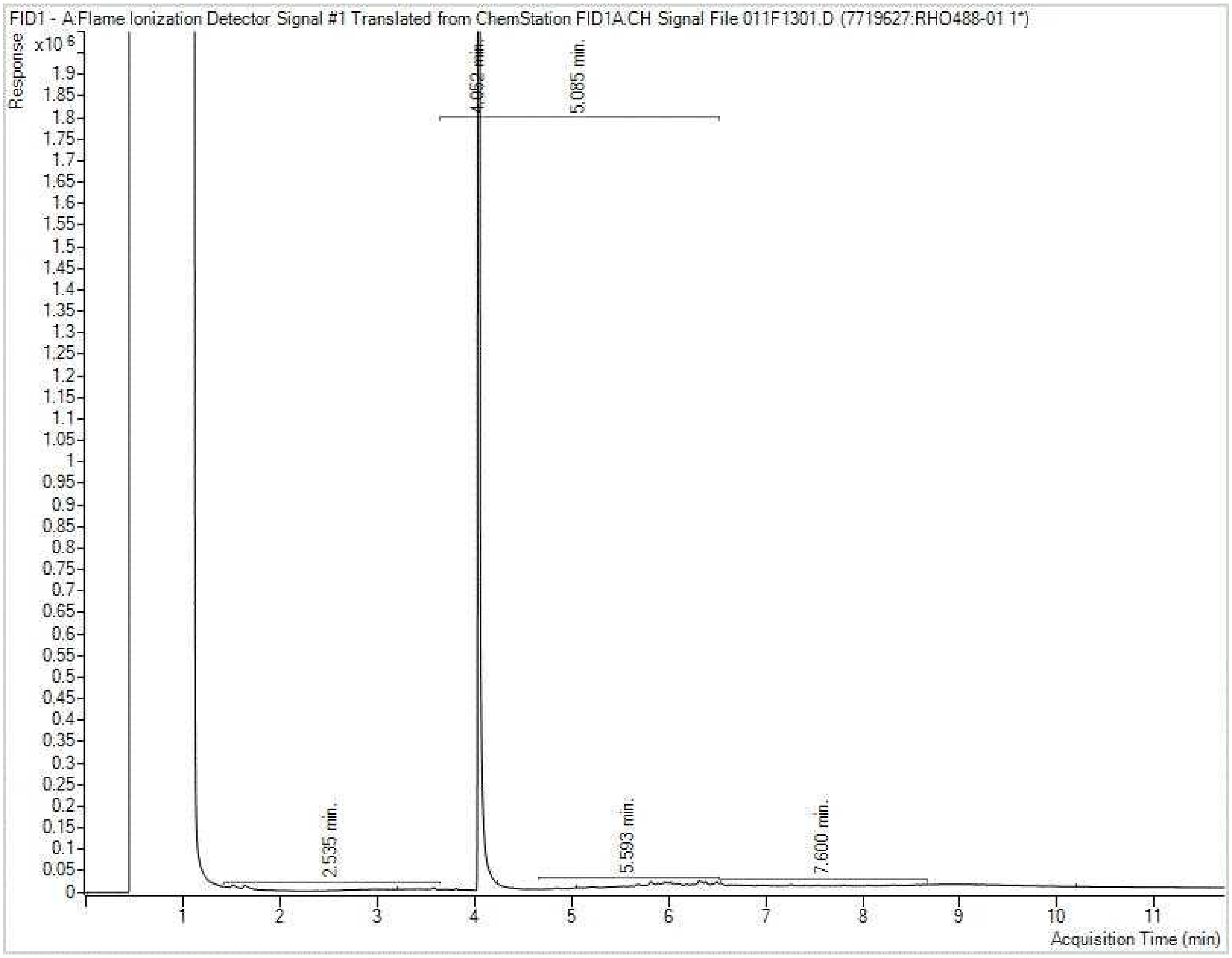
Eva Pranjic

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Bureau Veritas Job #: C1Y4340
Report Date: 2022/01/04
Bureau Veritas Sample: RHO488

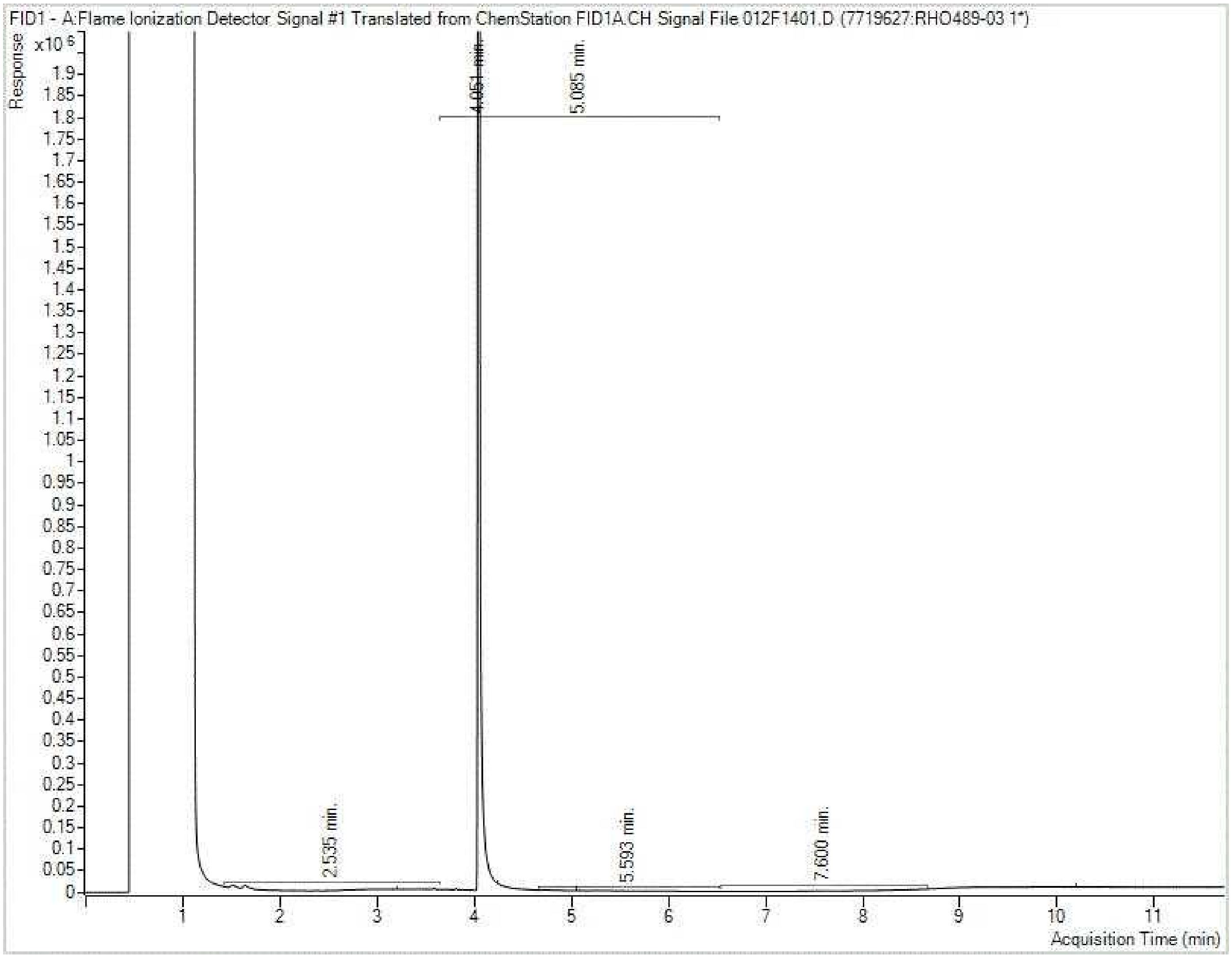
Pinchin Ltd
Client Project #: 296202.001
Client ID: SS01

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

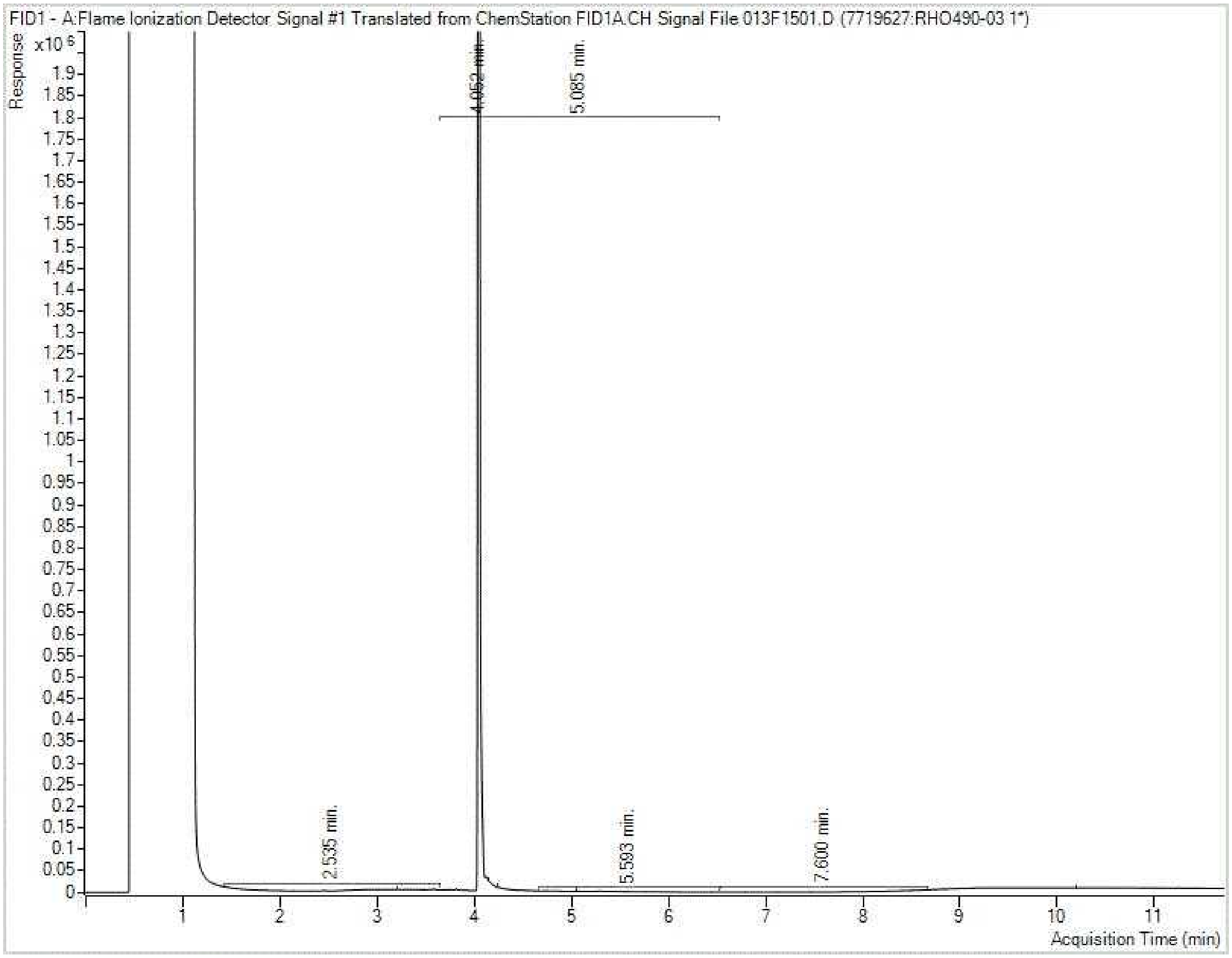


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y4340
Report Date: 2022/01/04
Bureau Veritas Sample: RHO490

