APPENDIX C - GEOTECHNICAL REPORT

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Geotechnical Investigation

Proposed Bridge Replacement and Resurfacing Design
Cross Street, between 7th Line to Kennedy Road
Town of Innisfil, Ontario

Prepared For:

Associated Engineering (Ontario) Limited

GeoPro Project No. 18-2298G Revised

Report Date: November 21, 2018

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1. INTRODUCTION

GeoPro Consulting Limited (GeoPro) was retained by Associated Engineering (Ontario) Limited (the Client) to conduct a geotechnical investigation for the proposed bridge replacement and resurfacing design located on Cross Street, between 7th Line to Kennedy Road, Town of Innisfil, Ontario.

The purpose of this geotechnical investigation was to obtain information on the existing subsurface conditions by means of a limited number of boreholes and/or test pits, in-situ tests and laboratory tests of soil samples to provide required geotechnical design information. Based on GeoPro's interpretation of the data obtained, geotechnical comments and recommendations related to the project designs are provided.

The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Further, the recommendations and opinions in this report are applicable only to the proposed project as described above. On-going liaison and communication with GeoPro during the design stage and construction phases of the project is strongly recommended to confirm that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed project shall be directed to GeoPro for further elaboration and/or clarification.

This report is provided on the basis of the terms of reference presented in our approved proposal prepared based on our understanding of the project. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this report can be relied upon.

This report deals with geotechnical issues only. The geo-environmental (chemical) aspects of the subsurface conditions, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, were not investigated and were beyond the scope of this assignment. However, a limited chemical testing was carried out on selected soil samples for excess soil disposal purposes.

The site investigation and recommendations follow generally accepted practice for geotechnical and geo-environmental consultants in Ontario. Laboratory testing follows ASTM or CSA Standards or modifications of these standards that have become standard practice in Ontario.

This report has been prepared for the Client only. Third party use of this report without GeoPro's consent is prohibited. The limitations to the report presented in this report form an integral part of the report and they must be considered in conjunction with this report.

2. FIELD WORK

The field work for the geotechnical investigation was carried out on June 2 and 22, 2018, during which time two (2) boreholes (Boreholes BH1 and BH2) was advanced at the location shown on the Borehole Location Plan, Drawing 1. The boreholes were drilled to depths ranging from about 6.6 m to 9.1 m below the existing ground surface.

A proposed borehole location plan prepared by GeoPro was provided to Client for review prior to the field investigation work. The approved borehole locations were staked in the field by GeoPro; the borehole locations in the field were adjusted according to the drill rig accessibility and the underground utility conditions. The field work for this investigation was monitored by a member of our engineering staff who logged the boreholes and cared for the recovered samples.

The borehole was advanced using continuous flight auger equipment supplied by a drilling specialist subcontracted to GeoPro. Samples were retrieved with a 51 mm (2 inches) O.D. split-barrel (split spoon) sampler driven with a hammer weighing 624 N and dropping 760 mm (30 inches) in accordance with the Standard Penetration Test (SPT) method.

Groundwater condition observations were made in the boreholes during drilling and immediately upon completion of drilling. Monitoring well (51 mm in diameter) was installed in Boreholes BH1 and BH2 to monitor long-term groundwater conditions as well as to facilitate the in-situ hydrogeological testing.

All soil samples obtained during this investigation were brought to our laboratory for further examination and geotechnical classification testing (including water contents, grain size distributions and Atterberg limits, when applicable) on selected soil samples. These soil samples will be stored for a period of three (3) months after the day of issuing draft report, after which time they will be discarded unless we are advised otherwise in writing. The result of grain size analysis of the selected soil sample is presented on Figure 1.

The approximate elevations at the as-drilled borehole locations were surveyed using a DGPS unit. The elevations at the as-drilled borehole locations were not provided by a professional surveyor and should be considered to be approximate. Contractors performing the work should confirm the elevations prior to construction. The borehole locations plotted on Borehole Location Plan Drawing 1 were based on the measurements of the site features and should be considered to be approximate.

3. SUBSURFACE CONDITIONS

Notes on Sample descriptions are presented on Enclosure 1A. Explanation of terms used in the record of borehole is presented on Enclosure 1B. The subsurface conditions in the boreholes (Boreholes BH1 and BH2) are presented in the individual borehole logs (Enclosures 2 and 3). The following are detailed descriptions of the soil strata encountered in the borehole drilled at the site.

3.1 Soil Conditions

Pavement

Asphalt with thicknesses ranging from about 50 mm to 60 mm was encountered surficially in Boreholes BH1 and BH2.

Granular base and subbase materials with thickness ranging from about 280 mm to 750 mm were encountered below the asphalt in Boreholes BH1 and BH2.

Borehole BH1 was moved to the paved shoulder due to the existing underground utilities and overhead cables. The pavement structure of Borehole BH1 may not be able to present the existing pavement structure of the road.

Due to the generally sandy/gravelly nature of the sand and gravelly sand subgrade soils, the exact depths of granular subbase were difficult to distinguish.

(Probable) Fill Materials

(Probable) fill materials consisting of silty fine sand, (fine) sand and gravelly sand were encountered below the granular base and subbase materials in Boreholes BH1 and BH2, and extended to depths ranging from about 1.4 m to 2.9 m below the existing ground surface. SPT N values ranging from 3 to 9 blows per 300 mm penetration indicated a very loose to loose compactness. The in-situ moisture content measured in the soil samples ranged from approximately 9% to 15%.

Sand and Fine Sand

Sand and fine sand deposits were encountered below the probable fill materials in Boreholes BH1 and BH2, and extended to depths ranging from about 6.1 to 6.6 m below the existing ground surface. Borehole BH1 was terminated in these deposits. SPT N values ranging from about 2 to 4 blows per 300 mm penetration indicated a very loose to loose compactness. The natural moisture content measured in the soil samples ranged from approximately 14% to 22%.

Dynamic Cone Penetration Test (DCPT)

Dynamic cone penetration test (DCPT) was carried out at a depth of about 6.1 m below the existing ground surface in Borehole BH2, and extended to a depth of about 9.1 m below the existing ground surface. DCPT testing was carried out until the termination depth of the Borehole BH2. The inferred N values ranged from 2 to 226 blows per 300 mm penetration.

3.2 Groundwater Conditions

Groundwater condition observations made in the boreholes during and immediately upon completion of drilling are shown in the borehole logs and are also summarized in the following table.

BH No.	BH Depth (m)	Depth of Water Encountered during Drilling (mBGS)	Water Level upon Completion of Drilling (mBGS)	Cave-in Depth upon Completion of Drilling (mBGS)
BH1	6.6	0.8	0.8	0.8
BH2	9.1	0.8	0.9	2.4

Note: mBGS = meters below ground surface

Monitoring well construction details and the measured groundwater levels are shown in the borehole logs and also summarized in the following table.

Monitoring Well ID	Screen Interval (mBGS)	Water Level (mBGS)
		July 16, 2018
BH1	1.5 - 3.0	1.05
BH2	1.5 – 3.0	0.96

Notes: mBGS = meters below ground surface

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to weather events.

4. DISCUSSION AND RECOMMENDATIONS

This report contains the findings of GeoPro's geotechnical investigation, together with the geotechnical engineering recommendations and comments. These recommendations and comments are based on factual information and are intended only for use by the design engineers. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. Construction methods discussed, however, express GeoPro's opinion only and are not intended to direct the contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all the factors that may have an effect upon the construction.

The design drawings of the project are not available at the time of preparing this report. Once the design drawings and detail site plan are available, this report should be reviewed by GeoPro and further recommendations be provided as appropriate.

4.1 Site and Project Description

The existing concrete box culvert is located south of the 7th Line and north of Kennedy Road where Cross Street crosses a tributary of Banks Creek in Alcona, Town of Innisfil, approximately 80 m south of the 7th Line. It is understood that the existing concrete culvert will be replaced with a new concrete box culvert. It is understood that the culvert replacement will be designed in accordance with the current Canadian Highway Bridge Design Code (CHBDC).

4.2 Foundation Design Considerations and Wingwalls

Shallow Foundation

Based on the results of this investigation, the fill materials and very loose to loose sandy deposits encountered at the site are considered unsuitable to support the proposed culvert/wingwall and should be completely removed within the footprint of the culvert. The proposed culvert may be founded in the native, undisturbed, competent soil deposits. The soil bearing resistances at Serviceability Limit States (SLS) and a factored bearing resistances at Ultimate Limit States (ULS) together with the corresponding founding depths at the borehole locations and anticipated soils are provided in the following table.

Borehole No.	Bearing Resistance at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Anticipated Bearing Soil
BH1	50	75	1.4	Very Loose Fine Sand
BH2	50	75	2.9	Loose Sand to Fine Sand

The proposed founding soils to be exposed at the founding/subgrade level are susceptible to disturbance from construction traffic and ponded water, leading to degradation of the founding soils. To limit this detrimental condition, a working mat of consisting of at least 100 mm lean concrete (i.e. 10 MPa) should be placed on the subgrade as soon as possible after the base of excavation has been inspected and approved by the geotechnical engineer from GeoPro, unless the foundation concrete is to be placed immediately.

It is recommended that a 75 mm thick leveling pad of Granular A or concrete fine aggregate (meeting the gradation requirements in OPSS 1002) be placed on top of the approved subgrade to facilitate positioning and seating of the culvert segment(s).

Should shallower founding elevations be required, consideration may be given to subexcavating and replacing the existing fill materials and soft/loose soils to a minimum depth of 1.0 m below the proposed founding elevation and replaced with engineered fill consisting of Granular A and

Granular B Type I for the culvert foundation. Following the approval of the subexcavated subgrade by a geotechnical engineer from GeoPro, the engineered granular fill pad (i.e. at least upper 500 mm of Granular A over at least 500 mm of Granular B Type II) should be placed in layers not exceeding 200 mm loose thickness and compacted to a minimum of 100 percent of the material's standard Proctor maximum dry density (SPMDD). The engineered granular fill pad should extend at least 1.0 m beyond the edge of box culvert with a minimum thickness of 1.0 m on the approved subgrade soils. A full time inspection and compaction testing should be carried out by GeoPro during construction stage. A geotechnical bearing resistance of 75 kPa at Serviceability Limit States (SLS) and a factored geotechnical bearing resistance of 112 kPa at Ultimate Limit States (ULS) may be used for the design of the box culvert bearing on the engineered granular fill pad. Consideration may be given to installing geogrid, such as Terrafix BX2500 (one layer of geogrid every 300 mm) in the engineered granular fill pad to increase the stability of the founding soils.

All foundation bases must be inspected by GeoPro prior to pouring concrete to confirm the design bearing values.

Foundations designed to the specified bearing resistance values at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

Where it is necessary to place foundations at different levels, the upper foundation must be founded below an imaginary 7 vertical to 10 horizontal (7V:10H) line drawn up from the base of the lower foundation. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

It should be noted that the recommended foundation type, founding depths, and bearing resistances were based on the borehole information only. The geotechnical recommendations and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to the subsurface conditions between and beyond the boreholes when foundation construction is underway. The interpretation between and beyond the boreholes and the recommendations of this report **must** therefore be checked through field inspections provided by a qualified geotechnical engineer from GeoPro to validate the information for use during the construction stage. Due to the anticipated variation of the subsurface conditions at this specific site, the geotechnical engineer who carried out the geotechnical investigation shall be retained during the construction stage to avoid the potential misinterpretation of the soil information presented in the report.