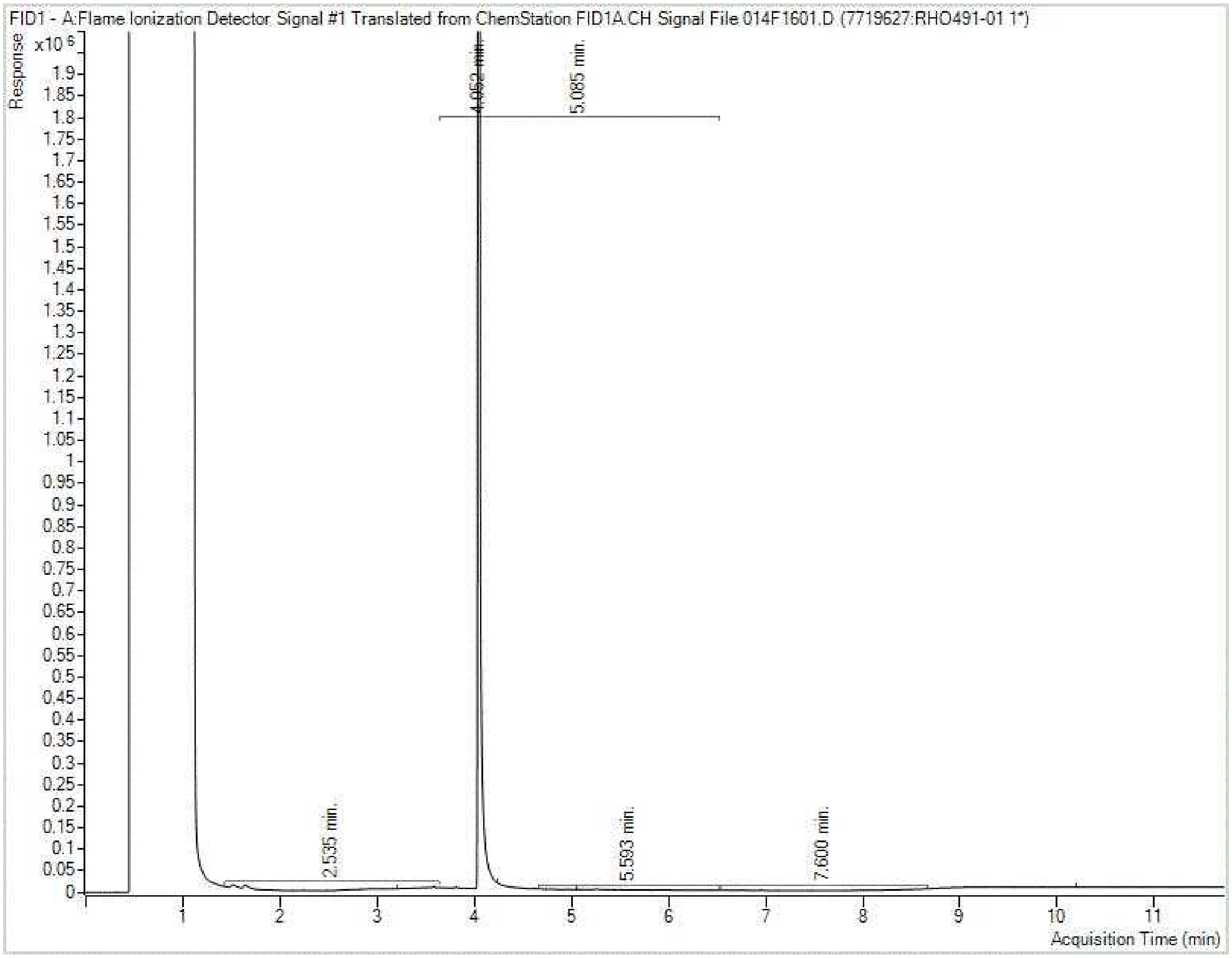
Pinchin Ltd
Client Project #: 296202.001
Client ID: MW102-3

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

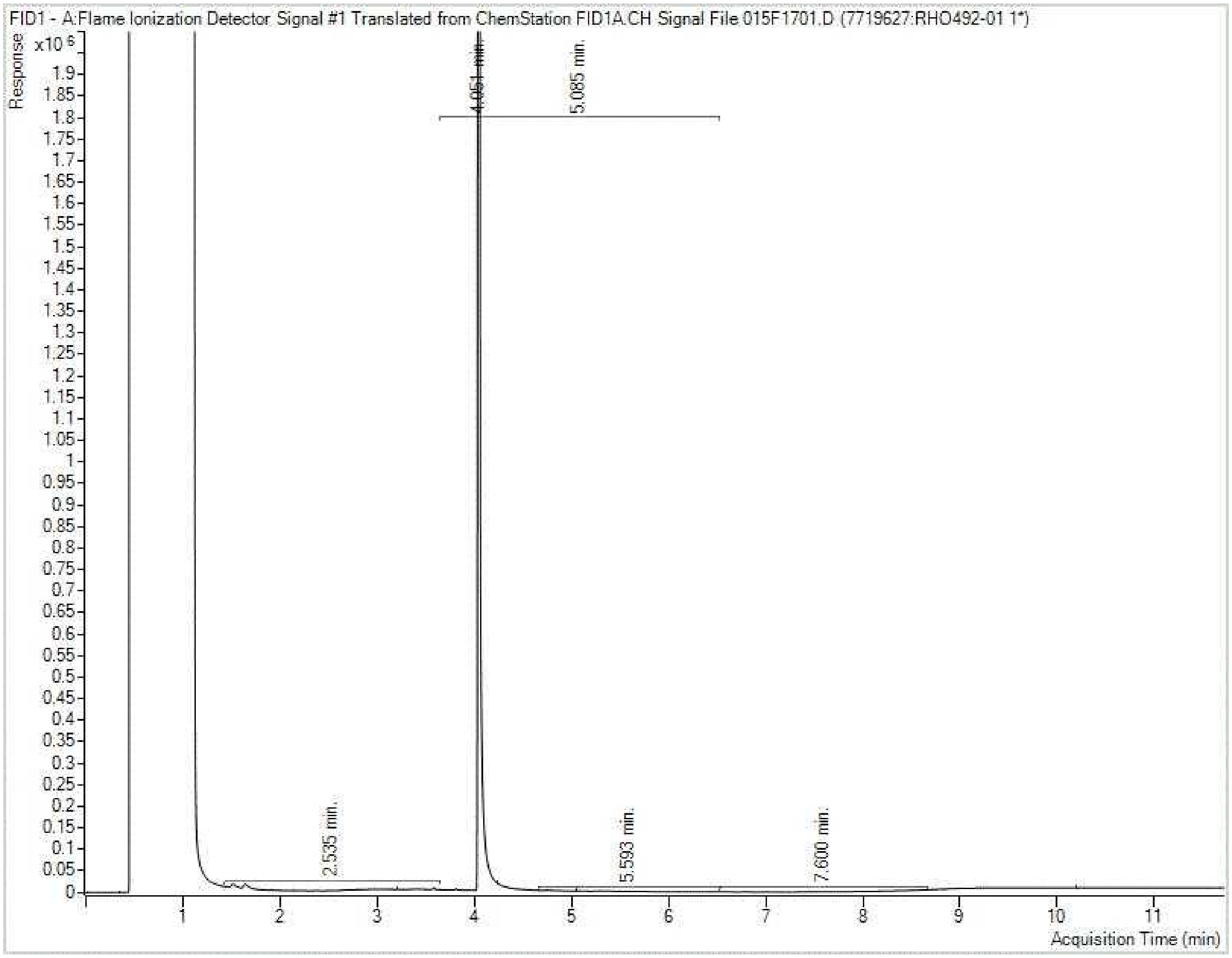


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y4340
Report Date: 2022/01/04
Bureau Veritas Sample: RHO492

Pinchin Ltd
Client Project #: 296202.001
Client ID: BH104-3

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

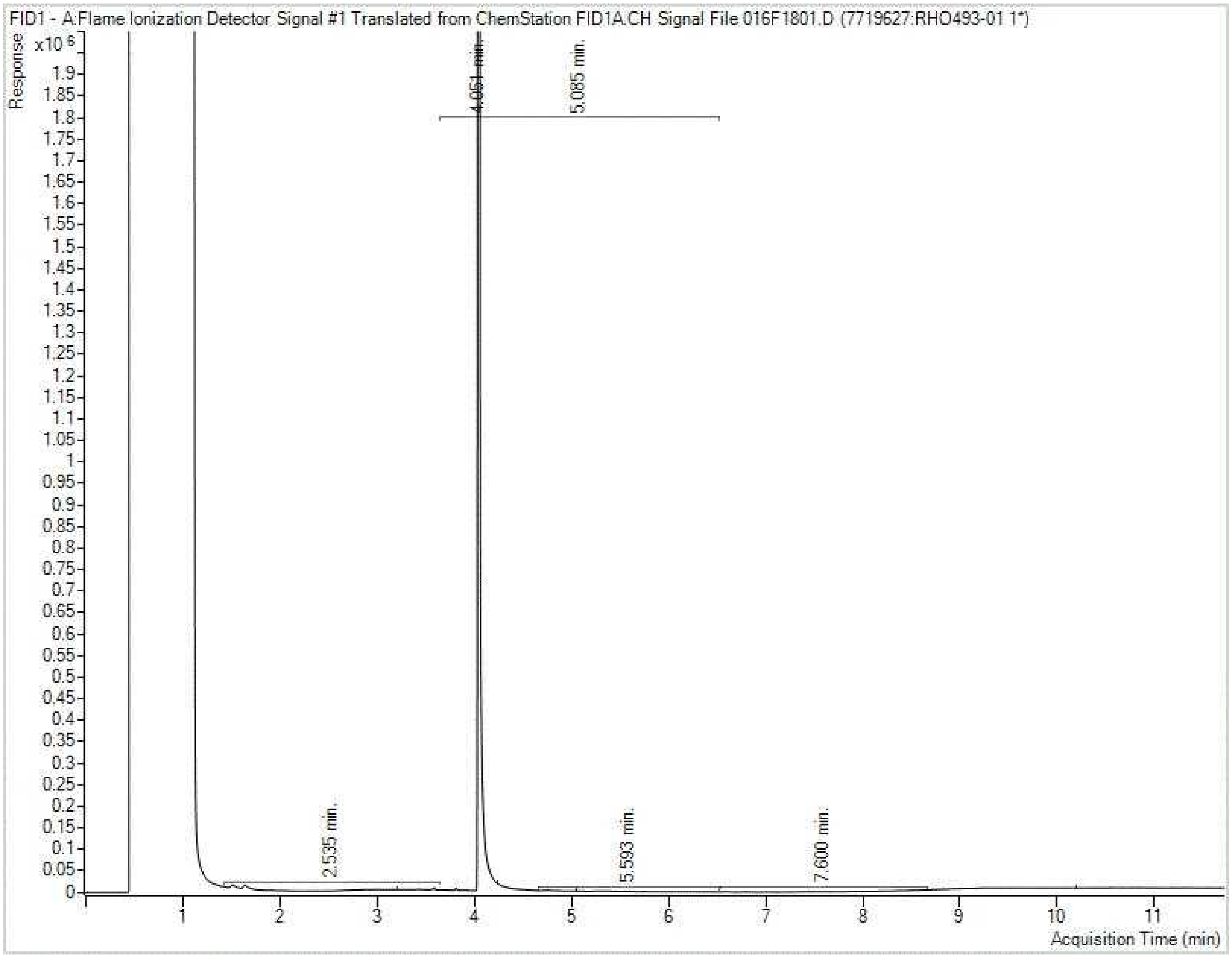


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y4340
Report Date: 2022/01/04
Bureau Veritas Sample: RHO493

Pinchin Ltd
Client Project #: 296202.001
Client ID: DUP09

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

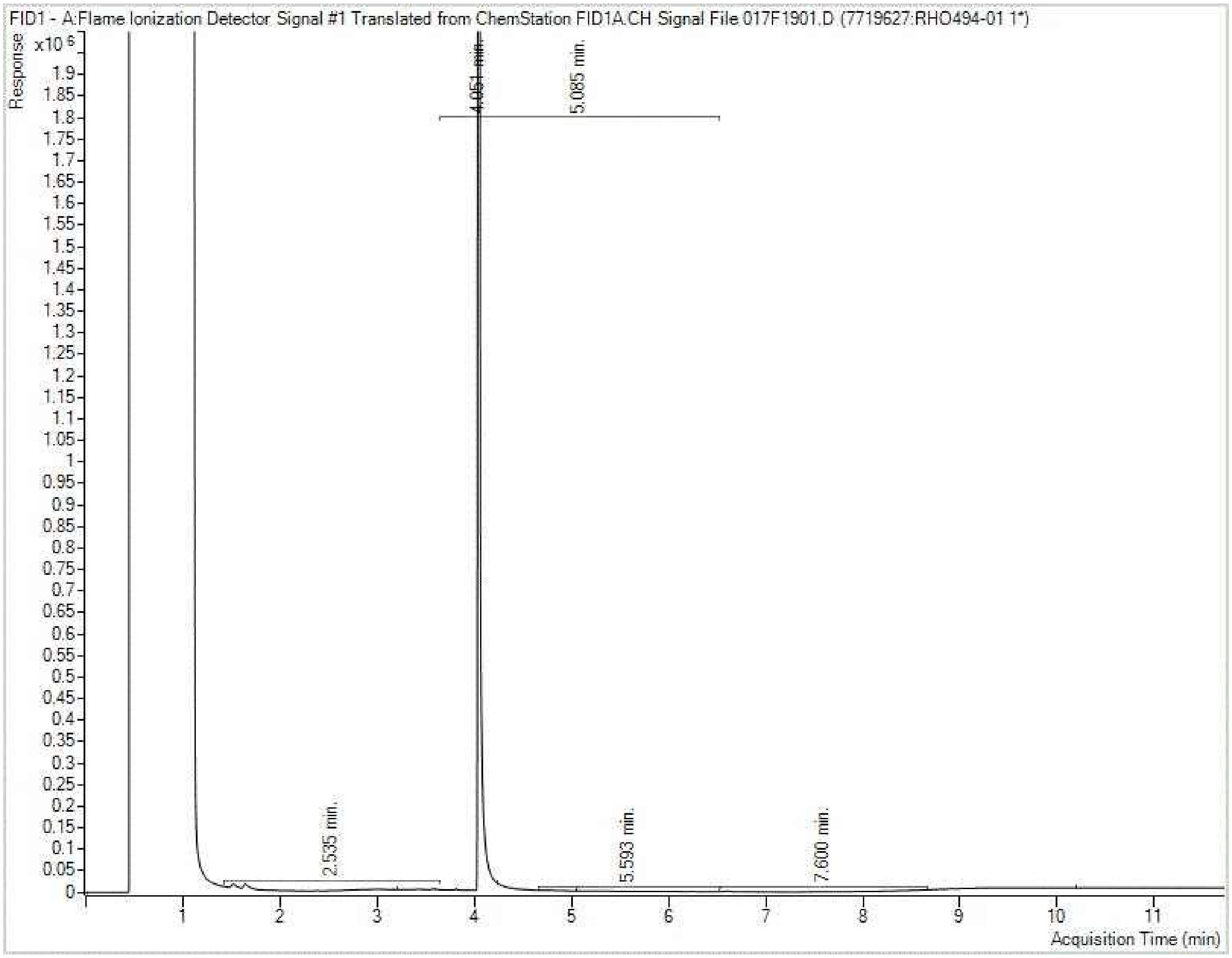


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y4340
Report Date: 2022/01/04
Bureau Veritas Sample: RHO494

Pinchin Ltd
Client Project #: 296202.001
Client ID: BH105-1

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

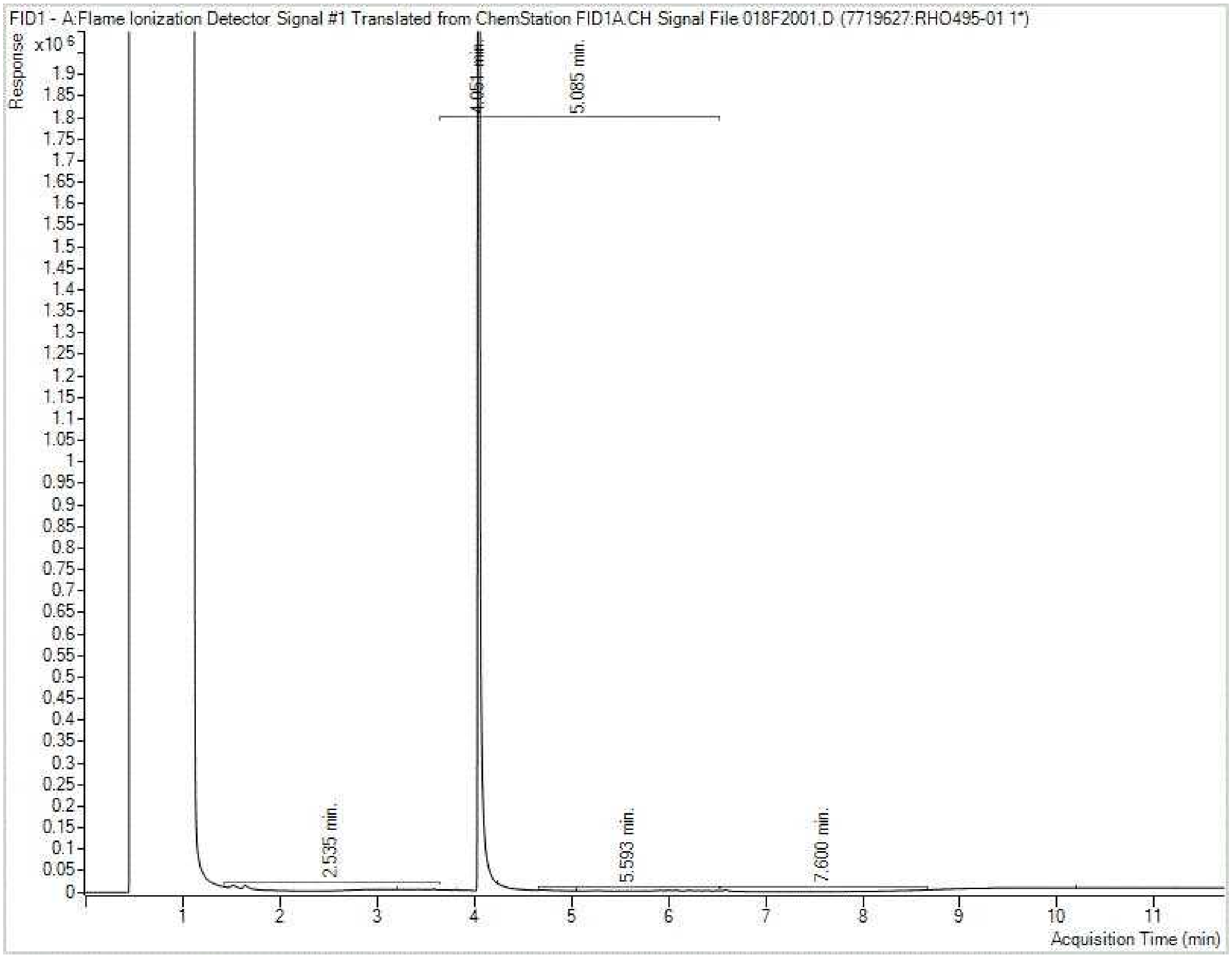


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C1Y4340
Report Date: 2022/01/04
Bureau Veritas Sample: RHO495

Pinchin Ltd
Client Project #: 296202.001
Client ID: BH106-1

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

09-Dec-21 15:42

Antonella Brasil

C1Y4340

DSG ENV-1470

Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvlabs.com

INVOICE TO:

Company Name: #29276 Pinchin Ltd
Attention: Accounts Payable
Address: 386 St. Paul Street Suite 202
St. Catharines ON L2R 3N2
Tel: (289) 241-1988 Fax:
Email: ap@pinchin.com

REPORT TO:

Company Name:
Attention: David Mignone, Erin Tracey
Address:
Tel: (289) 241-1988 Fax:
Email: dmignone@pinchin.com, etracey@pinchin.com

PROJECT INFORMATION:

Quotation #: A70927
P.O. #:
Project: ~~280401.002~~ 296202.001
Project Name:
Site #:
Sampled By: ET

Bottle Order #: 837213
COC #: C#837213-01-01
Project Manager: Antonella Brasil

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)
☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other ☑ For RSC
☐ Table ___

Other Regulations
☐ CCME ☐ Sanitary Sewer Bylaw
☐ Reg 558. ☐ Storm Sewer Bylaw
☐ MISA Municipality ___
☐ PWQO ☐ Reg 406 Table ___
☐ Other ___

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ☐
Rush Confirmation Number: ___ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	O.Reg 153 VOCs by HS	O.Reg 153 PAHs (Soil)	PHCs F1-F4 (no BTEX)	PCBs	pH	Grain Size (Hydrometer)	TCLP Inorganics	TCLP benzo(a)pyrene	TCLP VOCs	TCLP PCBs	# of Bottles	Comments
1		SS01	21/12/06	13:00	SOIL				X	X	X						3	
2		MW101-7	21/12/06	10:15			X	X	X		X						4	
3		MW102-3	21/12/06	14:00			X	X	X								4	
4		BH103-1	21/12/06	16:30			X	X	X								3	Limited Sample Volume
5		BH104-3	21/12/06	15:30			X	X	X		X	X					3	Limited Sample Volume
6		DUP09	21/12/06	15:30			X	X	X								2	
7		BH105-1	21/12/06	15:45			X	X	X								3	
8		BH106-1	21/12/07	8:30					X	X	X	X					3	
9		DUP16	21/12/07	8:30						X							1	
10		TCLP	21/12/06	15:00									X	X	X	X	2	

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
E. Tracey / E. TRACEY	21/12/09	8:30	JI TRINH	2021/12/09	15:42	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	7/7/5	Present	Y	
		Intact	Y	

White: BV Labs Yellow: Client

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvlabs.com

CHAIN OF CUSTODY RECORD

Page 2 of 2

INVOICE TO:

Company Name: #29276 Pinchin Ltd
Attention: Accounts Payable
Address: 386 St. Paul Street Suite 202
St. Catharines ON L2R 3N2
Tel: (289) 241-1988 Fax:
Email: ap@pinchin.com

REPORT TO:

Company Name:
Attention: David Mignone, EnnTracey
Address:
Tel: (289) 241-1988 Fax:
Email: dmignone@pinchin.com, etracey@pinchin.com

PROJECT INFORMATION:

Quotation #: A70927
P.O. #:
Project: ~~[illegible]~~ 296202.001
Project Name:
Site #:
Sampled By: ET

Laboratory Use Only:

BV Labs Job #:	Bottle Order #:
	837213
COC #:	**Project Manager:**
C#837213-02-01	Antonella Brasil

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)

☐ Table 1 ☐ Res/Park ☐ Medium/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other [✓ ☑ For RSC]
☐ Table ___

Other Regulations

☐ CCME ☐ Sanitary Sewer Bylaw
☐ Reg 558 ☐ Storm Sewer Bylaw
☐ MISA Municipality ______
☐ PWQO ☐ Reg 406 Table ______
☐ Other ______

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ______

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
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(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (If applies to entire submission)
Date Required: ______ Time Required: ______ ☐
Rush Confirmation Number: ______ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	O.Reg 153 VOCs by HS	O.Reg 153 PAHs (Soil)									# of Bottles	Comments
1		Trip Blank #1	21/12/06	–	SOIL		X										2	
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
E. Tracey / E. TRACEY	21/12/09	8:30	See page 1			

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
		Present		
		Intact		

White: BV Labs Yellow: Client

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

Grain Size Analysis Report

Client Sample ID: RNY857-BH106-2
Maxxam Sample ID: AMT014-01
Maxxam Job #: C200820

Tot. Sample Wt (g)*: 8.98
> 2 mm Sample Wt (g)*: 0.11
* Dry mass based on Sieve Aliquot

Batch # (Sieve): A467457
Batch # (Hydro): A467232

Analysis Date (Sieve): 1/10/2022
Analysis Date (Hydro): 1/10/2022

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	98.8
	Sieve 20	0.850	98.6
	Sieve 40	0.425	98.3
	Sieve 100	0.150	97.7
	Sieve 200	0.075	96.7
Hydrometer	R1min	0.0418	81.7
	R3min	0.0253	67.7
	R10min	0.0141	58.4
	R30min	0.0084	49.0
	R90min	0.0052	44.4
	R270min	0.0029	39.7
	R1080min	0.0015	35.0

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	13.5
Silt	0.002	0.050	49.3
Clay	-	0.002	37.2

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

Based on the entire sample

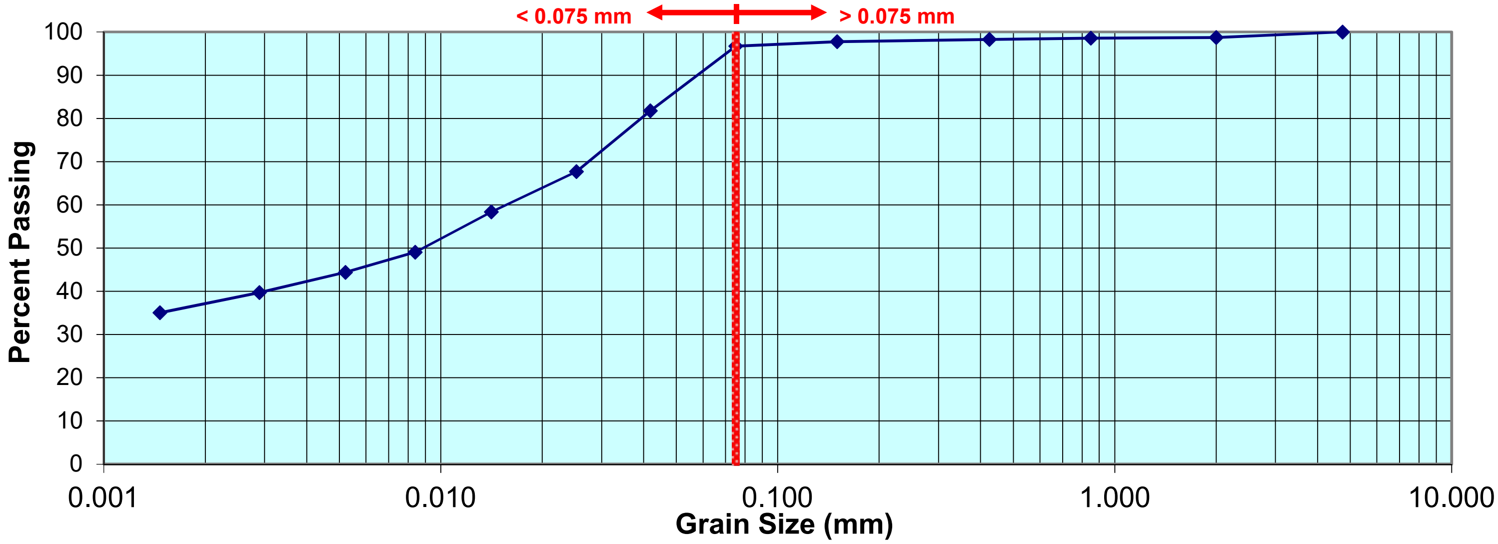
Percentage (by mass) less than 0.075 mm = 96.7
Classification = Fine Textured Soil

Based on the < 2 mm fraction ****

Percentage (by mass) less than 0.075 mm = 97.9
Classification = Fine Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.