Deep Foundation

Due to the relatively deep fill materials and very loose to loose sandy deposits encountered at the site, shallow foundations are not considered to be a desirable option. As such, deep foundation system, such as helical piles founded in very dense/hard deposits at a greater depth may be considered.

The actual design details of the helical piles are typically provided by a design-installation specialist contractor. The specialist contractor will provide the designs as per the requirements provided by the project structural engineer. The specialist contractor will then install the helical piles under the monitoring of a third party geotechnical consultant.

Compared with conventional deep foundation systems, such as piles and caissons, the helical piles provide a number of advantages:

1. A properly designed and installed helical pile is unlikely to have adverse impact on the existing structures and utilities.

2. Helical pile installation requires use of comparatively smaller equipment which will not generate excessive noise or visible air pollution.

3. The relatively small size of the helical pile installation equipment would allow easier access.

4. Should an obstruction be encountered, the pile may be extracted and reused an alternate location.

The helical piles are generally designed as end bearing and the friction from the upper fill and loose/soft soils must be ignored.

A specialist contractor must be retained to design and install helical piles. The details of the bearing capacity, the founding depths, the size of the helical piles, the type of the helical piles and other design details regarding helical piles should be consulted with the specialist contractor's engineer.

For preliminary planning and concept design purposes, preliminary bearing resistance value of 30 kN per pile at Serviceability Limit States (SLS) and 36 kN per pile at factored Ultimate Limit States (ULS) may be considered for the helical pile installed into the hard/very dense deposits at an approximately depths ranging from 8.5 to 9.0 m below the ground surface.

Field load testing of piles must be considered to confirm the design bearing capacity. The installation of the helical piles shall be monitored by a geotechnical engineer who is familiar with the soil conditions and the installation of the helical piles.

All foundations and pile caps exposed to seasonal freezing conditions must have at least 1.6 metres of soil cover or its thermal equivalent for frost protection.

Should helical piles be considered, a provisional cost of installing helical piles shall be considered in the contract.

It should be noted that the recommended foundation type, founding depths, and bearing resistances were based on the borehole information only. The geotechnical recommendations and comments are necessarily on-going as new information of the underground conditions

becomes available. For example, more specific information is available with respect to the subsurface conditions between and beyond the boreholes when foundation construction is underway. The interpretation between and beyond the boreholes and the recommendations of this report **must** therefore be checked through field inspections provided by a qualified geotechnical engineer from GeoPro to validate the information for use during the construction stage. Due to the anticipated variation of the subsurface conditions at this specific site, the geotechnical engineer who carried out the geotechnical investigation shall be retained during the construction stage to avoid the potential misinterpretation of the soil information presented in the report.

Corrugate Steel Pipe (CSP) Culvert Option

As an alternative to the concrete culvert supported on helical piles or shallow foundations, a corrugate steel pipe (CSP) culvert may be considered.

Based on the subsoils encountered at the site, the existing fills and native soils may be considered suitable to support the proposed CSP culvert replacement subject to the inspection during the construction by a qualified geotechnical engineer. Consideration should be given to removing any loosened/softened fill materials and/or native soils at the proposed culvert replacement locations to expose the underlying competent fill materials or native soils, which have to be inspected and approved by a qualified geotechnical engineer. A layer of concrete mud slab consisting of at least 75 mm lean concrete (10 MPa) should be placed immediately upon the inspection and approval of the subgrade by a qualified geotechnical engineer.

Should it be required, the existing fill materials may be removed and replaced with engineering fills consisting of granular A materials for at least 1.0 m below the proposed invert elevation of the CSP to reduce the different settlement.

The proposed design of the CSP culverts should follow the OPSD 802-010 or 802-014.

It should be noted that the existing road embankment appeared to be stable and there were no obvious signs of settlement observed on the pavement surface. However, the fill materials and very loose to loose silty/sandy soils are extremely easy to be disturbed and may undergo settlement. Subject to the workmanship of the contractor and the weights of the construction machines used for the construction, some disturbances may occur to the underlying fill materials, and very loose to loose silty/sandy soils. Should this be the case, excessive settlement might occur, which may require future repair of the roadway pavement. As such, a full-time inspection by a qualified geotechnical engineer should be considered.

4.3 Subgrade Protection, Frost Protection and Scour Protection

The existing very loose to loose sandy/gravelly soils are extremely easy to be disturbed and may not be able to provide a sufficient support for construction equipment. A sufficient thickness of mud slab consisting of lean concrete will have to be considered to provide a stable work plat form.

It should be noted that the proposed founding level should be at least 1.6 m below the proposed final grade to provide sufficient earth cover for frost protection unless the culvert is designed to withstand the frost pressures. It should be noted that the scour protection, such as rip rap and rock blocks should not be considered as earth cover for frost protection purposes.

If the water course flow velocities are sufficiently high, provision should be made for scour and erosion protection for the new culvert. For culvert protection, there are two treatment zones to be considered, namely the embankment and the creek channel. If required, a seal of compacted cohesive clayey soil at least 300 mm thick may be placed in front and at the sides of the culvert inlet to prevent water infiltrations to the sides and below the culvert which could wash out the granular base and backfill material. The culvert inlet should also be protected with at least 0.6 m thick rip rap and extending to a minimum 1 m beyond the clay seal. Clay seal may not be required at the outlet but it should also be protected with at least 0.6 m rip rap.

The requirements for design of erosion protection measures for the inlet and outlet of the proposed culvert should be considered by design engineers. As a minimum, rip rap treatment for the outlet of the culvert should be consistent with the standard presented in OPSD 810.010 (Rip-Rap Treatment for Sewer and Culvert Outlets).

Frost treatment (i.e. frost taper) should be designed and constructed as per OPSD 803-030 and 803-031.

4.4 Sliding Resistance

Resistance to lateral forces / sliding resistance between the culvert footing base concrete and the subgrade should be calculated in accordance with Section 6.7.5 of the CHBDC. The coefficient of friction may be considered as follows:

- Coefficient of friction between Pour-in-place concrete footings and native soils = 0.3(unfactored)
- Coefficient of friction between precast concrete footings and native soils = 0.25 (unfactored)

It should be noted that the values are unfactored; and in accordance with Section 6.7.5 of the CHBDC, a factor of 0.8 is to be applied in calculating the horizontal resistance.

4.5 Temporary Excavations and Groundwater Control

It is anticipated that foundation excavations at the site will consist of temporary open cuts with side slopes not steeper than 1.5 horizontal to 1 vertical (1.5H:1V). However, depending on the construction procedures adopted by the contractor and weather conditions at the time of construction, some local flattening of the slopes should be required, especially in looser/softer zones (i.e. in fills) or where localized seepage is encountered. All excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. According to the Act, the existing fills and native soils would be classified as Type 3 soils above groundwater table and Type 4 below the groundwater table.

The excavations for proposed culvert are anticipated to go through the existing fill materials and cohesionless (fine) sandy deposits. If space permits, open-cut excavations to the proposed depths should be carried out in accordance with the guidelines outlined in the occupational Health and Safety Act (OHSA) for Construction Activities. In addition, care must be taken during excavation to ensure that adequate support is provided for any existing structures and underground services located adjacent to the excavations.

Should adjacent structures and/or utilities be susceptible to damage from construction induced settlement, a more positive excavation support system may be considered.

Groundwater control at this location would be required to allow for construction of foundation elements in a dry condition. A cofferdam cut-off, such as a sheet pile wall enclosure, may be considered to support the excavation and to improve the effectiveness of the groundwater control measures depending upon the construction procedures and dewatering measures adopted by the contractor. Subject to the effectiveness of the cofferdam cut-off installed by the contractor and the potential water seepage from the soils within the cofferdam, some form of positive proactive groundwater control should be required to maintain the stability of the base and side slopes of the excavations at this area, in addition to pumping from sumps. Groundwater control measures or dewatering should be carried out by a specialist contractor to draw down the groundwater level to at least 1.0 m below the base level of the excavation to ensure stable conditions during excavation. It should be noted that a complete cut-off may not able to be achieved by single layer of sheet pile wall, and seals on both sides of the walls or double layers of sheet pile wall may be needed to obtain sufficient cut-off depending on the elevation of the working platform and the water level in the river during the time of the construction as well as the construction procedures and dewatering measures adopted by the contractor. Significant seepage may still be expected from the bottom of the cofferdam enclosure due to extensive cohesionless sandy/silty soils encountered. A thick mud slab (or tremie concrete base, if required) may be required in addition to the positive dewatering and pumping from sumps. It should be noted that the stability of the sheet pile cofferdam should be assessed by the engineers.

It should be noted that the existing soils can be easily disturbed and may not remain stable under heavy construction equipment loading. Concrete mud slabs should be placed to provide stable dry working surfaces for the construction.

It should be noted that any construction dewatering or water taking in Ontario is governed by Ontario Regulation 387/04 - Water Taking and Transfer, made under the Ontario Water Resources Act (OWRA), and/or Ontario Regulation 63/16 – Registrations under Part II.2 of the Act – Water Taking, made under Environmental Protection Act. Based on these regulations, water taking of more than 400,000 L/day is subject to a Permit to Take Water (PTTW), while water taking of 50,000 L/day to 400,000 L/day is to be registered through the Environmental Activity and Sector Registry (EASR). Due to the extensive silty/sandy soils encountered at the site and to close proximity to the lake, a hydrogeological investigation, consisting of a pumping test, may be

required to assess the groundwater seepage conditions and to support the application for a Permit To Take Water (PTTW).

Pumping discharges should conform to the guidelines from local municipality, MOECC, conversation authority and other relevant agencies.

Control of the surface flow water, if any, at the base of the excavation from the existing water course should be necessary at the culvert site in order for foundation construction to be carried out in dry conditions. Depending on the water flow at the time of construction, surface water could flow through the culvert area by means of a temporary pipe, if required.

Surface water should be directed away from the excavation area, to prevent ponding of water that could result in disturbance and weakening of the foundation subgrade.

Depending on the construction staging sequence and schedule, temporary roadway protection may be required along the roadway to facilitate the culvert construction works.

4.6 Lateral Earth Pressures for Design

The following recommendations are made concerning the design of the walls, assuming that the backfill to the culvert and wing walls consists of free-draining granular fill meeting the requirements of OPSS 1010 Granular A or Granular B Type II. This fill should be compacted in loose lifts not greater than 200 mm in thickness to 95 percent of the material's Standard Proctor maximum dry density in accordance with OPSS 501. The fill materials should be benched into the existing roadway embankment side slopes. Longitudinal drains and weep holes should be installed to provide positive drainage of the granular backfill. Other aspects of the granular backfill requirements with respect to subdrains and frost taper should be in accordance with applicable Ontario Provincial Standard Drawings.

Computation of earth pressures acting against any wing walls should be in accordance with the Canadian Highway Bridge Design Code, (CHBDC) S6-06. For design purposes, the following properties can be assumed for backfill.