CLAY	SILT			SAND			GRAVEL	
< 0.002 mm	Fine 0.002 - 0.0063 mm	Medium 0.0063 - 0.02 mm	Coarse 0.02 - 0.05 mm	Fine 0.05 - 0.2 mm	Medium 0.2 - 0.63 mm	Coarse 0.63 - 2 mm	Fine 2 - 6.3 mm	Med > 6.3



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: **RNY857-BH106-2**
Maxxam Sample ID: **DUP AMT014-01**
Maxxam Job #: **C200820**

Tot. Sample Wt (g)*: **9.05**
> 2 mm Sample Wt (g)*: **0.19**
* Dry mass based on Sieve Aliquot

Batch # (Sieve): **A467457**
Batch # (Hydro): **A467232**

Analysis Date (Sieve): **1/10/2022**
Analysis Date (Hydro): **1/10/2022**

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	97.9
	Sieve 20	0.850	97.7
	Sieve 40	0.425	97.5
	Sieve 100	0.150	96.9
	Sieve 200	0.075	96.0
Hydrometer	R1min	0.0415	82.2
	R3min	0.0251	68.5
	R10min	0.0140	59.4
	R30min	0.0083	51.4
	R90min	0.0052	44.5
	R270min	0.0029	40.0
	R1080min	0.0015	35.4

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	12.5
Silt	0.002	0.050	49.6
Clay	-	0.002	37.9

** Calculations based only on sub 2 mm fraction. Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

Based on the entire sample

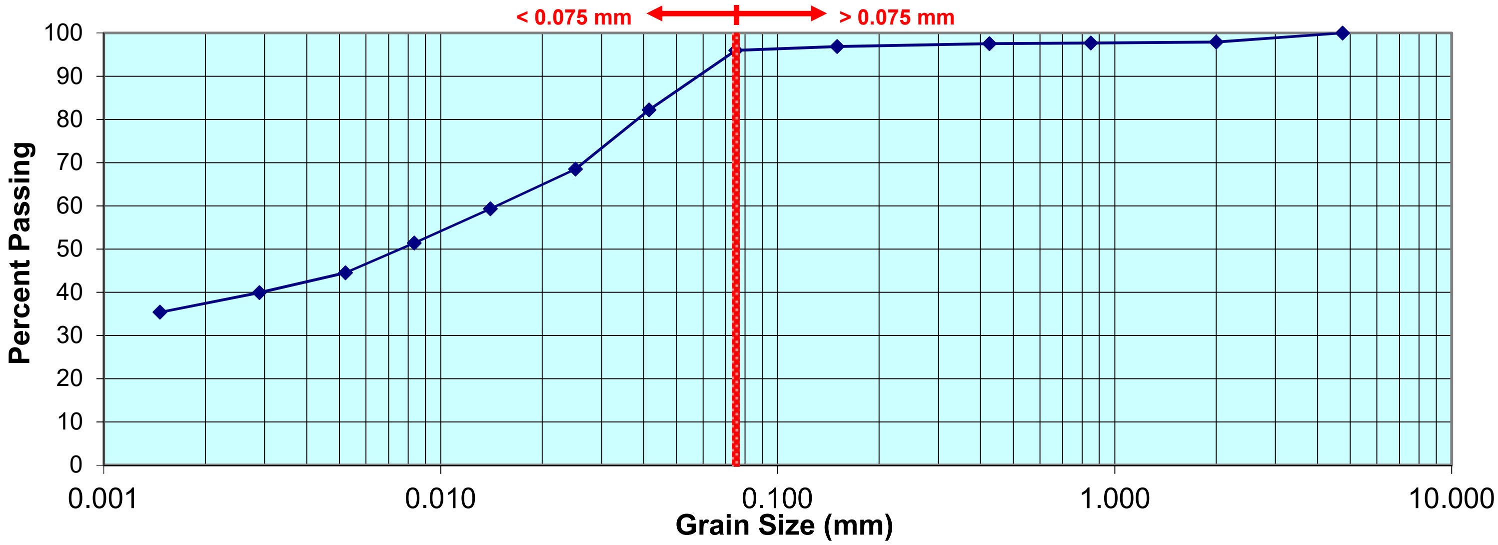
Percentage (by mass) less than 0.075 mm = 96.0
Classification = Fine Textured Soil

Based on the < 2 mm fraction ****

Percentage (by mass) less than 0.075 mm = 98.0
Classification = Fine Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.

CLAY	SILT			SAND			GRAVEL	
< 0.002 mm	Fine 0.002 - 0.0063 mm	Medium 0.0063 - 0.02 mm	Coarse 0.02 - 0.05 mm	Fine 0.05 - 0.2 mm	Medium 0.2 - 0.63 mm	Coarse 0.63 - 2 mm	Fine 2 - 6.3 mm	Med > 6.3



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report

Client Sample ID: RNY856-BH104-2
Maxxam Sample ID: AMT013-01
Maxxam Job #: C200820

Tot. Sample Wt (g)*: 8.97
> 2 mm Sample Wt (g)*: 0.02
* Dry mass based on Sieve Aliquot

Batch # (Sieve): A467457
Batch # (Hydro): A467232

Analysis Date (Sieve): 1/10/2022
Analysis Date (Hydro): 1/10/2022

	Description	Particle Size (mm)	Percent Passing
Sieve	Sieve 4	4.750	100.0
	Sieve 10	2.000	99.8
	Sieve 20	0.850	99.6
	Sieve 40	0.425	99.4
	Sieve 100	0.150	98.6
	Sieve 200	0.075	98.1
Hydrometer	R1min	0.0415	85.5
	R3min	0.0264	55.8
	R10min	0.0152	33.3
	R30min	0.0091	19.0
	R90min	0.0057	11.9
	R270min	0.0031	11.9
	R1080min	0.0016	9.5

Grain Size Proportion (%)**:

	Min (mm)	Max (mm)	Percentage
Sand	0.050	2.000	11.1
Silt	0.002	0.050	78.7
Clay	-	0.002	10.2

** Calculations based only on sub 2 mm fraction.
Compatible with USDA and Canadian Soil Triangles

Soil Classification***:

Based on the entire sample

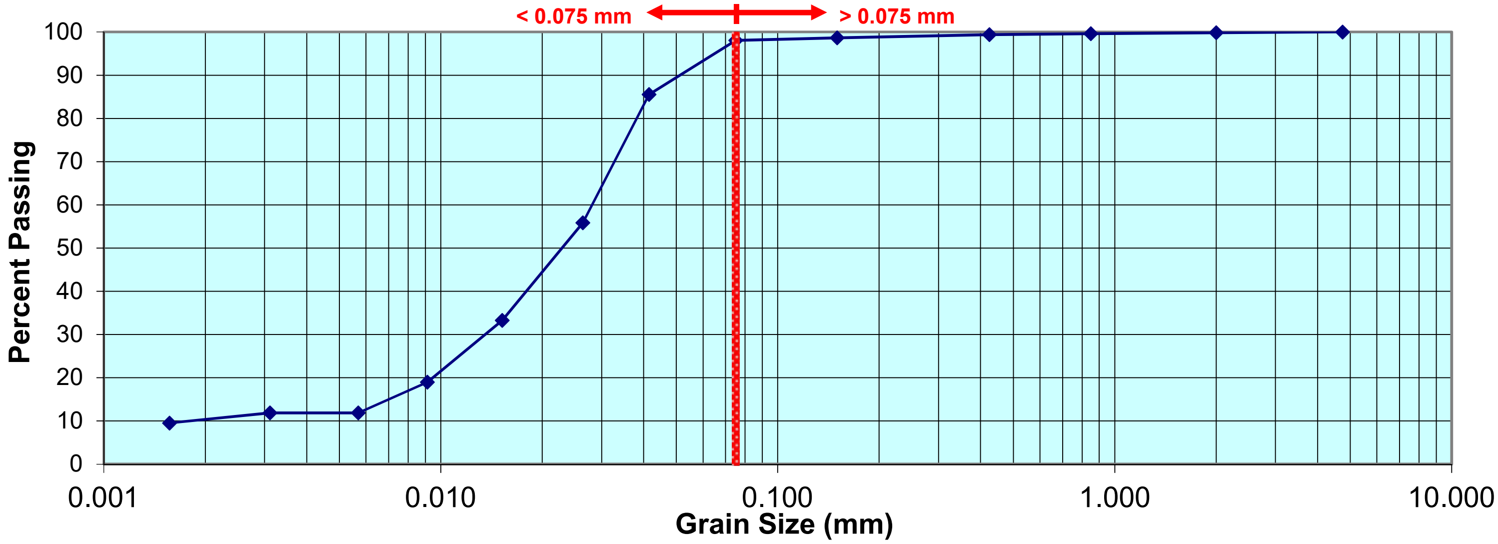
Percentage (by mass) less than 0.075 mm = 98.1
Classification = Fine Textured Soil

Based on the < 2 mm fraction **

Percentage (by mass) less than 0.075 mm = 98.3
Classification = Fine Textured Soil

**** Grain size analysis performed to classify the soil material according to the criteria prescribed in Section 42.2 of Ontario Regulation 153/04 as amended by Ontario Regulation 511/09, and conducted in accordance with test procedures outlined in ASTM D422.

CLAY	SILT			SAND			GRAVEL	
< 0.002 mm	Fine 0.002 - 0.0063 mm	Medium 0.0063 - 0.02 mm	Coarse 0.02 - 0.05 mm	Fine 0.05 - 0.2 mm	Medium 0.2 - 0.63 mm	Coarse 0.63 - 2 mm	Fine 2 - 6.3 mm	Med > 6.3



*** ON Regulation 153/04 requires coarse:fine determination on the < 2 mm fraction. Other jurisdictions may require the entire sample, thus both classifications are provided

Note: Clay/Silt/Sand/Gravel Graphic above Graph: Sand | Silt | Clay fractions in accordance with USDA and Canadian System of Soil Classification. Sub fractions in accordance with the British (BSI) system for information purposes.

Grain Size Analysis Report (QA-SRM)

Sieve Batch #: A467457

Hydrometer Batch #: A467232

Standard Reference Material

			Acceptance Limits	
	Fraction	**% Recovery**	**Minimum**	**Maximum**
Sieve	**> 0.075 mm**	100	75	125
	< 0.075 mm	100	75	125
Hydrometer	**Sand**	91	75	125
	Silt	125	75	125
	Clay	88	75	125

Grain Size Analysis Report (QA-DUP)

Sieve Batch #: A467457

Hydrometer Batch #: A467232

Maxxam Job #: C200820

Duplicate Sample ID: AMT014

	Fraction (mm)	% RPD	Acceptance Limit Maximum
Sieve	**4.750**	NC	30
	2.000	**51.5**	30
	0.850	NC	30
	0.425	NC	30
	0.150	NC	30
	0.075	NC	30
Hydrometer	**0.0415**	NC	30
	0.0251	NC	30
	0.0140	NC	30
	0.0083	NC	30
	0.0052	NC	30
	0.0029	NC	30
	0.0015	NC	30

Your Project #: 296202.001
Your C.O.C. #: 835786-16-01

Attention: David Mignone
Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2022/01/20
Report #: R6969932
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C210981
Received: 2022/01/14, 12:33

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Methylnaphthalene Sum	4	N/A	2022/01/20	CAM SOP-00301	EPA 8270D m
1,3-Dichloropropene Sum	4	N/A	2022/01/19		EPA 8260C m
1,3-Dichloropropene Sum	1	N/A	2022/01/20		EPA 8260C m
Petroleum Hydrocarbons F2-F4 in Water (1)	4	2022/01/18	2022/01/19	CAM SOP-00316	CCME PHC-CWS m
PAH Compounds in Water by GC/MS (SIM)	4	2022/01/18	2022/01/19	CAM SOP-00318	EPA 8270D m
Volatile Organic Compounds and F1 PHCs	4	N/A	2022/01/18	CAM SOP-00230	EPA 8260C m
Volatile Organic Compounds in Water	1	N/A	2022/01/19	CAM SOP-00228	EPA 8260C m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas Laboratories conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods

Your Project #: 296202.001
Your C.O.C. #: 835786-16-01

Attention: David Mignone

Pinchin Ltd
386 St. Paul Street
Suite 202
St. Catharines, ON
CANADA L2R 3N2

Report Date: 2022/01/20
Report #: R6969932
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C210981
Received: 2022/01/14, 12:33

September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Antonella Brasil, Senior Project Manager
Email: Antonella.Brasil@bureauveritas.com
Phone# (905)817-5817
===
This report has been generated and distributed using a secure automated process.
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total Cover Pages : 2

O.REG 153 PAHS (WATER)

Bureau Veritas ID		RPV426	RPV427	RPV428	RPV429		
Sampling Date		2022/01/12 15:00	2022/01/12 13:30	2022/01/12 13:30	2022/01/12 16:30		
COC Number		835786-16-01	835786-16-01	835786-16-01	835786-16-01		
	UNITS	**MW101**	**MW102**	**DUP999**	**MW03**	**RDL**	**QC Batch**
Calculated Parameters							
Methylnaphthalene, 2-(1-)	ug/L	<0.071	<0.071	<0.071	<0.071	0.071	7782662
Polyaromatic Hydrocarbons							
Acenaphthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Acenaphthylene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Benzo(a)anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Benzo(a)pyrene	ug/L	<0.0090	<0.0090	<0.0090	<0.0090	0.0090	7786247
Benzo(b/j)fluoranthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Benzo(g,h,i)perylene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Benzo(k)fluoranthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Chrysene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Dibenzo(a,h)anthracene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Fluoranthene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Fluorene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Indeno(1,2,3-cd)pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
1-Methylnaphthalene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
2-Methylnaphthalene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Naphthalene	ug/L	0.064	0.066	0.062	0.050	0.050	7786247
Phenanthrene	ug/L	<0.030	0.031	0.034	<0.030	0.030	7786247
Pyrene	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7786247
Surrogate Recovery (%)							
D10-Anthracene	%	105	98	103	97		7786247
D14-Terphenyl (FS)	%	98	96	95	90		7786247
D8-Acenaphthylene	%	103	95	100	95		7786247

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (WATER)

Bureau Veritas ID		RPV426	RPV427			RPV427		
Sampling Date		2022/01/12 15:00	2022/01/12 13:30			2022/01/12 13:30		
COC Number		835786-16-01	835786-16-01			835786-16-01		
	UNITS	**MW101**	**MW102**	**RDL**	**QC Batch**	**MW102 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters								
1,3-Dichloropropene (cis+trans)	ug/L	<0.50	<0.50	0.50	7782562			
Volatile Organics								
Acetone (2-Propanone)	ug/L	<10	<10	10	7783728	<10	10	7783728
Benzene	ug/L	<0.17	<0.17	0.17	7783728	<0.17	0.17	7783728
Bromodichloromethane	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
Bromoform	ug/L	<1.0	<1.0	1.0	7783728	<1.0	1.0	7783728
Bromomethane	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
Carbon Tetrachloride	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
Chlorobenzene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
Chloroform	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
Dibromochloromethane	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
1,2-Dichlorobenzene	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
1,3-Dichlorobenzene	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
Dichlorodifluoromethane (FREON 12)	ug/L	<1.0	<1.0	1.0	7783728	<1.0	1.0	7783728
1,1-Dichloroethane	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
1,2-Dichloroethane	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
1,1-Dichloroethylene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
cis-1,2-Dichloroethylene	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
trans-1,2-Dichloroethylene	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
1,2-Dichloropropane	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
cis-1,3-Dichloropropene	ug/L	<0.30	<0.30	0.30	7783728	<0.30	0.30	7783728
trans-1,3-Dichloropropene	ug/L	<0.40	<0.40	0.40	7783728	<0.40	0.40	7783728
Ethylbenzene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
Ethylene Dibromide	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
Hexane	ug/L	<1.0	<1.0	1.0	7783728	<1.0	1.0	7783728
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	2.0	7783728	<2.0	2.0	7783728
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	<10	10	7783728	<10	10	7783728
Methyl Isobutyl Ketone	ug/L	<5.0	<5.0	5.0	7783728	<5.0	5.0	7783728
Methyl t-butyl ether (MTBE)	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
Styrene	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
1,1,1,2-Tetrachloroethane	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
1,1,2,2-Tetrachloroethane	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
Tetrachloroethylene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 VOCS BY HS & F1-F4 (WATER)

Bureau Veritas ID		RPV426	RPV427			RPV427		
Sampling Date		2022/01/12 15:00	2022/01/12 13:30			2022/01/12 13:30		
COC Number		835786-16-01	835786-16-01			835786-16-01		
	UNITS	**MW101**	**MW102**	**RDL**	**QC Batch**	**MW102 Lab-Dup**	**RDL**	**QC Batch**
Toluene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
1,1,1-Trichloroethane	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
1,1,2-Trichloroethane	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
Trichloroethylene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
Trichlorofluoromethane (FREON 11)	ug/L	<0.50	<0.50	0.50	7783728	<0.50	0.50	7783728
Vinyl Chloride	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
p+m-Xylene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
o-Xylene	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
Total Xylenes	ug/L	<0.20	<0.20	0.20	7783728	<0.20	0.20	7783728
F1 (C6-C10)	ug/L	<25	<25	25	7783728	<25	25	7783728
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	7783728	<25	25	7783728
F2-F4 Hydrocarbons								
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	7786277			
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	200	7786277			
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	200	7786277			
Reached Baseline at C50	ug/L	Yes	Yes		7786277			
Surrogate Recovery (%)								
o-Terphenyl	%	102	102		7786277			
4-Bromofluorobenzene	%	99	100		7783728	99		7783728
D4-1,2-Dichloroethane	%	100	101		7783728	99		7783728
D8-Toluene	%	100	99		7783728	100		7783728

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 VOCS BY HS & F1-F4 (WATER)

Bureau Veritas ID		RPV428	RPV429		
Sampling Date		2022/01/12 13:30	2022/01/12 16:30		
COC Number		835786-16-01	835786-16-01		
	UNITS	**DUP999**	**MW03**	**RDL**	**QC Batch**
Calculated Parameters					
1,3-Dichloropropene (cis+trans)	ug/L	<0.50	<0.50	0.50	7782562
Volatile Organics					
Acetone (2-Propanone)	ug/L	<10	<10	10	7783728
Benzene	ug/L	<0.17	<0.17	0.17	7783728
Bromodichloromethane	ug/L	<0.50	<0.50	0.50	7783728
Bromoform	ug/L	<1.0	<1.0	1.0	7783728
Bromomethane	ug/L	<0.50	<0.50	0.50	7783728
Carbon Tetrachloride	ug/L	<0.20	<0.20	0.20	7783728
Chlorobenzene	ug/L	<0.20	<0.20	0.20	7783728
Chloroform	ug/L	<0.20	<0.20	0.20	7783728
Dibromochloromethane	ug/L	<0.50	<0.50	0.50	7783728
1,2-Dichlorobenzene	ug/L	<0.50	<0.50	0.50	7783728
1,3-Dichlorobenzene	ug/L	<0.50	<0.50	0.50	7783728
1,4-Dichlorobenzene	ug/L	<0.50	<0.50	0.50	7783728
Dichlorodifluoromethane (FREON 12)	ug/L	<1.0	<1.0	1.0	7783728
1,1-Dichloroethane	ug/L	<0.20	<0.20	0.20	7783728
1,2-Dichloroethane	ug/L	<0.50	<0.50	0.50	7783728
1,1-Dichloroethylene	ug/L	<0.20	<0.20	0.20	7783728
cis-1,2-Dichloroethylene	ug/L	<0.50	<0.50	0.50	7783728
trans-1,2-Dichloroethylene	ug/L	<0.50	<0.50	0.50	7783728
1,2-Dichloropropane	ug/L	<0.20	<0.20	0.20	7783728
cis-1,3-Dichloropropene	ug/L	<0.30	<0.30	0.30	7783728
trans-1,3-Dichloropropene	ug/L	<0.40	<0.40	0.40	7783728
Ethylbenzene	ug/L	<0.20	<0.20	0.20	7783728
Ethylene Dibromide	ug/L	<0.20	<0.20	0.20	7783728
Hexane	ug/L	<1.0	<1.0	1.0	7783728
Methylene Chloride(Dichloromethane)	ug/L	<2.0	<2.0	2.0	7783728
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	<10	10	7783728
Methyl Isobutyl Ketone	ug/L	<5.0	<5.0	5.0	7783728
Methyl t-butyl ether (MTBE)	ug/L	<0.50	<0.50	0.50	7783728
Styrene	ug/L	<0.50	<0.50	0.50	7783728
1,1,1,2-Tetrachloroethane	ug/L	<0.50	<0.50	0.50	7783728
1,1,2,2-Tetrachloroethane	ug/L	<0.50	<0.50	0.50	7783728
Tetrachloroethylene	ug/L	<0.20	<0.20	0.20	7783728
Toluene	ug/L	<0.20	<0.20	0.20	7783728

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS & F1-F4 (WATER)

Bureau Veritas ID		RPV428	RPV429		
Sampling Date		2022/01/12 13:30	2022/01/12 16:30		
COC Number		835786-16-01	835786-16-01		
	UNITS	**DUP999**	**MW03**	**RDL**	**QC Batch**
1,1,1-Trichloroethane	ug/L	<0.20	<0.20	0.20	7783728
1,1,2-Trichloroethane	ug/L	<0.50	<0.50	0.50	7783728
Trichloroethylene	ug/L	<0.20	<0.20	0.20	7783728
Trichlorofluoromethane (FREON 11)	ug/L	<0.50	<0.50	0.50	7783728
Vinyl Chloride	ug/L	<0.20	<0.20	0.20	7783728
p+m-Xylene	ug/L	<0.20	<0.20	0.20	7783728
o-Xylene	ug/L	<0.20	<0.20	0.20	7783728
Total Xylenes	ug/L	<0.20	<0.20	0.20	7783728
F1 (C6-C10)	ug/L	<25	<25	25	7783728
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	7783728
F2-F4 Hydrocarbons					
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	7786277
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	200	7786277
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	200	7786277
Reached Baseline at C50	ug/L	Yes	Yes		7786277
Surrogate Recovery (%)					
o-Terphenyl	%	103	101		7786277
4-Bromofluorobenzene	%	100	101		7783728
D4-1,2-Dichloroethane	%	102	102		7783728
D8-Toluene	%	99	101		7783728

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS (WATER)

Bureau Veritas ID		RPV430		
Sampling Date				
COC Number		835786-16-01		
	UNITS	**TBLK-VOC/F1BTEX-21-3719**	**RDL**	**QC Batch**
Calculated Parameters				
1,3-Dichloropropene (cis+trans)	ug/L	<0.50	0.50	7782562
Volatile Organics				
Acetone (2-Propanone)	ug/L	<10	10	7783727
Benzene	ug/L	<0.20	0.20	7783727
Bromodichloromethane	ug/L	<0.50	0.50	7783727
Bromoform	ug/L	<1.0	1.0	7783727
Bromomethane	ug/L	<0.50	0.50	7783727
Carbon Tetrachloride	ug/L	<0.19	0.19	7783727
Chlorobenzene	ug/L	<0.20	0.20	7783727
Chloroform	ug/L	<0.20	0.20	7783727
Dibromochloromethane	ug/L	<0.50	0.50	7783727
1,2-Dichlorobenzene	ug/L	<0.40	0.40	7783727
1,3-Dichlorobenzene	ug/L	<0.40	0.40	7783727
1,4-Dichlorobenzene	ug/L	<0.40	0.40	7783727
Dichlorodifluoromethane (FREON 12)	ug/L	<1.0	1.0	7783727
1,1-Dichloroethane	ug/L	<0.20	0.20	7783727
1,2-Dichloroethane	ug/L	<0.49	0.49	7783727
1,1-Dichloroethylene	ug/L	<0.20	0.20	7783727
cis-1,2-Dichloroethylene	ug/L	<0.50	0.50	7783727
trans-1,2-Dichloroethylene	ug/L	<0.50	0.50	7783727
1,2-Dichloropropane	ug/L	<0.20	0.20	7783727
cis-1,3-Dichloropropene	ug/L	<0.30	0.30	7783727
trans-1,3-Dichloropropene	ug/L	<0.40	0.40	7783727
Ethylbenzene	ug/L	<0.20	0.20	7783727
Ethylene Dibromide	ug/L	<0.19	0.19	7783727
Hexane	ug/L	<1.0	1.0	7783727
Methylene Chloride(Dichloromethane)	ug/L	<2.0	2.0	7783727
Methyl Ethyl Ketone (2-Butanone)	ug/L	<10	10	7783727
Methyl Isobutyl Ketone	ug/L	<5.0	5.0	7783727
Methyl t-butyl ether (MTBE)	ug/L	<0.50	0.50	7783727
Styrene	ug/L	<0.40	0.40	7783727
1,1,1,2-Tetrachloroethane	ug/L	<0.50	0.50	7783727
1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7783727
Tetrachloroethylene	ug/L	<0.20	0.20	7783727
Toluene	ug/L	<0.20	0.20	7783727
1,1,1-Trichloroethane	ug/L	<0.20	0.20	7783727