Compacted Granular 'A' or Granular 'B' Type II

Angle of Internal Friction ϕ=35° (unfactored)

Unit weight = 22 kN/m^3

Coefficient of Lateral Earth Pressure:

Level Backfill	Backfill Sloping at 3H:1V	Backfill Sloping at 2H:1V
K_a=0.27	K_a=0.34	K_a=0.40
K_b=0.35	K_b=0.44	K_b=0.50
K_o=0.43	K_o=0.56	K_o=0.62

K*=0.45	K*=0.60	K*=0.66

Compacted Granular 'B' Type I

Angle of Internal Friction ϕ=32° (unfactored)

Unit Weight = 21 kN/m^3

Coefficient of Lateral Earth Pressure:

Level Backfill	Backfill Sloping at 3H:1V	Backfill Sloping at 2H:1V
K_a=0.31	K_a=0.39	K_a=0.47
K_b=0.39	K_b=0.49	K_b=0.57
K_o=0.47	K_o=0.62	K_o=0.69
K*=0.54	K*=0.68	K*=0.78

Note: K_a is the coefficient of active earth pressure

K_b is the backfill earth pressure coefficient for an unrestrained structure including compaction efforts

K_o is the coefficient of earth pressure at rest

K* is the earth pressure coefficient for a soil loading a fully restrained structure and includes compaction effects

These values are based on the assumption that the backfill behind the retaining structures is free-draining granular material and adequate drainage is provided.

The earth pressure coefficient to be adopted will depend on whether the retaining structure is restrained or some movement can occur such that the active state of earth pressure can develop. The effect of compaction should also be taken into account in the selection of the appropriate earth pressure coefficients. The use of vibratory compaction equipment behind the abutments and the retaining walls should be restricted in size.

A minimum compaction surcharge of 12 kPa should be included in the lateral earth pressures for the structural design of the walls, according to CHBDC Section 6.9.3 and Figure 6.6. Other surcharge loadings should be accounted for in the design as required.

The above calculation yields lateral pressures due to soil loading only. If the culvert is intended to become partially submerged during the design flood event, then appropriate hydrostatic pressures below the water table should be added to the earth pressures calculated as above in order to obtain the total lateral pressure acting on the culvert.

The fill depth during placement should be maintained equal on both sides of the culvert walls, with one side not exceeding the other by more than 500 mm.

The use of heavy vibratory equipment behind the culvert and any other below-grade structures should be limited within a lateral distance equal to the height of the backfill (at the time of compaction) above the base of the structure. If required, GeoPro can provide additional assistance with the refinement of design earth pressure parameters based on the type of culvert selected, dimensions, etc.

4.7 Pavement Restoration

The traffic data, including the percentage of the commercial traffic, is not available at the time of preparing the report. The following preliminary pavement design (local road or minor collector) is recommended for the pavement restoration, based on the pavement structure revealed from the two boreholes carried out on the site. The pavement structure provided may be further reviewed by the geotechnical engineer once the traffic data is available.

Material		Thickness of Pavement Elements (mm)
Hot-Mix Asphalt (OPSS 1150)	HL 3 or Superpave 12.5 mm "Cat B"	40
	HL 4, HL 8 or Superpave 19 mm "Cat B"	60
Granular Material (OPSS.MUNI 1010)	Granular A Base	150
	Granular B Type I Subbase	400
Prepared and Approved Subgrade		

Prior to placing the granular subbase material, the exposed soil subgrade should be heavily proofrolled in conjunction with an inspection by qualified geotechnical personnel. Remedial work (i.e. further subexcavation and replacement) should be carried out on any disturbed, softened or poorly performing zones, as directed by geotechnical personnel.

The granular subbase and base materials should be uniformly compacted to 100 percent of their standard Proctor maximum dry densities. The asphalt materials should be compacted to 92 to 96.5 percent of their Marshall Maximum Relative Densities ("MRD"), as measured in the field using a nuclear density gauge.

The granular materials should daylight to the ditches. The ditches should be at least 0.5 m below the bottom of the granular subbase grade.

The pavement structure abutting existing pavement should match or exceed the depth of the existing pavement structure, if applicable.

Where new pavement abuts existing pavement (e.g. at the construction limits), proper longitudinal lap joints should be constructed to key the new asphalt into the existing pavement. The existing asphalt edges should be provided with a proper sawcut edge prior to keying in the new asphalt. It should be ensured that any undermined or broken edges resulting from the construction activities are removed by sawcut.

5. ENVIRONMENTAL SOIL ANALYTICAL RESULTS

In order to provide information on the chemical quality of the subsurface soils, selected soil sample was submitted to ALS Environmental Laboratories in Waterloo, Ontario ("ALS") for chemical analyses. Descriptions of the selected soil samples and analytical parameters are presented in the following table:

Sample ID	Soil Depth (mBGS)	Primary Soil	Analytical Parameters
BH1 SS3	1.5 – 2.0	Fine Sand	Metals and Inorganics
BH2 SS2+SS3	0.8 – 2.0	Fill: Gravelly Sand and Sand	Metals and Inorganics
BH2 SS3	1.5 – 2.0	Fill: Sand	PHCs, VOCs and PAHs

Note: PHCs = Petroleum Hydrocarbons F1 to F4;
VOCs = Volatile Organic Compounds
PAHs = Polycyclic Aromatic Hydrocarbons

5.1 Soil Analytical Results

Three (3) soil samples were analysed for the parameters of metals and inorganics, Petroleum Hydrocarbons F1 to F4 (PHCs), Volatile Organic Compounds (VOCs) and Polycyclic Aromatic Hydrocarbons (PAHs), under Ontario Regulation 153/04 ("O. Reg. 153/04") as amended. A copy of the soil analytical results is provided in the Laboratory Certificates of Analysis, attached in Appendix A.

The soil analytical results were compared with the Ontario Ministry of the Environment and Climate Change ("MOECC") "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", April 2011, Table 1: Full Depth Background Site Condition Standards for Residential/Parkland/Institutional/Industrial/Commercial/Community Property Uses ("2011 MOECC Table 1 Standards"); Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition ("2011 MOECC Table 2 Standards"), and Table 3: Full Depth Generic Site Condition Standards in a non-potable Ground Water Condition ("2011 MOECC Table 3 Standards").

Based on the comparison, no exceedances were found for Metals and Inorganics, VOCs and/or PAHs in the analyzed soil samples collected from Boreholes BH1 and BH2. However, exceedance was noted for PHCs F2 in the tested soil sample. The exceedance value detected in the soil sample is summarized in the following table.

Soil Sample ID	Parameter	Detected Value	MOECC Table 1 Standards Guideline Value	MOECC Table 2 and 3 Standards (R/P/I) Guideline Value	MOECC Table 2 and 3 Standards (I/C/C) Guideline Value
BH2 SS3	PHCs F2 (C10-C16)	117	**10** ug/g	**98** ug/g	230 ug/g

Note: R/P/I = Residential, Parkland and Institutional Property Use

I/C/C = Industrial, Commercial and Community property Use
10 = standard value exceeded by the analytical result

5.2 Discussion of Analytical Results

Based on the analytical results, exceedances of MOECC Table 1, Table 2 or Table 3 Standards were noted for PHCs F2 in the tested soil sample. Although no elevated Electrical Conductivity (EC) and/or Sodium Adsorption Ratio (SAR) values were detected in the tested samples, they should be expected in the soils at the site due to the application of de-icing salt on the road. The sources of elevated concentrations of PHCs F2 is not known.

Based on the results of soil sample analysis, GeoPro would recommend that the following disposal option:

1) The soils generated at the Site at the same tested sample depth from Borehole BH2 may be disposed at a licensed landfill site; however, additional chemical testing under O. Reg. 347/90 may be required by the landfill site.

It should be noted that the results of the chemical analysis refer only to the soil samples analyzed, which were obtained from specific sampling locations and sampling depths, and that the soil chemistry may vary between and beyond the location and depth of the samples taken. Therefore, soil materials to be used on site or transported to other sites must be inspected during excavation for indication of variance in composition or any chemical/environmental constraints. If conditions indicate significant variations, further chemical analyses should be carried out.

Please note that the level of testing outlined herein is meant to provide a broad indication of soil quality based on the limited soil samples tested. The analytical results contained in this report should not be considered a warranty with respect to the soil quality or the use of the soil for any specific purpose. Furthermore, it must be noted that our scope of work was only limited to the review of the analytical results of the limited number of samples. The scope of work did not include any environmental evaluation or assessment of the subject site (such as a Phase One or Phase Two Environmental Site Assessment).

Sites accepting fill may have requirements relating to its aesthetic or engineering properties in addition to its chemical quality. Some receiving sites may have specific chemical testing protocols, which may require additional tests to meet the requirements. The requirements for accepting the fill at an off-site location must be confirmed in advance. GeoPro would be pleased to assist once the receiving sites are determined and the requirements of the receiving sites are available.

6. ASBESTOS ANALYSIS RESULTS

Two (2) asphalt concrete samples were taken on the roadway and paved shoulder on each side of the existing culvert. These asphalt samples were submitted to Eurofins Environmental Laboratories (“Eurofins”) in Ottawa, Ontario to determine if asbestos fibres are present in the existing asphalt concrete. To analyze for asbestos in asphalt samples, Eurofins uses mineralogical

characterisation by polarised light microscopy and dispersion staining colours in accordance with EPA 600/R-93/116 method.

Based on the analytical results, no asbestos fibres were identified in the asphalt concrete samples. A copy of asbestos analysis results with the Laboratory Certificates of Analysis are attached to Appendix B.

7. MONITORING AND TESTING

The geotechnical aspects of the final design drawings and specifications should be reviewed by GeoPro prior to tendering and construction, to confirm that the intent of this report has been met. During construction, full-time engineered fill monitoring and sufficient foundation inspections, subgrade inspections, in-situ density tests and materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes, and to monitor conformance to the pertinent project specifications.

8. CLOSURE

We appreciate the opportunity to be of service to you and trust that this report provides sufficient geotechnical engineering information to facilitate the detail design of this project. We look forward to providing you with continuing service during the construction stage. Please do not hesitate to contact our office should you wish to discuss, in further detail, any aspects of this project.

Yours very truly,

GEOPRO CONSULTING LIMITED

DRAFT

Dylan Q. Xiao, M.A.Sc., P.Eng.
Geotechnical Group

DRAFT

David B. Liu, P.Eng., Principal

DRAWINGS

Legend:

Borehole Location

Client:	**Associated Engineering (Ont.) Ltd.**			Project No.: **18-2298GH**	Drawing No.: **1**
Drawn:	**FW**	Approved:	**DL**	Title:	**Borehole Location Plan**
Date:	**July 2018**	Scale:	**N.T.S**	Project:	**Geotechnical Investigations Bridge Replacement & Resurfacing Design Cross Street, Town of Innisfil, Ontario**
Original Size:	**Letter**	Rev:	**DX**		*GeoPro* Consulting Limited

ENCLOSURES

Enclosure 1A: Notes on Sample Descriptions

1. Each soil stratum is described according to the *Modified Unified Soil Classification System*. The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined according to Canadian Foundation Engineering Manual, 4th Edition. Different soil classification systems may be used by others. Please note that a description of the soil stratums is based on visual and tactile examination of the samples augmented with field and laboratory test results, such as a grain size analysis and/or Atterberg Limits testing. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Enclosure 1B: Explanation of Terms Used in the Record of Boreholes

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube Sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

PM – Samples advanced by manual pressure
WR – Samples advanced by weight of sampler and rod
WH – Samples advanced by static weight of hammer

Dynamic Cone Penetration Resistance, N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in).