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

O.REG 153 VOCS BY HS (WATER)

Bureau Veritas ID		RPV430		
Sampling Date				
COC Number		835786-16-01		
	UNITS	**TBLK-VOC/F1BTEX-21-3719**	**RDL**	**QC Batch**
1,1,2-Trichloroethane	ug/L	<0.40	0.40	7783727
Trichloroethylene	ug/L	<0.20	0.20	7783727
Trichlorofluoromethane (FREON 11)	ug/L	<0.50	0.50	7783727
Vinyl Chloride	ug/L	<0.20	0.20	7783727
p+m-Xylene	ug/L	<0.20	0.20	7783727
o-Xylene	ug/L	<0.20	0.20	7783727
Total Xylenes	ug/L	<0.20	0.20	7783727
Surrogate Recovery (%)				
4-Bromofluorobenzene	%	95		7783727
D4-1,2-Dichloroethane	%	109		7783727
D8-Toluene	%	95		7783727

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

TEST SUMMARY

Bureau Veritas ID: RPV426
Sample ID: MW101
Matrix: Water

Collected: 2022/01/12
Shipped:
Received: 2022/01/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7782662	N/A	2022/01/20	Automated Statchk
1,3-Dichloropropene Sum	CALC	7782562	N/A	2022/01/19	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7786277	2022/01/18	2022/01/19	Agnieszka Brzuzy-Snopko
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7786247	2022/01/18	2022/01/19	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7783728	N/A	2022/01/18	Jett Wu

Bureau Veritas ID: RPV427
Sample ID: MW102
Matrix: Water

Collected: 2022/01/12
Shipped:
Received: 2022/01/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7782662	N/A	2022/01/20	Automated Statchk
1,3-Dichloropropene Sum	CALC	7782562	N/A	2022/01/19	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7786277	2022/01/18	2022/01/19	Agnieszka Brzuzy-Snopko
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7786247	2022/01/18	2022/01/19	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7783728	N/A	2022/01/18	Jett Wu

Bureau Veritas ID: RPV427 Dup
Sample ID: MW102
Matrix: Water

Collected: 2022/01/12
Shipped:
Received: 2022/01/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7783728	N/A	2022/01/18	Jett Wu

Bureau Veritas ID: RPV428
Sample ID: DUP999
Matrix: Water

Collected: 2022/01/12
Shipped:
Received: 2022/01/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7782662	N/A	2022/01/20	Automated Statchk
1,3-Dichloropropene Sum	CALC	7782562	N/A	2022/01/19	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7786277	2022/01/18	2022/01/19	Agnieszka Brzuzy-Snopko
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7786247	2022/01/18	2022/01/19	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7783728	N/A	2022/01/18	Jett Wu

Bureau Veritas ID: RPV429
Sample ID: MW03
Matrix: Water

Collected: 2022/01/12
Shipped:
Received: 2022/01/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	7782662	N/A	2022/01/20	Automated Statchk
1,3-Dichloropropene Sum	CALC	7782562	N/A	2022/01/19	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	7786277	2022/01/18	2022/01/19	Agnieszka Brzuzy-Snopko
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7786247	2022/01/18	2022/01/19	Jonghan Yoon
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7783728	N/A	2022/01/18	Jett Wu

TEST SUMMARY

Bureau Veritas ID: RPV430
Sample ID: TBLK-VOC/F1BTEX-21-3719
Matrix: Water

Collected:
Shipped:
Received: 2022/01/14

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	7782562	N/A	2022/01/20	Automated Statchk
Volatile Organic Compounds in Water	GC/MS	7783727	N/A	2022/01/19	Ancheol Jeong

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.7°C

Cooler custody seal was present and intact.

All 40 ml vials for F1BTEX and VOC analyses contained visible sediment.
All 100 ml amber glass bottles for F2-F4 and PAH analyses contained visible sediment, which was included in the extraction.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
7783727	4-Bromofluorobenzene	2022/01/19	102	70 - 130	101	70 - 130	102	%		
7783727	D4-1,2-Dichloroethane	2022/01/19	108	70 - 130	105	70 - 130	108	%		
7783727	D8-Toluene	2022/01/19	101	70 - 130	101	70 - 130	95	%		
7783728	4-Bromofluorobenzene	2022/01/18	100	70 - 130	100	70 - 130	100	%		
7783728	D4-1,2-Dichloroethane	2022/01/18	101	70 - 130	102	70 - 130	99	%		
7783728	D8-Toluene	2022/01/18	101	70 - 130	100	70 - 130	100	%		
7786247	D10-Anthracene	2022/01/19	101	50 - 130	100	50 - 130	109	%		
7786247	D14-Terphenyl (FS)	2022/01/19	86	50 - 130	97	50 - 130	101	%		
7786247	D8-Acenaphthylene	2022/01/19	100	50 - 130	98	50 - 130	105	%		
7786277	o-Terphenyl	2022/01/18	105	60 - 130	105	60 - 130	100	%		
7783727	1,1,1,2-Tetrachloroethane	2022/01/19	94	70 - 130	93	70 - 130	<0.50	ug/L	NC	30
7783727	1,1,1-Trichloroethane	2022/01/19	98	70 - 130	99	70 - 130	<0.20	ug/L	NC	30
7783727	1,1,2,2-Tetrachloroethane	2022/01/19	99	70 - 130	93	70 - 130	<0.40	ug/L	NC	30
7783727	1,1,2-Trichloroethane	2022/01/19	106	70 - 130	100	70 - 130	<0.40	ug/L	NC	30
7783727	1,1-Dichloroethane	2022/01/19	92	70 - 130	92	70 - 130	<0.20	ug/L	NC	30
7783727	1,1-Dichloroethylene	2022/01/19	92	70 - 130	94	70 - 130	<0.20	ug/L	NC	30
7783727	1,2-Dichlorobenzene	2022/01/19	93	70 - 130	92	70 - 130	<0.40	ug/L	NC	30
7783727	1,2-Dichloroethane	2022/01/19	100	70 - 130	96	70 - 130	<0.49	ug/L	NC	30
7783727	1,2-Dichloropropane	2022/01/19	96	70 - 130	95	70 - 130	<0.20	ug/L	NC	30
7783727	1,3-Dichlorobenzene	2022/01/19	91	70 - 130	91	70 - 130	<0.40	ug/L	NC	30
7783727	1,4-Dichlorobenzene	2022/01/19	106	70 - 130	106	70 - 130	<0.40	ug/L	NC	30
7783727	Acetone (2-Propanone)	2022/01/19	116	60 - 140	108	60 - 140	<10	ug/L	NC	30
7783727	Benzene	2022/01/19	86	70 - 130	85	70 - 130	<0.20	ug/L	NC	30
7783727	Bromodichloromethane	2022/01/19	102	70 - 130	99	70 - 130	<0.50	ug/L	NC	30
7783727	Bromoform	2022/01/19	102	70 - 130	96	70 - 130	<1.0	ug/L	NC	30
7783727	Bromomethane	2022/01/19	93	60 - 140	91	60 - 140	<0.50	ug/L	NC	30
7783727	Carbon Tetrachloride	2022/01/19	96	70 - 130	97	70 - 130	<0.19	ug/L	NC	30
7783727	Chlorobenzene	2022/01/19	95	70 - 130	94	70 - 130	<0.20	ug/L	NC	30
7783727	Chloroform	2022/01/19	98	70 - 130	97	70 - 130	<0.20	ug/L	NC	30
7783727	cis-1,2-Dichloroethylene	2022/01/19	100	70 - 130	98	70 - 130	<0.50	ug/L	NC	30
7783727	cis-1,3-Dichloropropene	2022/01/19	99	70 - 130	94	70 - 130	<0.30	ug/L	NC	30

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7783727	Dibromochloromethane	2022/01/19	100	70 - 130	93	70 - 130	<0.50	ug/L	NC	30
7783727	Dichlorodifluoromethane (FREON 12)	2022/01/19	66	60 - 140	72	60 - 140	<1.0	ug/L	NC	30
7783727	Ethylbenzene	2022/01/19	86	70 - 130	88	70 - 130	<0.20	ug/L	NC	30
7783727	Ethylene Dibromide	2022/01/19	98	70 - 130	92	70 - 130	<0.19	ug/L	NC	30
7783727	Hexane	2022/01/19	88	70 - 130	94	70 - 130	<1.0	ug/L	NC	30
7783727	Methyl Ethyl Ketone (2-Butanone)	2022/01/19	114	60 - 140	105	60 - 140	<10	ug/L	NC	30
7783727	Methyl Isobutyl Ketone	2022/01/19	116	70 - 130	109	70 - 130	<5.0	ug/L	NC	30
7783727	Methyl t-butyl ether (MTBE)	2022/01/19	93	70 - 130	91	70 - 130	<0.50	ug/L	NC	30
7783727	Methylene Chloride(Dichloromethane)	2022/01/19	96	70 - 130	94	70 - 130	<2.0	ug/L	NC	30
7783727	o-Xylene	2022/01/19	83	70 - 130	86	70 - 130	<0.20	ug/L	NC	30
7783727	p+m-Xylene	2022/01/19	89	70 - 130	91	70 - 130	<0.20	ug/L	NC	30
7783727	Styrene	2022/01/19	101	70 - 130	102	70 - 130	<0.40	ug/L	NC	30
7783727	Tetrachloroethylene	2022/01/19	89	70 - 130	88	70 - 130	<0.20	ug/L	NC	30
7783727	Toluene	2022/01/19	92	70 - 130	91	70 - 130	<0.20	ug/L	NC	30
7783727	Total Xylenes	2022/01/19					<0.20	ug/L	NC	30
7783727	trans-1,2-Dichloroethylene	2022/01/19	96	70 - 130	97	70 - 130	<0.50	ug/L	NC	30
7783727	trans-1,3-Dichloropropene	2022/01/19	111	70 - 130	102	70 - 130	<0.40	ug/L	NC	30
7783727	Trichloroethylene	2022/01/19	99	70 - 130	98	70 - 130	<0.20	ug/L	NC	30
7783727	Trichlorofluoromethane (FREON 11)	2022/01/19	90	70 - 130	92	70 - 130	<0.50	ug/L	NC	30
7783727	Vinyl Chloride	2022/01/19	82	70 - 130	85	70 - 130	<0.20	ug/L	NC	30
7783728	1,1,1,2-Tetrachloroethane	2022/01/18	90	70 - 130	95	70 - 130	<0.50	ug/L	NC	30
7783728	1,1,1-Trichloroethane	2022/01/18	93	70 - 130	98	70 - 130	<0.20	ug/L	NC	30
7783728	1,1,2,2-Tetrachloroethane	2022/01/18	87	70 - 130	91	70 - 130	<0.50	ug/L	NC	30
7783728	1,1,2-Trichloroethane	2022/01/18	91	70 - 130	96	70 - 130	<0.50	ug/L	NC	30
7783728	1,1-Dichloroethane	2022/01/18	88	70 - 130	93	70 - 130	<0.20	ug/L	NC	30
7783728	1,1-Dichloroethylene	2022/01/18	91	70 - 130	96	70 - 130	<0.20	ug/L	NC	30
7783728	1,2-Dichlorobenzene	2022/01/18	92	70 - 130	95	70 - 130	<0.50	ug/L	NC	30
7783728	1,2-Dichloroethane	2022/01/18	88	70 - 130	93	70 - 130	<0.50	ug/L	NC	30
7783728	1,2-Dichloropropane	2022/01/18	88	70 - 130	93	70 - 130	<0.20	ug/L	NC	30
7783728	1,3-Dichlorobenzene	2022/01/18	92	70 - 130	95	70 - 130	<0.50	ug/L	NC	30
7783728	1,4-Dichlorobenzene	2022/01/18	107	70 - 130	110	70 - 130	<0.50	ug/L	NC	30