Piezo-Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60 degree conical tip and a projected end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurement of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

Textural Classification of Soils (ASTM D2487)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm – 4.75 mm
Silt	0.002 mm-0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	> 35%

Soil Description

a) Cohesive Soils(*)

Consistency	Undrained Shear Strength (kPa)	SPT "N" Value
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction

1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT "N" value
5. Pocket penetrometer

b) Cohesionless Soils

Compactness Condition (Formerly Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

LOG OF BOREHOLE BH1

PROJECT: Geotechnical Investigation Proposed Bridge Replacement and Resurfacing Design

CLIENT: Associated Engineering (Ontario) Limited

PROJECT LOCATION: Cross Street, Town of Innisfil, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-06-02

REF. NO.: 18-2298GH

ENCL. NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION	UNIT WT (kN/m³)	GR	SA	SI	CL
219.9											
219.6 / 0.3	**ASPHALT:** (50 mm) **GRANULAR BASE/SUBBASE:** (280 mm)	1	AS		Concrete						
219.2 / 0.8	**FILL:** sand, trace to some silt, trace gravel, brown, wet				Bentonite						
1	**PROBABLE FILL:** silty fine sand to fine sand, trace gravel, pockets of organic silt, organics inclusions, brown, wet, loose	2	SS	9	218.9/Jul 16	219					
218.5 / 1.4	**FINE SAND:** trace to some silt, trace gravel, brown to grey, wet, very loose to loose	3	SS	3	Sand	218					
2	--- grey				Screen						
		4	SS	3		217					
3		5	SS	3				7	88		6
4						216					
		6	SS	3	Natural pack	215					
5											
6						214					
		7	SS	4							
213.4 / 6.6	**END OF BOREHOLE**										

Notes: -
1) Water encountered at a depth of -0.8 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 0.8 mBGS upon completion of drilling.
3) Borehole caved at a depth of 0.8 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
July 16, 2018	1.05

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit / Natural Moisture Content / Liquid Limit
w_P w w_L
WATER CONTENT (%)
10 20 30 40

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
▲ ε=3% Strain at Failure

LOG OF BOREHOLE BH2

PROJECT: Geotechnical Investigation Proposed Bridge Replacement and Resurfacing Design

CLIENT: Associated Engineering (Ontario) Limited

PROJECT LOCATION: Cross Street, Town of Innisfil, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: KL

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 205 mm

DATE: 2018-06-22

REF. NO.: 18-2298GH

ENCL. NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3m	GROUND WATER	ELEVATION
219.8							
219.8 / 0.0	**ASPHALT:** (60 mm)					Concrete	
219.7 / 0.1	**GRANULAR BASE/SUBBASE:** (750 mm)		1	AS			
219.0						Bentonite	
0.8	**FILL:** gravelly sand, trace silt, brown, saturated, loose		2A / 2B	SS / SS	7	218.9/Jul 16	219
218.5							
1.4	**FILL:** sand, trace to some silt, trace gravel, hydrocarbon odour, organic inclusions, brown, wet, very loose to loose		3	SS	8	Sand	218
	--- rock fragments		4	SS	3	Screen	
216.9							217
2.9	**SAND TO FINE SAND:** trace to some silt, trace gravel, pockets of organic silt, organics inclusions, brown, wet, loose		5	SS	4		
215.8							216
4.0	**SAND TO FINE SAND:** trace to some silt, trace gravel, organic odour, brown, saturated, very loose		6	SS	2		215
213.7						Natural pack	214
6.1	---------- Dynamic Cone Starting at 6.1 m						213
							212
210.8							211
9.1	**END OF BOREHOLE**						

Notes: -
1) Water encountered at a depth of -0.8 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 0.9 mBGS upon completion of drilling.
3) Borehole caved at a depth of 2.4 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
July 16, 2018	0.96

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

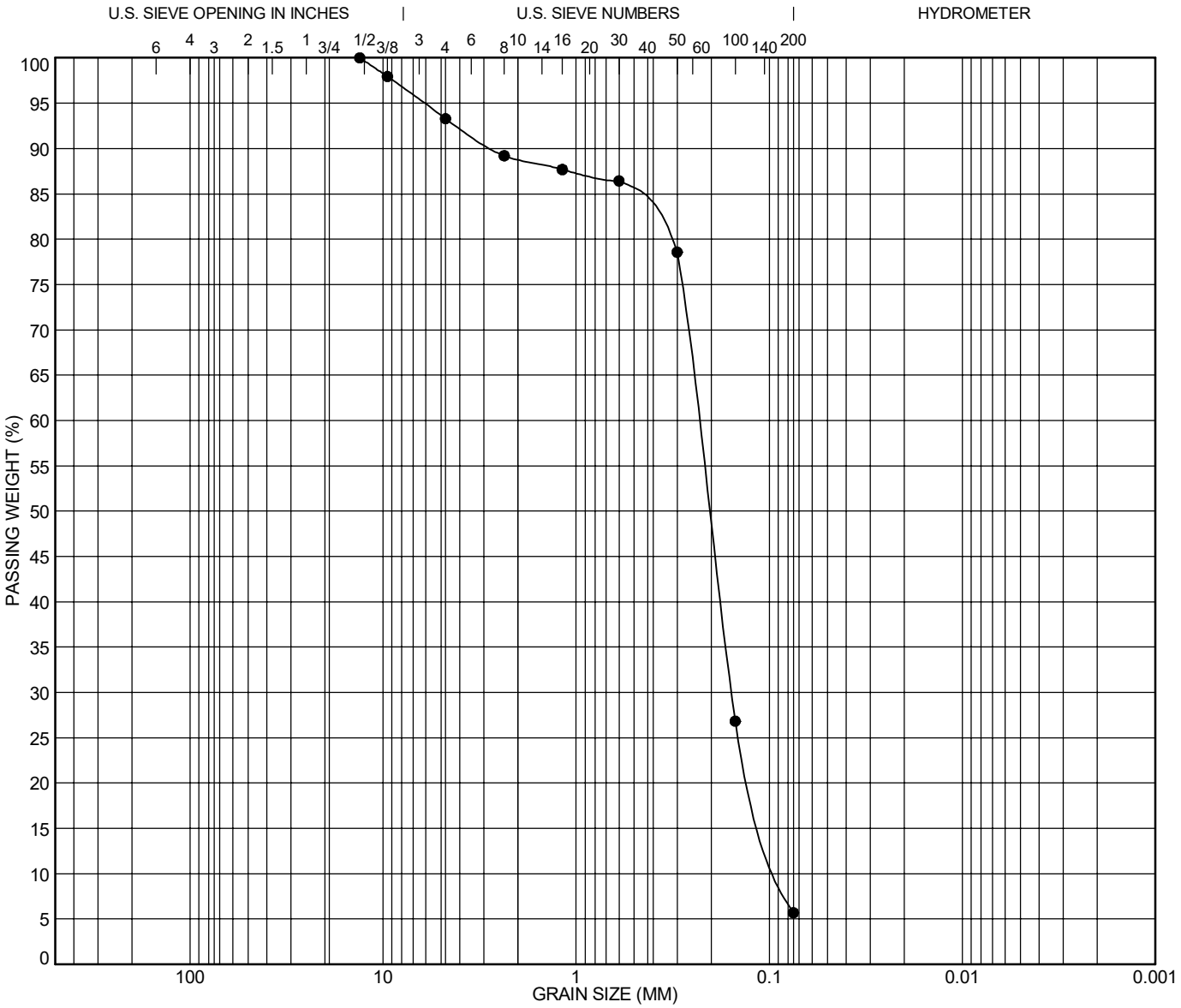
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ▲ ε=3% Strain at Failure

01 - GEOPRO SOIL LOG GEOPRO BH LOG DATA 18-2298GH 20180723-2-DX.GPJ 2018-07-23 16:53

FIGURES



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**BH1**	**SS5**	**3.09**					**1.21**	**2.71**

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH1**	**SS5**	**3.09**	**13.2**	**0.234**	**0.157**	**0.086**	**6.7**	**87.6**	**5.7**	

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Tel: 905-237-8336 Fax: 905-248-3699
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GRAIN SIZE DISTRIBUTION

PROJECT: Geotechnical Investigation Proposed Bridge Replacement and Resurfacing Design

LOCATION: 7th Line to Kennedy Road, Town of Innisfil, Ontario

PROJECT NO.: 18-2298GH	SAMPLED ON: 2018-06-02
FIGURE NO.: 1	TESTED ON: 2018-07-13

APPENDIX A

GeoPro Consulting Limited (Richmond Hill)
ATTN: Sarena Sarenam
40 Vogell Road
Unit 22
Richmond Hill ON L4B 3N6

Date Received: 12-JUL-18
Report Date: 20-JUL-18 06:14 (MT)
Version: FINAL

Client Phone: 905-237-8336

Certificate of Analysis

Lab Work Order #: L2127983

Project P.O. #: NOT SUBMITTED
Job Reference: 18-2298GH
C of C Numbers:
Legal Site Desc: Town of Innisfil, ON

Rick Hawthorne
Account Manager

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Guideline						
Ontario Regulation 153/04 - April 15, 2011 Standards - T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use						
L2127983-3	BH2 SS3	Hydrocarbons	F2 (C10-C16)	117	10	ug/g

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Physical Tests - SOIL

		Guide Limits				
Lab ID				L2127983-1	L2127983-2	L2127983-3
Sample Date				28-JUN-18	22-JUN-18	22-JUN-18
Sample ID				BH1 SS3	BH2 SS2+SS3	BH2 SS3
Analyte	**Unit**	**#1**	**#2**			
Conductivity	mS/cm	0.57	-	0.216	0.192	
% Moisture	%	-	-	15.0	18.9	10.5
pH	pH units	-	-	7.59	7.67	

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Cyanides - SOIL

		Guide Limits			
Lab ID				L2127983-1	L2127983-2
Sample Date				28-JUN-18	22-JUN-18
Sample ID				BH1 SS3	BH2 SS2+SS3
Analyte	**Unit**	**#1**	**#2**		
Cyanide, Weak Acid Diss	ug/g	0.051	-	<0.050	<0.050
					<0.050

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Saturated Paste Extractables - SOIL

		Guide Limits			
Lab ID				L2127983-1	L2127983-2
Sample Date				28-JUN-18	22-JUN-18
Sample ID				BH1 SS3	BH2 SS2+SS3
Analyte	**Unit**	**#1**	**#2**		
SAR	SAR	2.4	-	1.56 SAR:M	2.23 SAR:M
Calcium (Ca)	mg/L	-	-	7.8	4.3
Magnesium (Mg)	mg/L	-	-	<1.0	<1.0
Sodium (Na)	mg/L	-	-	15.8	16.9

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Metals - SOIL

		Guide Limits			
Lab ID				L2127983-1	L2127983-2
Sample Date				28-JUN-18	22-JUN-18
Sample ID				BH1 SS3	BH2 SS2+SS3
Analyte	**Unit**	**#1**	**#2**		
Antimony (Sb)	ug/g	1.3	-	<1.0	<1.0
Arsenic (As)	ug/g	18	-	<1.0	<1.0
Barium (Ba)	ug/g	220	-	18.9	8.2
Beryllium (Be)	ug/g	2.5	-	<0.50	<0.50
Boron (B)	ug/g	36	-	<5.0	<5.0
Boron (B), Hot Water Ext.	ug/g	36	-	0.11	<0.10
Cadmium (Cd)	ug/g	1.2	-	<0.50	<0.50
Chromium (Cr)	ug/g	70	-	8.4	5.6
Cobalt (Co)	ug/g	21	-	2.0	1.3
Copper (Cu)	ug/g	92	-	7.4	1.7
Lead (Pb)	ug/g	120	-	1.9	<1.0
Mercury (Hg)	ug/g	0.27	-	0.0063	<0.0050
Molybdenum (Mo)	ug/g	2	-	<1.0	<1.0
Nickel (Ni)	ug/g	82	-	3.6	2.2
Selenium (Se)	ug/g	1.5	-	<1.0	<1.0
Silver (Ag)	ug/g	0.5	-	<0.20	<0.20
Thallium (Tl)	ug/g	1	-	<0.50	<0.50
Uranium (U)	ug/g	2.5	-	<1.0	<1.0
Vanadium (V)	ug/g	86	-	18.3	15.3
Zinc (Zn)	ug/g	290	-	14.8	5.5

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Speciated Metals - SOIL

		Guide Limits			
Lab ID				L2127983-1	L2127983-2
Sample Date				28-JUN-18	22-JUN-18
Sample ID				BH1 SS3	BH2 SS2+SS3
Analyte	**Unit**	**#1**	**#2**		
Chromium, Hexavalent	ug/g	0.66	-	<0.20	<0.20

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Volatile Organic Compounds - SOIL

			Lab ID	L2127983-3
			Sample Date	22-JUN-18
			Sample ID	BH2 SS3
		Guide Limits		
Analyte	Unit	#1	#2	
Acetone	ug/g	0.5	-	<0.50
Benzene	ug/g	0.02	-	<0.0068
Bromodichloromethane	ug/g	0.05	-	<0.050
Bromoform	ug/g	0.05	-	<0.050
Bromomethane	ug/g	0.05	-	<0.050
Carbon tetrachloride	ug/g	0.05	-	<0.050
Chlorobenzene	ug/g	0.05	-	<0.050
Dibromochloromethane	ug/g	0.05	-	<0.050
Chloroform	ug/g	0.05	-	<0.050
1,2-Dibromoethane	ug/g	0.05	-	<0.050
1,2-Dichlorobenzene	ug/g	0.05	-	<0.050
1,3-Dichlorobenzene	ug/g	0.05	-	<0.050
1,4-Dichlorobenzene	ug/g	0.05	-	<0.050
Dichlorodifluoromethane	ug/g	0.05	-	<0.050
1,1-Dichloroethane	ug/g	0.05	-	<0.050
1,2-Dichloroethane	ug/g	0.05	-	<0.050
1,1-Dichloroethylene	ug/g	0.05	-	<0.050
cis-1,2-Dichloroethylene	ug/g	0.05	-	<0.050
trans-1,2-Dichloroethylene	ug/g	0.05	-	<0.050
Methylene Chloride	ug/g	0.05	-	<0.050
1,2-Dichloropropane	ug/g	0.05	-	<0.050
cis-1,3-Dichloropropene	ug/g	-	-	<0.030
trans-1,3-Dichloropropene	ug/g	-	-	<0.030
1,3-Dichloropropene (cis & trans)	ug/g	0.05	-	<0.042
Ethylbenzene	ug/g	0.05	-	<0.018
n-Hexane	ug/g	0.05	-	<0.050
Methyl Ethyl Ketone	ug/g	0.5	-	<0.50
Methyl Isobutyl Ketone	ug/g	0.5	-	<0.50
MTBE	ug/g	0.05	-	<0.050
Styrene	ug/g	0.05	-	<0.050

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Volatile Organic Compounds - SOIL

			Lab ID	L2127983-3
			Sample Date	22-JUN-18
			Sample ID	BH2 SS3
		Guide Limits		
Analyte	Unit	#1	#2	
1,1,1,2-Tetrachloroethane	ug/g	0.05	-	<0.050
1,1,2,2-Tetrachloroethane	ug/g	0.05	-	<0.050
Tetrachloroethylene	ug/g	0.05	-	<0.050
Toluene	ug/g	0.2	-	<0.080
1,1,1-Trichloroethane	ug/g	0.05	-	<0.050
1,1,2-Trichloroethane	ug/g	0.05	-	<0.050
Trichloroethylene	ug/g	0.05	-	<0.010
Trichlorofluoromethane	ug/g	0.25	-	<0.050
Vinyl chloride	ug/g	0.02	-	<0.020
o-Xylene	ug/g	-	-	<0.020
m+p-Xylenes	ug/g	-	-	<0.030
Xylenes (Total)	ug/g	0.05	-	<0.050
Surrogate: 4-Bromofluorobenzene	%	-	-	99.3
Surrogate: 1,4-Difluorobenzene	%	-	-	102.7

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Hydrocarbons - SOIL

			Lab ID	L2127983-3
			Sample Date	22-JUN-18
			Sample ID	BH2 SS3
		Guide Limits		
Analyte	**Unit**	**#1**	**#2**	
F1 (C6-C10)	ug/g	25	-	<5.0
F1-BTEX	ug/g	25	-	<5.0
F2 (C10-C16)	ug/g	10	-	117
F2-Naphth	ug/g	-	-	117
F3 (C16-C34)	ug/g	240	-	176
F3-PAH	ug/g	-	-	176
F4 (C34-C50)	ug/g	120	-	<50
Total Hydrocarbons (C6-C50)	ug/g	-	-	293
Chrom. to baseline at nC50		-	-	YES
Surrogate: 2-Bromobenzotrifluoride	%	-	-	85.7
Surrogate: 3,4-Dichlorotoluene	%	-	-	91.9

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Polycyclic Aromatic Hydrocarbons - SOIL

			Lab ID	L2127983-3
			Sample Date	22-JUN-18
			Sample ID	BH2 SS3
		Guide Limits		
Analyte	Unit	#1	#2	
Acenaphthene	ug/g	0.072	-	<0.050
Acenaphthylene	ug/g	0.093	-	<0.050
Anthracene	ug/g	0.16	-	<0.050
Benzo(a)anthracene	ug/g	0.36	-	<0.050
Benzo(a)pyrene	ug/g	0.3	-	<0.050
Benzo(b)fluoranthene	ug/g	0.47	-	<0.050
Benzo(g,h,i)perylene	ug/g	0.68	-	<0.050
Benzo(k)fluoranthene	ug/g	0.48	-	<0.050
Chrysene	ug/g	2.8	-	<0.050
Dibenzo(ah)anthracene	ug/g	0.1	-	<0.050
Fluoranthene	ug/g	0.56	-	<0.050
Fluorene	ug/g	0.12	-	<0.050
Indeno(1,2,3-cd)pyrene	ug/g	0.23	-	<0.050
1+2-Methylnaphthalenes	ug/g	0.59	-	0.059
1-Methylnaphthalene	ug/g	0.59	-	0.059
2-Methylnaphthalene	ug/g	0.59	-	<0.030
Naphthalene	ug/g	0.09	-	<0.013
Phenanthrene	ug/g	0.69	-	0.079
Pyrene	ug/g	1	-	<0.050
Surrogate: 2-Fluorobiphenyl	%	-	-	81.1
Surrogate: p-Terphenyl d14	%	-	-	80.6

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
SAR:M	Reported SAR represents a maximum value. Actual SAR may be lower if both Ca and Mg were detectable.

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
B-HWS-R511-WT	Soil	Boron-HWE-O.Reg 153/04 (July 2011)	HW EXTR, EPA 6010B

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CN-WAD-R511-WT	Soil	Cyanide (WAD)-O.Reg 153/04 (July 2011)	MOE 3015/APHA 4500CN I-WAD

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CR-CR6-IC-WT	Soil	Hexavalent Chromium in Soil	SW846 3060A/7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC, Pub #1310, Dec 2001-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT Soil F1-O.Reg 153/04 (July 2011) E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT Soil F2-F4-O.Reg 153/04 (July 2011) CCME Tier 1

Petroleum Hydrocarbons (F2-F4 fractions) are extracted from soil with 1:1 hexane:acetone using a rotary extractor. Extracts are treated with silica gel to remove polar organic interferences. F2, F3, & F4 are analyzed by GC-FID. F4G-sg is analyzed gravimetrically.

Notes:
1. F2 (C10-C16): Sum of all hydrocarbons that elute between nC10 and nC16.
2. F3 (C16-C34): Sum of all hydrocarbons that elute between nC16 and nC34.
3. F4 (C34-C50): Sum of all hydrocarbons that elute between nC34 and nC50.
4. F4G: Gravimetric Heavy Hydrocarbons
5. F4G-sg: Gravimetric Heavy Hydrocarbons (F4G) after silica gel treatment.
6. Where both F4 (C34-C50) and F4G-sg are reported for a sample, the larger of the two values is used for comparison against the relevant CCME guideline for F4.
7. F4G-sg cannot be added to the C6 to C50 hydrocarbon results to obtain an estimate of total extractable hydrocarbons.
8. This method is validated for use.
9. Data from analysis of validation and quality control samples is available upon request.
10. Reported results are expressed as milligrams per dry kilogram, unless otherwise indicated.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

HG-200.2-CVAA-WT Soil Mercury in Soil by CVAAS EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-200.2-CCMS-WT Soil Metals in Soil by CRC ICPMS EPA 200.2/6020A (mod)

This method uses a heated strong acid digestion with HNO3 and HCl and is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Analysis is by Collision/Reaction Cell ICPMS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

METHYLNAPS-CALC-WT Soil ABN-Calculated Parameters SW846 8270

MOISTURE-WT Soil % Moisture Gravimetric: Oven Dried

PAH-511-WT Soil PAH-O.Reg 153/04 (July 2011) SW846 3510/8270

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

A representative sub-sample of soil is fortified with deuterium-labelled surrogates and a mechanical shaking techniqueis used to extract the sample with a mixture of methanol and toluene. The extracts are concentrated and analyzed by GC/MS. Results for benzo(b) fluoranthene may include contributions from benzo(j)fluoranthene, if also present in the sample.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

SAR-R511-WT	Soil	SAR-O.Reg 153/04 (July 2011)	SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

VOC-1,3-DCP-CALC-WT	Soil	Regulation 153 VOCs	SW8260B/SW8270C
VOC-511-HS-WT	Soil	VOC-O.Reg 153/04 (July 2011)	SW846 8260 (511)

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2127983 Report Date: 20-JUL-18

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	**Soil**							
Batch R4130390								
WG2824059-4 DUP		**L2128480-8**						
Boron (B), Hot Water Ext.		0.36	0.38		ug/g	5.7	30	17-JUL-18
WG2824059-2 IRM		**HOTB-SAL_SOIL5**						
Boron (B), Hot Water Ext.			90.8		%		70-130	17-JUL-18
WG2824059-3 LCS								
Boron (B), Hot Water Ext.			114.0		%		70-130	17-JUL-18
WG2824059-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	17-JUL-18
CN-WAD-R511-WT	**Soil**							
Batch R4129068								
WG2821717-3 DUP		**L2126763-1**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	16-JUL-18
WG2821717-2 LCS								
Cyanide, Weak Acid Diss			90.8		%		80-120	16-JUL-18
WG2821717-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	16-JUL-18
WG2821717-4 MS		**L2126763-1**						
Cyanide, Weak Acid Diss			92.3		%		70-130	16-JUL-18
Batch R4131572								
WG2823179-2 LCS								
Cyanide, Weak Acid Diss			94.0		%		80-120	17-JUL-18
WG2823179-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	17-JUL-18
Batch R4133062								
WG2825976-3 DUP		**L2127928-9**						
Cyanide, Weak Acid Diss		0.081	0.092		ug/g	13	35	19-JUL-18
WG2825976-2 LCS								
Cyanide, Weak Acid Diss			92.1		%		80-120	19-JUL-18
WG2825976-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	19-JUL-18
WG2825976-4 MS		**L2127928-9**						
Cyanide, Weak Acid Diss			98.4		%		70-130	19-JUL-18
CR-CR6-IC-WT	**Soil**							
Batch R4129262								
WG2823167-5 CRM		**WT-SQC012**						
Chromium, Hexavalent			93.3		%		70-130	17-JUL-18
WG2823167-6 DUP		**L2128480-3**						