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7783728	Acetone (2-Propanone)	2022/01/18	90	60 - 140	95	60 - 140	<10	ug/L	NC	30
7783728	Benzene	2022/01/18	82	70 - 130	87	70 - 130	<0.17	ug/L	NC	30
7783728	Bromodichloromethane	2022/01/18	92	70 - 130	98	70 - 130	<0.50	ug/L	NC	30
7783728	Bromoform	2022/01/18	87	70 - 130	93	70 - 130	<1.0	ug/L	NC	30
7783728	Bromomethane	2022/01/18	92	60 - 140	94	60 - 140	<0.50	ug/L	NC	30
7783728	Carbon Tetrachloride	2022/01/18	91	70 - 130	97	70 - 130	<0.20	ug/L	NC	30
7783728	Chlorobenzene	2022/01/18	92	70 - 130	96	70 - 130	<0.20	ug/L	NC	30
7783728	Chloroform	2022/01/18	90	70 - 130	95	70 - 130	<0.20	ug/L	NC	30
7783728	cis-1,2-Dichloroethylene	2022/01/18	91	70 - 130	96	70 - 130	<0.50	ug/L	NC	30
7783728	cis-1,3-Dichloropropene	2022/01/18	95	70 - 130	94	70 - 130	<0.30	ug/L	NC	30
7783728	Dibromochloromethane	2022/01/18	88	70 - 130	93	70 - 130	<0.50	ug/L	NC	30
7783728	Dichlorodifluoromethane (FREON 12)	2022/01/18	74	60 - 140	79	60 - 140	<1.0	ug/L	NC	30
7783728	Ethylbenzene	2022/01/18	84	70 - 130	88	70 - 130	<0.20	ug/L	NC	30
7783728	Ethylene Dibromide	2022/01/18	88	70 - 130	93	70 - 130	<0.20	ug/L	NC	30
7783728	F1 (C6-C10) - BTEX	2022/01/18					<25	ug/L	NC	30
7783728	F1 (C6-C10)	2022/01/18	89	60 - 140	89	60 - 140	<25	ug/L	NC	30
7783728	Hexane	2022/01/18	93	70 - 130	97	70 - 130	<1.0	ug/L	NC	30
7783728	Methyl Ethyl Ketone (2-Butanone)	2022/01/18	88	60 - 140	94	60 - 140	<10	ug/L	NC	30
7783728	Methyl Isobutyl Ketone	2022/01/18	86	70 - 130	92	70 - 130	<5.0	ug/L	NC	30
7783728	Methyl t-butyl ether (MTBE)	2022/01/18	86	70 - 130	91	70 - 130	<0.50	ug/L	NC	30
7783728	Methylene Chloride(Dichloromethane)	2022/01/18	89	70 - 130	94	70 - 130	<2.0	ug/L	NC	30
7783728	o-Xylene	2022/01/18	83	70 - 130	87	70 - 130	<0.20	ug/L	NC	30
7783728	p+m-Xylene	2022/01/18	86	70 - 130	91	70 - 130	<0.20	ug/L	NC	30
7783728	Styrene	2022/01/18	95	70 - 130	100	70 - 130	<0.50	ug/L	NC	30
7783728	Tetrachloroethylene	2022/01/18	87	70 - 130	92	70 - 130	<0.20	ug/L	NC	30
7783728	Toluene	2022/01/18	92	70 - 130	97	70 - 130	<0.20	ug/L	NC	30
7783728	Total Xylenes	2022/01/18					<0.20	ug/L	NC	30
7783728	trans-1,2-Dichloroethylene	2022/01/18	91	70 - 130	96	70 - 130	<0.50	ug/L	NC	30
7783728	trans-1,3-Dichloropropene	2022/01/18	104	70 - 130	100	70 - 130	<0.40	ug/L	NC	30
7783728	Trichloroethylene	2022/01/18	97	70 - 130	101	70 - 130	<0.20	ug/L	NC	30
7783728	Trichlorofluoromethane (FREON 11)	2022/01/18	92	70 - 130	97	70 - 130	<0.50	ug/L	NC	30

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7783728	Vinyl Chloride	2022/01/18	81	70 - 130	86	70 - 130	<0.20	ug/L	NC	30
7786247	1-Methylnaphthalene	2022/01/19	NC	50 - 130	101	50 - 130	<0.050	ug/L	7.2	30
7786247	2-Methylnaphthalene	2022/01/19	NC	50 - 130	98	50 - 130	<0.050	ug/L	7.8	30
7786247	Acenaphthene	2022/01/19	NC	50 - 130	107	50 - 130	<0.050	ug/L	7.1	30
7786247	Acenaphthylene	2022/01/19	93	50 - 130	106	50 - 130	<0.050	ug/L	1.7	30
7786247	Anthracene	2022/01/19	98	50 - 130	107	50 - 130	<0.050	ug/L	9.0	30
7786247	Benzo(a)anthracene	2022/01/19	116	50 - 130	119	50 - 130	<0.050	ug/L	4.3	30
7786247	Benzo(a)pyrene	2022/01/19	112	50 - 130	118	50 - 130	<0.0090	ug/L	4.5	30
7786247	Benzo(b/j)fluoranthene	2022/01/19	107	50 - 130	114	50 - 130	<0.050	ug/L	4.0	30
7786247	Benzo(g,h,i)perylene	2022/01/19	107	50 - 130	115	50 - 130	<0.050	ug/L	4.1	30
7786247	Benzo(k)fluoranthene	2022/01/19	111	50 - 130	116	50 - 130	<0.050	ug/L	3.9	30
7786247	Chrysene	2022/01/19	115	50 - 130	118	50 - 130	<0.050	ug/L	1.6	30
7786247	Dibenzo(a,h)anthracene	2022/01/19	106	50 - 130	112	50 - 130	<0.050	ug/L	3.1	30
7786247	Fluoranthene	2022/01/19	116	50 - 130	125	50 - 130	<0.050	ug/L	4.7	30
7786247	Fluorene	2022/01/19	NC	50 - 130	110	50 - 130	<0.050	ug/L	7.8	30
7786247	Indeno(1,2,3-cd)pyrene	2022/01/19	111	50 - 130	119	50 - 130	<0.050	ug/L	3.6	30
7786247	Naphthalene	2022/01/19	NC	50 - 130	97	50 - 130	<0.050	ug/L	6.3	30
7786247	Phenanthrene	2022/01/19	NC	50 - 130	115	50 - 130	<0.030	ug/L	8.2	30
7786247	Pyrene	2022/01/19	112	50 - 130	122	50 - 130	<0.050	ug/L	4.8	30
7786277	F2 (C10-C16 Hydrocarbons)	2022/01/19	NC	60 - 130	106	60 - 130	<100	ug/L	NC	30
7786277	F3 (C16-C34 Hydrocarbons)	2022/01/19	91	60 - 130	109	60 - 130	<200	ug/L	NC	30

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**% Recovery**	**QC Limits**	**% Recovery**	**QC Limits**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
7786277	F4 (C34-C50 Hydrocarbons)	2022/01/19	94	60 - 130	111	60 - 130	<200	ug/L	NC	30

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Brad Newman, B.Sc., C.Chem., Scientific Service Specialist

14-Jan-22 12:33
Antonella Brasil
C210981
KSE ENV-953

Presence of Visible Particulate/Sediment

Maxxam Analytics
CAM FCD-01013/5
Page 1 of 1

When there is >1cm of visible particulate/sediment, the amount will be recorded in the field below

Bottle Types

			Inorganics					Organics											Hydrocarbons							Volatiles				Other
	Sample ID	All	CrVI	CN	General	Hg	Metals (Diss.)	Organic 1 of 2	Organic 2 of 2	PCB 1 of 2	PCB 2 of 2	Pest/ Herb 1 of 2	Pest/ Herb 2 of 2	SVOC/ ABN 1 of 2	SVOC/ ABN 2 of 2	PAH 1 of 2	PAH 2 of 2	Dioxin /Furan	F1 Vial 1	F1 Vial 2	F1 Vial 3	F1 Vial 4	F2-F4 1 of 2	F2-F4 2 of 2	F4G	VOC Vial 1	VOC Vial 2	VOC Vial 3	VOC Vial 4	
1	MW101	TS																												
2	MW102	TS																												
3	DUP999	TS																												
4	MW03	TS																												
5																														
6																														
7																														
8																														
9																														
10																														

Comments:

Legend:	
P	Suspended Particulate
TS	Trace Settled Sediment (just covers bottom of container or less)
S	Sediment greater than (>) Trace, but less than (<) 1 cm

Recorded By: (signature/print) KavithaSelvan

Bureau Veritas Laboratories
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvlabs.com

14-Jan-22 12:33
Antonella Brasil
C210981
KSE ENV-953

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INVOICE TO:		REPORT TO:	
Company Name:	#29276 Pinchin Ltd	Company Name:	PINCHIN
Attention:	Accounts Payable	Attention:	David Mignone, Erin Tracey
Address:	386 St. Paul Street Suite 202 St. Catharines ON L2R 3N2	Address:	
Tel:	(289) 241-1988 Fax:	Tel:	dmignone@pinchin.com
Email:	ap@pinchin.com	Email:	etracey@pinchin.com

PROJECT INFORMATION:

Quotation #: A70927
P.O. #:
Project: ~~280461.002~~ 296202.001
Project Name:
Site #:
Sampled By: ET

Only:
Bottle Order #: 835786
COC #: C#835786-16-01
Project Manager: Antonella Brasil

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)			Other Regulations		Special Instructions
☐ Table 1	☐ Res/Park	☐ Medium/Fine	☐ CCME	☐ Sanitary Sewer Bylaw	
☐ Table 2	☐ Ind/Comm	☐ ~~Coarse~~	☐ Reg 558	☐ Storm Sewer Bylaw	
☐ Table 3	☐ Agri/Other	[☑ For RSC]	☐ MISA	Municipality ______	
☐ Table ___			☐ PWQO	☐ Reg 406 Table ______	
			☐ Other ______		

Include Criteria on Certificate of Analysis (Y/N)? ______

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission) ☐
Date Required: ______ Time Required: ______
Rush Confirmation Number: ______ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	O Reg 153 PAHs (Soil)	O Reg 153 VOCs by HS & F1-F4 (Soil)	VOCs								# of Bottles	Comments
1		MW101	22/01/12	15:00	Water		X	X									5	
2		MW102	22/01/12	13:30			X	X									5	
3		DUP999	22/01/12	13:30			X	X									5	
4		MW03	22/01/12	16:30			X	X									5	
5		[illegible] TBLK-VOC/F1BTEX- 21-3719	—	—					X								2	
6																		
7																		
8																		
9																		
10																		

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
E. Tracey / E. TRACEY	22/01/14	9:00	Raj Masani	22/01/14	1233	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	2 | 2 | 1	Present	—	
		Intact	—	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

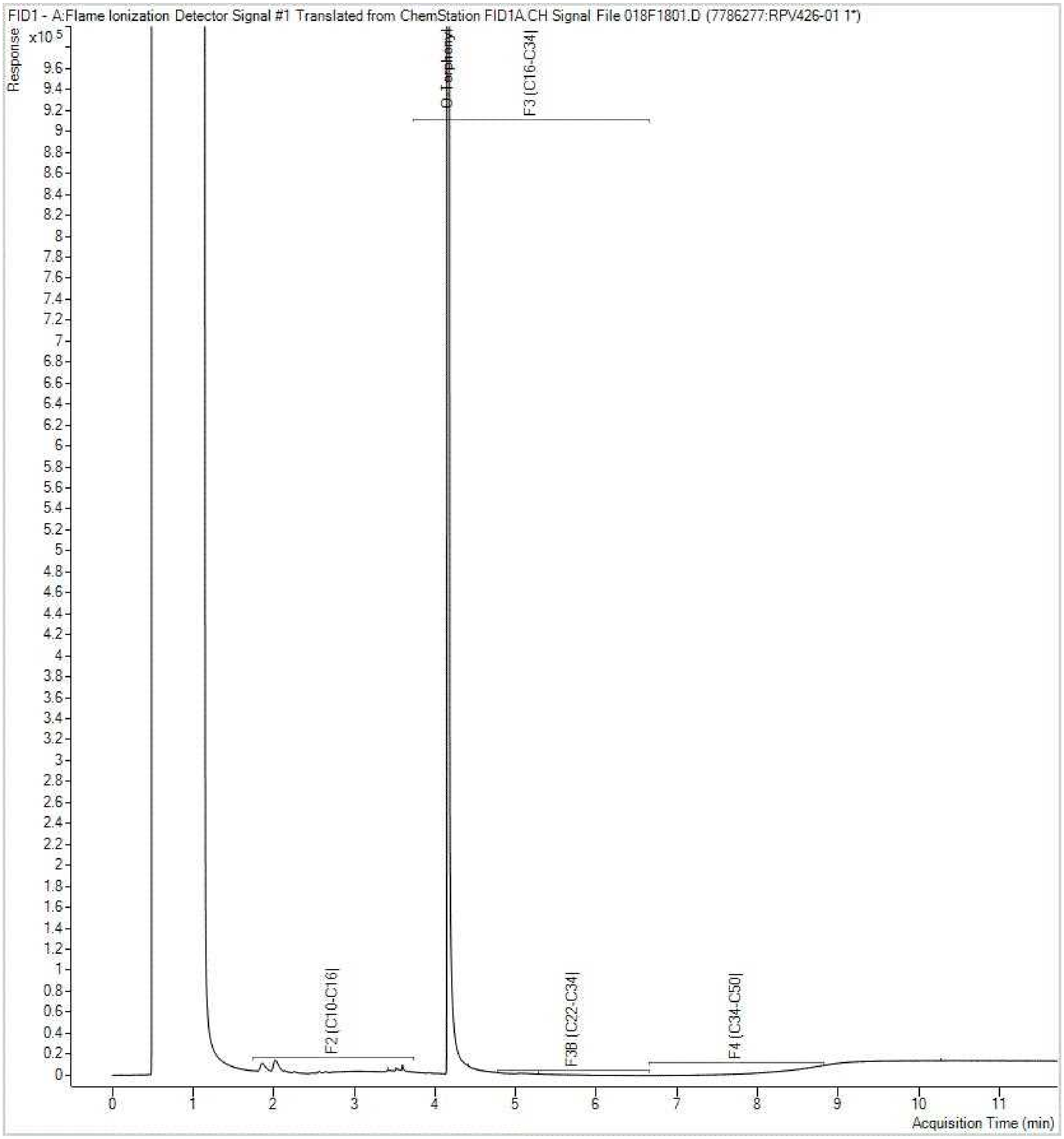
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