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CR-CR6-IC-WT	**Soil**							
Batch R4129262								
WG2823167-6 DUP		**L2128480-3**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	17-JUL-18
WG2823167-2 LCS								
Chromium, Hexavalent			98.1		%		80-120	17-JUL-18
WG2823167-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	17-JUL-18
EC-WT	**Soil**							
Batch R4131260								
WG2824071-4 DUP		**WG2824071-3**						
Conductivity		0.216	0.225		mS/cm	4.1	20	17-JUL-18
WG2824643-1 LCS								
Conductivity			99.0		%		90-110	17-JUL-18
WG2824071-1 MB								
Conductivity			<0.0040		mS/cm		0.004	17-JUL-18
F1-HS-511-WT	**Soil**							
Batch R4125842								
WG2821409-4 DUP		**WG2821409-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	16-JUL-18
WG2821409-2 LCS								
F1 (C6-C10)			105.3		%		80-120	16-JUL-18
WG2821409-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	16-JUL-18
Surrogate: 3,4-Dichlorotoluene			95.3		%		60-140	16-JUL-18
WG2821409-6 MS		**L2128628-1**						
F1 (C6-C10)			102.6		%		60-140	16-JUL-18
F2-F4-511-WT	**Soil**							
Batch R4131870								
WG2822502-4 DUP		**WG2822502-3**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	19-JUL-18
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	19-JUL-18
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	19-JUL-18
WG2822502-2 LCS								
F2 (C10-C16)			98.6		%		80-120	18-JUL-18
F3 (C16-C34)			101.0		%		80-120	18-JUL-18
F4 (C34-C50)			96.6		%		80-120	18-JUL-18
WG2822502-1 MB								
F2 (C10-C16)			<10		ug/g		10	18-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2-F4-511-WT	**Soil**							
Batch R4131870								
WG2822502-1 MB								
F3 (C16-C34)			<50		ug/g		50	18-JUL-18
F4 (C34-C50)			<50		ug/g		50	18-JUL-18
Surrogate: 2-Bromobenzotrifluoride			81.9		%		60-140	18-JUL-18
WG2822502-5 MS		**WG2822502-3**						
F2 (C10-C16)			97.7		%		60-140	18-JUL-18
F3 (C16-C34)			99.8		%		60-140	18-JUL-18
F4 (C34-C50)			95.9		%		60-140	18-JUL-18
HG-200.2-CVAA-WT	**Soil**							
Batch R4130216								
WG2824044-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			98.9		%		70-130	17-JUL-18
WG2824044-6 DUP		**WG2824044-5**						
Mercury (Hg)		0.0063	0.0059		ug/g	5.6	40	17-JUL-18
WG2824044-3 LCS								
Mercury (Hg)			101.5		%		80-120	17-JUL-18
WG2824044-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	17-JUL-18
MET-200.2-CCMS-WT	**Soil**							
Batch R4131513								
WG2824044-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			100.2		%		70-130	17-JUL-18
Arsenic (As)			102.3		%		70-130	17-JUL-18
Barium (Ba)			99.0		%		70-130	17-JUL-18
Beryllium (Be)			107.6		%		70-130	17-JUL-18
Boron (B)			3.2		mg/kg		0-8.2	17-JUL-18
Cadmium (Cd)			110.0		%		70-130	17-JUL-18
Chromium (Cr)			103.9		%		70-130	17-JUL-18
Cobalt (Co)			100.9		%		70-130	17-JUL-18
Copper (Cu)			101.6		%		70-130	17-JUL-18
Lead (Pb)			99.5		%		70-130	17-JUL-18
Molybdenum (Mo)			102.7		%		70-130	17-JUL-18
Nickel (Ni)			101.7		%		70-130	17-JUL-18
Selenium (Se)			0.32		mg/kg		0.11-0.51	17-JUL-18
Silver (Ag)			0.22		mg/kg		0.13-0.33	17-JUL-18
Thallium (Tl)			0.133		mg/kg		0.077-0.18	17-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4131513								
WG2824044-2 CRM		**WT-CANMET-TILL1**						
Uranium (U)			101.6		%		70-130	17-JUL-18
Vanadium (V)			102.2		%		70-130	17-JUL-18
Zinc (Zn)			99.6		%		70-130	17-JUL-18
WG2824044-6 DUP		**WG2824044-5**						
Antimony (Sb)		<0.10	<0.10	RPD-NA	ug/g	N/A	30	17-JUL-18
Arsenic (As)		0.86	0.83		ug/g	3.1	30	17-JUL-18
Barium (Ba)		18.9	18.7		ug/g	0.7	40	17-JUL-18
Beryllium (Be)		0.12	0.12		ug/g	0.4	30	17-JUL-18
Boron (B)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	17-JUL-18
Cadmium (Cd)		0.034	0.037		ug/g	10	30	17-JUL-18
Chromium (Cr)		8.36	8.74		ug/g	4.5	30	17-JUL-18
Cobalt (Co)		2.02	2.00		ug/g	1.0	30	17-JUL-18
Copper (Cu)		7.42	7.52		ug/g	1.4	30	17-JUL-18
Lead (Pb)		1.90	1.93		ug/g	1.3	40	17-JUL-18
Molybdenum (Mo)		0.65	0.66		ug/g	2.5	40	17-JUL-18
Nickel (Ni)		3.65	3.76		ug/g	3.0	30	17-JUL-18
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	17-JUL-18
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	17-JUL-18
Thallium (Tl)		<0.050	<0.050	RPD-NA	ug/g	N/A	30	17-JUL-18
Uranium (U)		0.253	0.253		ug/g	0.3	30	17-JUL-18
Vanadium (V)		18.3	18.5		ug/g	1.3	30	17-JUL-18
Zinc (Zn)		14.8	14.5		ug/g	2.1	30	17-JUL-18
WG2824044-4 LCS								
Antimony (Sb)			105.9		%		80-120	17-JUL-18
Arsenic (As)			102.5		%		80-120	17-JUL-18
Barium (Ba)			105.5		%		80-120	17-JUL-18
Beryllium (Be)			103.8		%		80-120	17-JUL-18
Boron (B)			94.3		%		80-120	17-JUL-18
Cadmium (Cd)			98.1		%		80-120	17-JUL-18
Chromium (Cr)			98.0		%		80-120	17-JUL-18
Cobalt (Co)			98.8		%		80-120	17-JUL-18
Copper (Cu)			99.6		%		80-120	17-JUL-18
Lead (Pb)			98.8		%		80-120	17-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4131513								
WG2824044-4 LCS								
Molybdenum (Mo)			103.4		%		80-120	17-JUL-18
Nickel (Ni)			99.2		%		80-120	17-JUL-18
Selenium (Se)			101.1		%		80-120	17-JUL-18
Silver (Ag)			97.3		%		80-120	17-JUL-18
Thallium (Tl)			103.3		%		80-120	17-JUL-18
Uranium (U)			96.2		%		80-120	17-JUL-18
Vanadium (V)			103.1		%		80-120	17-JUL-18
Zinc (Zn)			96.1		%		80-120	17-JUL-18
WG2824044-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	17-JUL-18
Arsenic (As)			<0.10		mg/kg		0.1	17-JUL-18
Barium (Ba)			<0.50		mg/kg		0.5	17-JUL-18
Beryllium (Be)			<0.10		mg/kg		0.1	17-JUL-18
Boron (B)			<5.0		mg/kg		5	17-JUL-18
Cadmium (Cd)			<0.020		mg/kg		0.02	17-JUL-18
Chromium (Cr)			<0.50		mg/kg		0.5	17-JUL-18
Cobalt (Co)			<0.10		mg/kg		0.1	17-JUL-18
Copper (Cu)			<0.50		mg/kg		0.5	17-JUL-18
Lead (Pb)			<0.50		mg/kg		0.5	17-JUL-18
Molybdenum (Mo)			<0.10		mg/kg		0.1	17-JUL-18
Nickel (Ni)			<0.50		mg/kg		0.5	17-JUL-18
Selenium (Se)			<0.20		mg/kg		0.2	17-JUL-18
Silver (Ag)			<0.10		mg/kg		0.1	17-JUL-18
Thallium (Tl)			<0.050		mg/kg		0.05	17-JUL-18
Uranium (U)			<0.050		mg/kg		0.05	17-JUL-18
Vanadium (V)			<0.20		mg/kg		0.2	17-JUL-18
Zinc (Zn)			<2.0		mg/kg		2	17-JUL-18
MOISTURE-WT	**Soil**							
Batch R4124403								
WG2821478-3 DUP		**L2128249-5**						
% Moisture		6.40	6.08		%	5.1	20	14-JUL-18
WG2821478-2 LCS								
% Moisture			100.8		%		90-110	14-JUL-18
WG2821478-1 MB								

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT	**Soil**							
Batch R4124403								
WG2821478-1 MB								
% Moisture			<0.10		%		0.1	14-JUL-18
Batch R4124429								
WG2821383-3 DUP		**L2127912-15**						
% Moisture		9.97	9.29		%	7.1	20	14-JUL-18
WG2821383-2 LCS								
% Moisture			100.7		%		90-110	14-JUL-18
WG2821383-1 MB								
% Moisture			<0.10		%		0.1	14-JUL-18
PAH-511-WT	**Soil**							
Batch R4131516								
WG2822153-3 DUP		**WG2822153-5**						
1-Methylnaphthalene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	18-JUL-18
2-Methylnaphthalene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	18-JUL-18
Acenaphthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Acenaphthylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Anthracene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Benzo(a)anthracene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Benzo(a)pyrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Benzo(b)fluoranthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Benzo(g,h,i)perylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Benzo(k)fluoranthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Chrysene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Dibenzo(ah)anthracene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Fluoranthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Fluorene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Indeno(1,2,3-cd)pyrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
Naphthalene		<0.013	<0.013	RPD-NA	ug/g	N/A	40	18-JUL-18
Phenanthrene		<0.046	<0.046	RPD-NA	ug/g	N/A	40	18-JUL-18
Pyrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	18-JUL-18
WG2822153-2 LCS								
1-Methylnaphthalene			86.3		%		50-140	18-JUL-18
2-Methylnaphthalene			86.3		%		50-140	18-JUL-18
Acenaphthene			85.3		%		50-140	18-JUL-18

Quality Control Report

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40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-511-WT	**Soil**							
Batch R4131516								
WG2822153-2 LCS								
Acenaphthylene			77.8		%		50-140	18-JUL-18
Anthracene			79.8		%		50-140	18-JUL-18
Benzo(a)anthracene			81.2		%		50-140	18-JUL-18
Benzo(a)pyrene			79.2		%		50-140	18-JUL-18
Benzo(b)fluoranthene			81.8		%		50-140	18-JUL-18
Benzo(g,h,i)perylene			82.6		%		50-140	18-JUL-18
Benzo(k)fluoranthene			83.4		%		50-140	18-JUL-18
Chrysene			83.7		%		50-140	18-JUL-18
Dibenzo(ah)anthracene			82.5		%		50-140	18-JUL-18
Fluoranthene			82.7		%		50-140	18-JUL-18
Fluorene			80.2		%		50-140	18-JUL-18
Indeno(1,2,3-cd)pyrene			80.0		%		50-140	18-JUL-18
Naphthalene			85.0		%		50-140	18-JUL-18
Phenanthrene			86.3		%		50-140	18-JUL-18
Pyrene			83.6		%		50-140	18-JUL-18
WG2822153-1 MB								
1-Methylnaphthalene			<0.030		ug/g		0.03	18-JUL-18
2-Methylnaphthalene			<0.030		ug/g		0.03	18-JUL-18
Acenaphthene			<0.050		ug/g		0.05	18-JUL-18
Acenaphthylene			<0.050		ug/g		0.05	18-JUL-18
Anthracene			<0.050		ug/g		0.05	18-JUL-18
Benzo(a)anthracene			<0.050		ug/g		0.05	18-JUL-18
Benzo(a)pyrene			<0.050		ug/g		0.05	18-JUL-18
Benzo(b)fluoranthene			<0.050		ug/g		0.05	18-JUL-18
Benzo(g,h,i)perylene			<0.050		ug/g		0.05	18-JUL-18
Benzo(k)fluoranthene			<0.050		ug/g		0.05	18-JUL-18
Chrysene			<0.050		ug/g		0.05	18-JUL-18
Dibenzo(ah)anthracene			<0.050		ug/g		0.05	18-JUL-18
Fluoranthene			<0.050		ug/g		0.05	18-JUL-18
Fluorene			<0.050		ug/g		0.05	18-JUL-18
Indeno(1,2,3-cd)pyrene			<0.050		ug/g		0.05	18-JUL-18
Naphthalene			<0.013		ug/g		0.013	18-JUL-18
Phenanthrene			<0.046		ug/g		0.046	18-JUL-18
Pyrene			<0.050		ug/g		0.05	18-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-511-WT	**Soil**							
Batch R4131516								
WG2822153-1 MB								
Surrogate: 2-Fluorobiphenyl			82.8		%		50-140	18-JUL-18
Surrogate: p-Terphenyl d14			74.5		%		50-140	18-JUL-18
WG2822153-4 MS		**WG2822153-5**						
1-Methylnaphthalene			87.3		%		50-140	18-JUL-18
2-Methylnaphthalene			88.6		%		50-140	18-JUL-18
Acenaphthene			88.8		%		50-140	18-JUL-18
Acenaphthylene			80.1		%		50-140	18-JUL-18
Anthracene			82.1		%		50-140	18-JUL-18
Benzo(a)anthracene			89.2		%		50-140	18-JUL-18
Benzo(a)pyrene			82.7		%		50-140	18-JUL-18
Benzo(b)fluoranthene			90.2		%		50-140	18-JUL-18
Benzo(g,h,i)perylene			78.1		%		50-140	18-JUL-18
Benzo(k)fluoranthene			87.6		%		50-140	18-JUL-18
Chrysene			82.5		%		50-140	18-JUL-18
Dibenzo(ah)anthracene			79.1		%		50-140	18-JUL-18
Fluoranthene			82.8		%		50-140	18-JUL-18
Fluorene			86.5		%		50-140	18-JUL-18
Indeno(1,2,3-cd)pyrene			80.4		%		50-140	18-JUL-18
Naphthalene			84.5		%		50-140	18-JUL-18
Phenanthrene			84.7		%		50-140	18-JUL-18
Pyrene			81.7		%		50-140	18-JUL-18
PH-WT	**Soil**							
Batch R4131128								
WG2823067-1 DUP		**L2127928-13**						
pH		7.18	7.09	J	pH units	0.09	0.3	17-JUL-18
WG2823462-1 LCS								
pH			6.93		pH units		6.9-7.1	17-JUL-18
SAR-R511-WT	**Soil**							
Batch R4131845								
WG2824071-4 DUP		**WG2824071-3**						
Calcium (Ca)		7.8	7.3		mg/L	6.5	30	17-JUL-18
Sodium (Na)		15.8	15.2		mg/L	3.8	30	17-JUL-18
Magnesium (Mg)		<1.0	<1.0	RPD-NA	mg/L	N/A	30	17-JUL-18
WG2824071-2 IRM		**WT SAR2**						

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R4131845								
WG2824071-2 IRM		**WT SAR2**						
Calcium (Ca)			90.3		%		70-130	17-JUL-18
Sodium (Na)			95.5		%		70-130	17-JUL-18
Magnesium (Mg)			87.4		%		70-130	17-JUL-18
WG2824071-1 MB								
Calcium (Ca)			<1.0		mg/L		1	17-JUL-18
Sodium (Na)			<1.0		mg/L		1	17-JUL-18
Magnesium (Mg)			<1.0		mg/L		1	17-JUL-18
VOC-511-HS-WT	**Soil**							
Batch R4125842								
WG2821409-4 DUP		**WG2821409-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	16-JUL-18
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	16-JUL-18
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	16-JUL-18
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R4125842								
WG2821409-4 DUP		**WG2821409-3**						
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	16-JUL-18
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	16-JUL-18
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	16-JUL-18
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	16-JUL-18
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	16-JUL-18
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	16-JUL-18
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	16-JUL-18
Trichloroethylene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	16-JUL-18
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	16-JUL-18
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	16-JUL-18
WG2821409-2 LCS								
1,1,1,2-Tetrachloroethane			105.0		%		60-130	16-JUL-18
1,1,2,2-Tetrachloroethane			92.8		%		60-130	16-JUL-18
1,1,1-Trichloroethane			96.6		%		60-130	16-JUL-18
1,1,2-Trichloroethane			102.9		%		60-130	16-JUL-18
1,1-Dichloroethane			90.3		%		60-130	16-JUL-18
1,1-Dichloroethylene			75.2		%		60-130	16-JUL-18
1,2-Dibromoethane			101.7		%		70-130	16-JUL-18
1,2-Dichlorobenzene			104.6		%		70-130	16-JUL-18
1,2-Dichloroethane			98.6		%		60-130	16-JUL-18
1,2-Dichloropropane			101.0		%		70-130	16-JUL-18
1,3-Dichlorobenzene			102.4		%		70-130	16-JUL-18
1,4-Dichlorobenzene			104.1		%		70-130	16-JUL-18
Acetone			104.2		%		60-140	16-JUL-18
Benzene			97.4		%		70-130	16-JUL-18
Bromodichloromethane			98.8		%		50-140	16-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R4125842								
WG2821409-2 LCS								
Bromoform			99.7		%		70-130	16-JUL-18
Bromomethane			74.2		%		50-140	16-JUL-18
Carbon tetrachloride			95.8		%		70-130	16-JUL-18
Chlorobenzene			104.1		%		70-130	16-JUL-18
Chloroform			99.4		%		70-130	16-JUL-18
cis-1,2-Dichloroethylene			94.9		%		70-130	16-JUL-18
cis-1,3-Dichloropropene			105.5		%		70-130	16-JUL-18
Dibromochloromethane			107.2		%		60-130	16-JUL-18
Dichlorodifluoromethane			50.2		%		50-140	16-JUL-18
Ethylbenzene			103.5		%		70-130	16-JUL-18
n-Hexane			108.8		%		70-130	16-JUL-18
Methylene Chloride			88.1		%		70-130	16-JUL-18
MTBE			106.6		%		70-130	16-JUL-18
m+p-Xylenes			104.0		%		70-130	16-JUL-18
Methyl Ethyl Ketone			99.4		%		60-140	16-JUL-18
Methyl Isobutyl Ketone			94.2		%		60-140	16-JUL-18
o-Xylene			104.7		%		70-130	16-JUL-18
Styrene			102.9		%		70-130	16-JUL-18
Tetrachloroethylene			101.6		%		60-130	16-JUL-18
Toluene			102.2		%		70-130	16-JUL-18
trans-1,2-Dichloroethylene			87.5		%		60-130	16-JUL-18
trans-1,3-Dichloropropene			101.8		%		70-130	16-JUL-18
Trichloroethylene			101.5		%		60-130	16-JUL-18
Trichlorofluoromethane			90.6		%		50-140	16-JUL-18
Vinyl chloride			60.0		%		60-140	16-JUL-18
WG2821409-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	16-JUL-18
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	16-JUL-18
1,1,1-Trichloroethane			<0.050		ug/g		0.05	16-JUL-18
1,1,2-Trichloroethane			<0.050		ug/g		0.05	16-JUL-18
1,1-Dichloroethane			<0.050		ug/g		0.05	16-JUL-18
1,1-Dichloroethylene			<0.050		ug/g		0.05	16-JUL-18
1,2-Dibromoethane			<0.050		ug/g		0.05	16-JUL-18
1,2-Dichlorobenzene			<0.050		ug/g		0.05	16-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R4125842								
WG2821409-1 MB								
1,2-Dichloroethane			<0.050		ug/g		0.05	16-JUL-18
1,2-Dichloropropane			<0.050		ug/g		0.05	16-JUL-18
1,3-Dichlorobenzene			<0.050		ug/g		0.05	16-JUL-18
1,4-Dichlorobenzene			<0.050		ug/g		0.05	16-JUL-18
Acetone			<0.50		ug/g		0.5	16-JUL-18
Benzene			<0.0068		ug/g		0.0068	16-JUL-18
Bromodichloromethane			<0.050		ug/g		0.05	16-JUL-18
Bromoform			<0.050		ug/g		0.05	16-JUL-18
Bromomethane			<0.050		ug/g		0.05	16-JUL-18
Carbon tetrachloride			<0.050		ug/g		0.05	16-JUL-18
Chlorobenzene			<0.050		ug/g		0.05	16-JUL-18
Chloroform			<0.050		ug/g		0.05	16-JUL-18
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	16-JUL-18
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	16-JUL-18
Dibromochloromethane			<0.050		ug/g		0.05	16-JUL-18
Dichlorodifluoromethane			<0.050		ug/g		0.05	16-JUL-18
Ethylbenzene			<0.018		ug/g		0.018	16-JUL-18
n-Hexane			<0.050		ug/g		0.05	16-JUL-18
Methylene Chloride			<0.050		ug/g		0.05	16-JUL-18
MTBE			<0.050		ug/g		0.05	16-JUL-18
m+p-Xylenes			<0.030		ug/g		0.03	16-JUL-18
Methyl Ethyl Ketone			<0.50		ug/g		0.5	16-JUL-18
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	16-JUL-18
o-Xylene			<0.020		ug/g		0.02	16-JUL-18
Styrene			<0.050		ug/g		0.05	16-JUL-18
Tetrachloroethylene			<0.050		ug/g		0.05	16-JUL-18
Toluene			<0.080		ug/g		0.08	16-JUL-18
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	16-JUL-18
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	16-JUL-18
Trichloroethylene			<0.010		ug/g		0.01	16-JUL-18
Trichlorofluoromethane			<0.050		ug/g		0.05	16-JUL-18
Vinyl chloride			<0.020		ug/g		0.02	16-JUL-18
Surrogate: 1,4-Difluorobenzene			102.7		%		50-140	16-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R4125842								
WG2821409-1 MB								
Surrogate: 4-Bromofluorobenzene			99.3		%		50-140	16-JUL-18
WG2821409-5 MS		**L2127912-11**						
1,1,1,2-Tetrachloroethane			116.5		%		50-140	16-JUL-18
1,1,2,2-Tetrachloroethane			103.0		%		50-140	16-JUL-18
1,1,1-Trichloroethane			106.7		%		50-140	16-JUL-18
1,1,2-Trichloroethane			113.2		%		50-140	16-JUL-18
1,1-Dichloroethane			99.3		%		50-140	16-JUL-18
1,1-Dichloroethylene			83.4		%		50-140	16-JUL-18
1,2-Dibromoethane			112.2		%		50-140	16-JUL-18
1,2-Dichlorobenzene			114.1		%		50-140	16-JUL-18
1,2-Dichloroethane			108.3		%		50-140	16-JUL-18
1,2-Dichloropropane			111.0		%		50-140	16-JUL-18
1,3-Dichlorobenzene			111.3		%		50-140	16-JUL-18
1,4-Dichlorobenzene			112.8		%		50-140	16-JUL-18
Acetone			116.9		%		50-140	16-JUL-18
Benzene			107.0		%		50-140	16-JUL-18
Bromodichloromethane			108.9		%		50-140	16-JUL-18
Bromoform			110.0		%		50-140	16-JUL-18
Bromomethane			81.0		%		50-140	16-JUL-18
Carbon tetrachloride			106.3		%		50-140	16-JUL-18
Chlorobenzene			114.3		%		50-140	16-JUL-18
Chloroform			109.6		%		50-140	16-JUL-18
cis-1,2-Dichloroethylene			104.0		%		50-140	16-JUL-18
cis-1,3-Dichloropropene			106.3		%		50-140	16-JUL-18
Dibromochloromethane			119.1		%		50-140	16-JUL-18
Dichlorodifluoromethane			57.5		%		50-140	16-JUL-18
Ethylbenzene			114.4		%		50-140	16-JUL-18
n-Hexane			123.4		%		50-140	16-JUL-18
Methylene Chloride			95.9		%		50-140	16-JUL-18
MTBE			117.3		%		50-140	16-JUL-18
m+p-Xylenes			114.0		%		50-140	16-JUL-18
Methyl Ethyl Ketone			102.3		%		50-140	16-JUL-18
Methyl Isobutyl Ketone			102.4		%		50-140	16-JUL-18
o-Xylene			115.5		%		50-140	16-JUL-18