ON24F

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

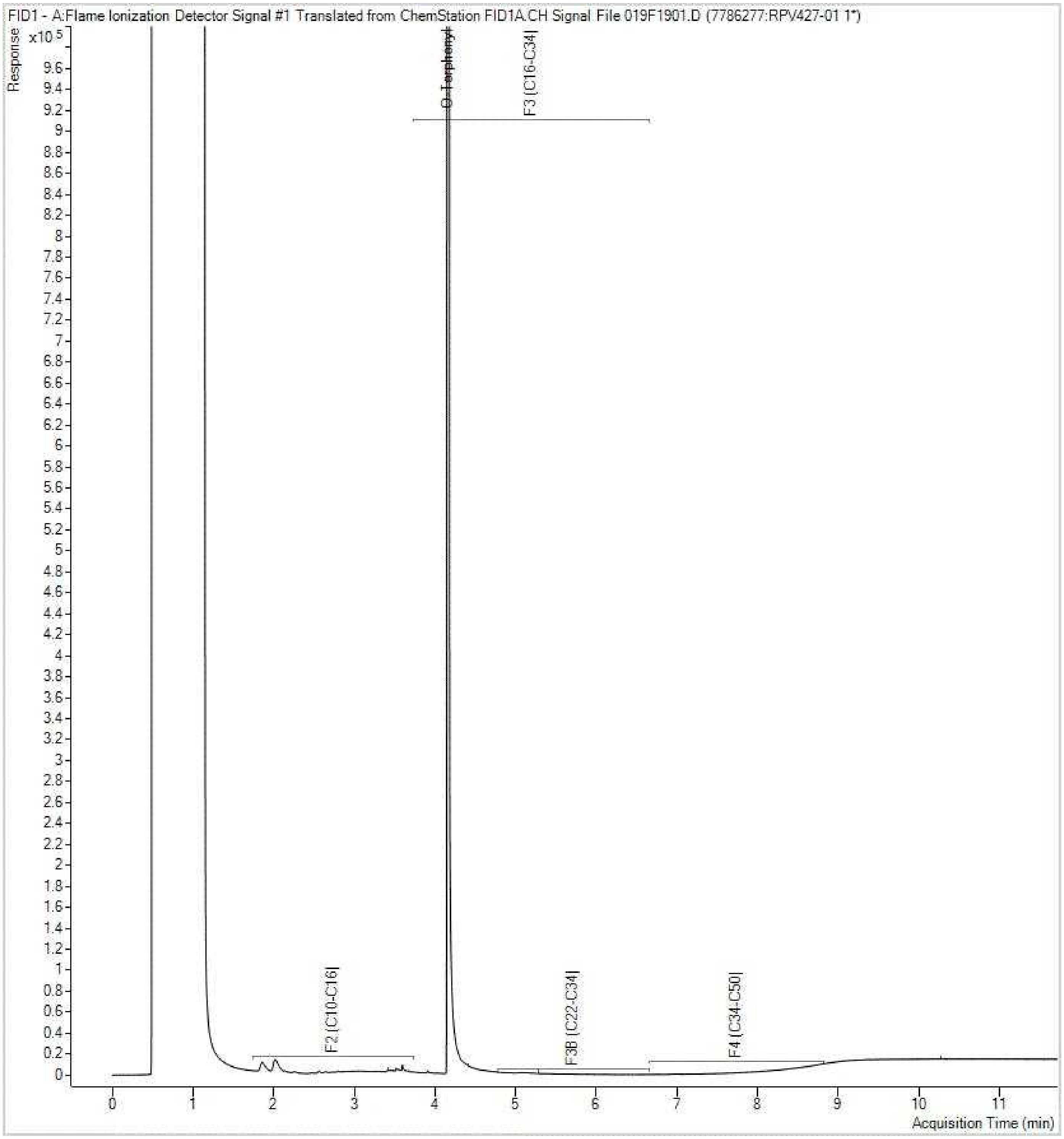


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C210981
Report Date: 2022/01/20
Bureau Veritas Sample: RPV427

Pinchin Ltd
Client Project #: 296202.001
Client ID: MW102

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

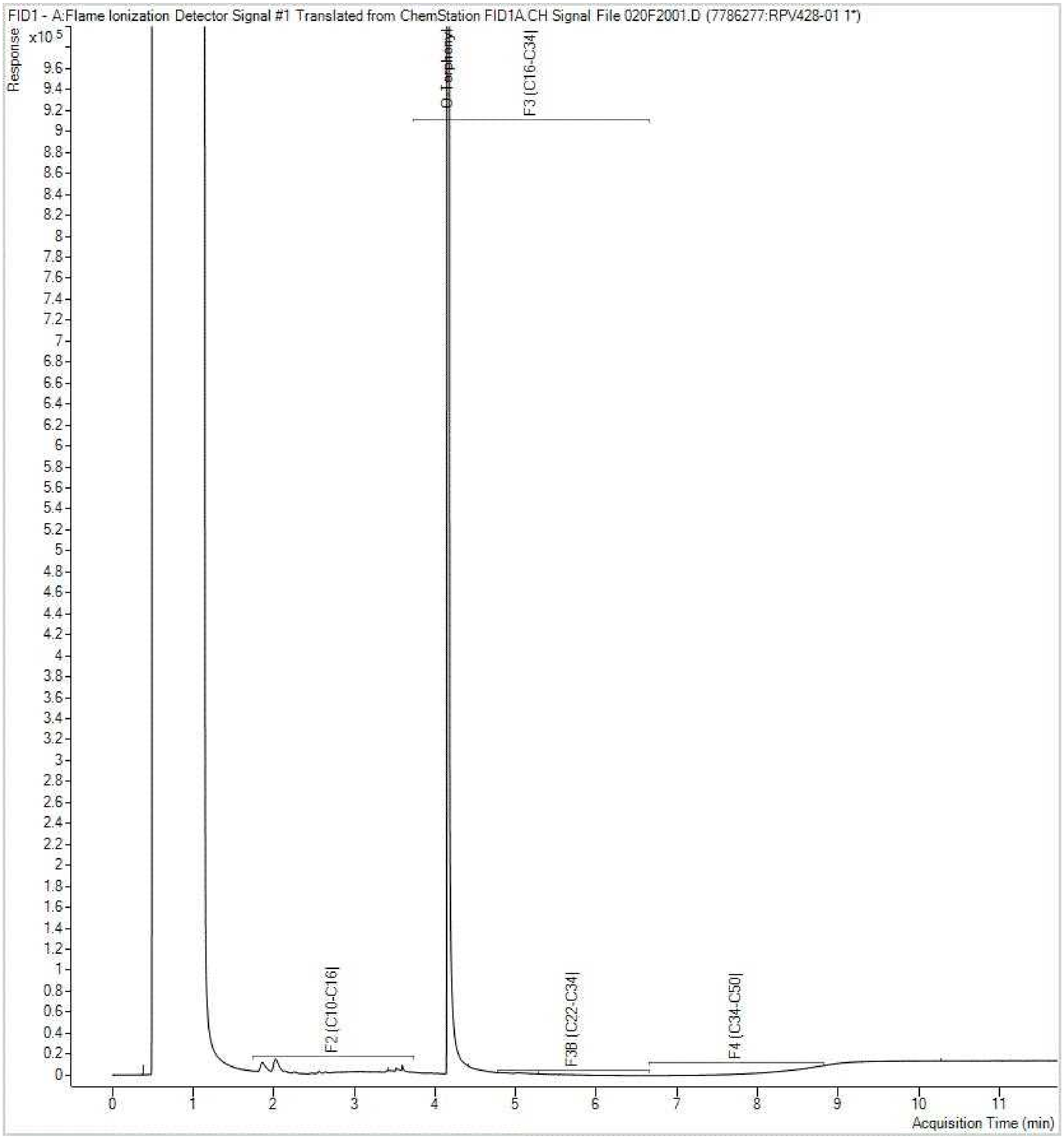


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C210981
Report Date: 2022/01/20
Bureau Veritas Sample: RPV428

Pinchin Ltd
Client Project #: 296202.001
Client ID: DUP999

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

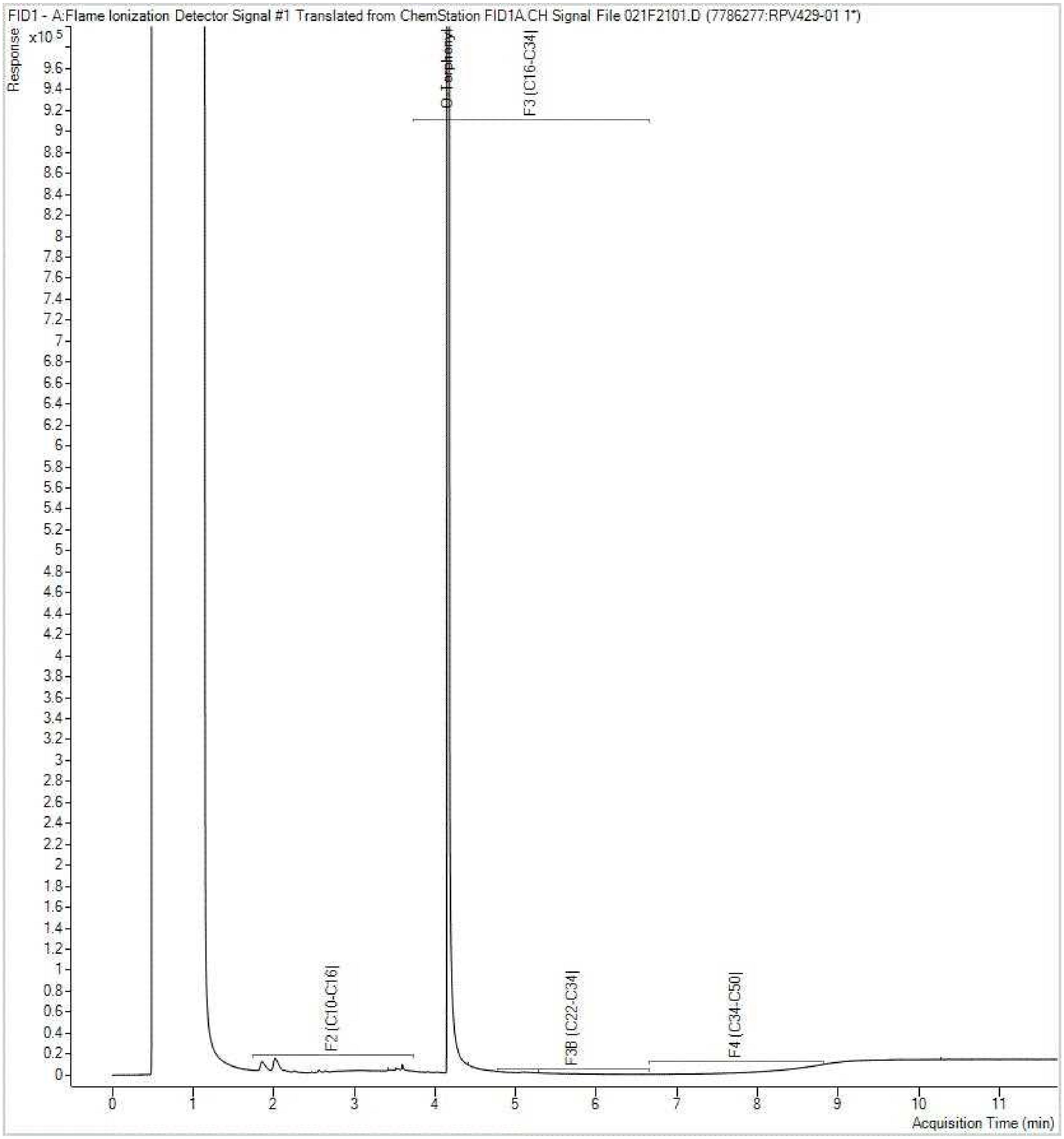


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Bureau Veritas Job #: C210981
Report Date: 2022/01/20
Bureau Veritas Sample: RPV429

Pinchin Ltd
Client Project #: 296202.001
Client ID: MW03

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.