Quality Control Report

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R4125842								
WG2821409-5 MS		**L2127912-11**						
Styrene			113.0		%		50-140	16-JUL-18
Tetrachloroethylene			111.5		%		50-140	16-JUL-18
Toluene			112.6		%		50-140	16-JUL-18
trans-1,2-Dichloroethylene			95.9		%		50-140	16-JUL-18
trans-1,3-Dichloropropene			106.8		%		50-140	16-JUL-18
Trichloroethylene			111.1		%		50-140	16-JUL-18
Trichlorofluoromethane			102.2		%		50-140	16-JUL-18
Vinyl chloride			67.1		%		50-140	16-JUL-18

Quality Control Report

Workorder: L2127983 Report Date: 20-JUL-18

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L2127983 Report Date: 20-JUL-18

Client: GeoPro Consulting Limited (Richmond Hill)
40 Vogell Road Unit 22
Richmond Hill ON L4B 3N6
Contact: Sarena Sarenam

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
% Moisture							
	1	28-JUN-18	14-JUL-18 07:56	14	16	days	EHTL
	2	22-JUN-18	14-JUL-18 10:05	14	22	days	EHTR
	3	22-JUN-18	14-JUL-18 10:06	14	22	days	EHTR
Cyanides							
Cyanide (WAD)-O.Reg 153/04 (July 2011)							
	1	28-JUN-18	13-JUL-18 13:00	14	15	days	EHTL
	2	22-JUN-18	16-JUL-18 10:00	14	24	days	EHTR
Volatile Organic Compounds							
VOC-O.Reg 153/04 (July 2011)							
	3	22-JUN-18	13-JUL-18 08:50	14	21	days	EHTR
Hydrocarbons							
F1-O.Reg 153/04 (July 2011)							
	3	22-JUN-18	13-JUL-18 08:50	14	21	days	EHTR
F2-F4-O.Reg 153/04 (July 2011)							
	3	22-JUN-18	14-JUL-18 11:00	14	22	days	EHTR

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2127983 were received on 12-JUL-18 09:00.

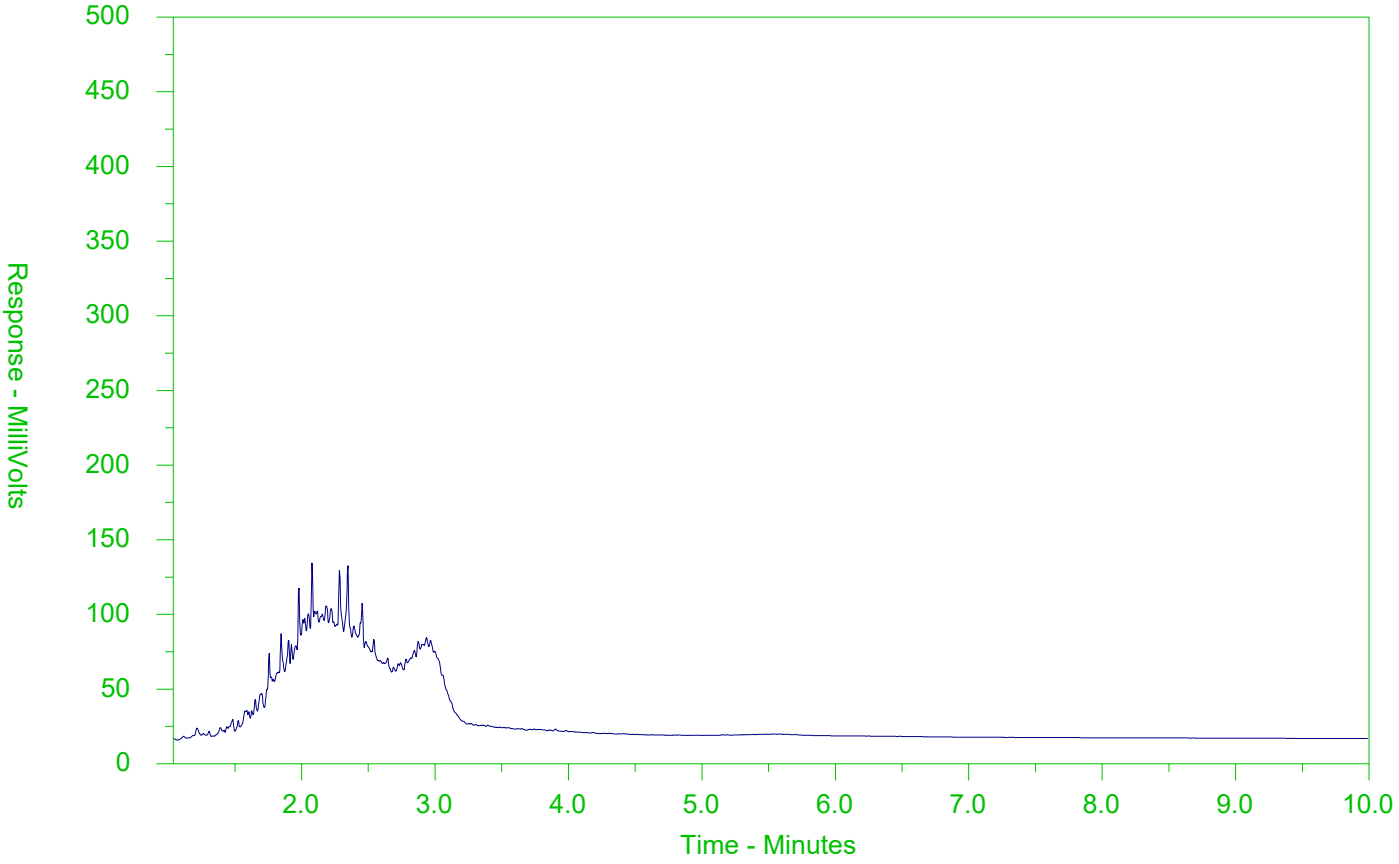
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L2127983-3
Client Sample ID: BH2 SS3



←F2→	←F3→	←F4→	
nC10	nC16	nC34	nC50
174°C	287°C	481°C	575°C
346°F	549°F	898°F	1067°F
Gasoline →		← Motor Oils/Lube Oils/Grease →	
← Diesel/Jet Fuels →			

The CCME F2-F4 Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor and the scale at the left.

Note: This chromatogram was produced using GC conditions that are specific to ALS Canada CCME F2-F4 method. Refer to the ALS Canada CCME F2-F4 Hydrocarbon Library for a collection of chromatograms from common reference samples (fuels, oils, etc.). The HDR Library can be found at www.alsglobal.com.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 18-2298-180711

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	GeoPro Consulting Ltd.
Contact:	Sarena (sarenam@geoproconsulting.ca)
Phone:	(905) 237-8336
	Company address below will appear on the final report
Street:	40 Vogell Road, Unit 57
City/Province:	Richmond Hill, ON
Postal Code:	L4B 3N6
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	As above
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ YES ☐ NO
☑ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: dylanx@geoproconsulting.ca
Email 2: kai@geoproconsulting.ca
Email 3: fanw@geoproconsulting.ca

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: sarenam@geoproconsulting.ca
Email 2: office@geoproconsulting.ca

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4] ☐ | 3 day [P3] ☐ | 2 day [P2] ☐
EMERGENCY: 1 Business day [E1] ☐ | Same Day, Weekend or Statutory holiday [E0] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q58286
Job #: 18-2298GH
PO / AFE:
LSD: Town of Innisfil, ON

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only): L2127983
ALS Contact: Rick
Sampler: Hasanur R

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals and Inorganics	PHC	VOCs	PAHs	Number of Containers
-1	BH1 SS3	28-Jun-18	AM	Soil	✓				1
-2	BH2 SS2+SS3	22-Jun-18	AM	Soil	✓				1
-3	BH2 SS3	22-Jun-18	AM	Soil		✓	✓	✓	4

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human drinking water use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

MOECC TABLE 1

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
3.4					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Hai Tian Wang	Date: July 11th, 2018	Time: 7:29pm	Received by: B	Date: July 12/18	Time: 9:00	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX B

eurofins | Environment Testing

Mr. Bujing Guan
Geo Pro Consulting
40 Vogell Rd, Unit 57
Richmond Hill (Ontario)
L4B 3K6

CERTIFICATE OF ANALYSIS

CERTIFICATE # 18-0844 VERSION 1.0

Client :	Geo Pro Consulting	**P.O. Number :**	Ottawa Project 1812293
Our Project :	18-891823	**Your Project :**	18-2298GH
Date Received :	July 16th 2018	**Date Analysed:**	July 16th 2018

MINERALOGICAL CHARACTERISATION BY POLARISED LIGHT MICROSCOPY AND DISPERSION STAINING COLOURS EPA METHOD EPA/600/R-93/116

Two (2) samples were submitted for analysis by polarised light microscopy and dispersion staining colours. The samples were prepared and observed using the following procedure:

A fragment of each sample was isolated. If needed in order to extract the fibres, the samples are submitted to light mechanical crushing. The particles and fibres produced are transferred to a glass slide, covered with a cover glass and immersed in the appropriate refractive index liquids in order to observe the dispersion staining colours. The orthoscopic and conoscopic optical properties of the samples are also used if they permit further characterisation of the samples. The results are summarised as follows:

1373970 – BH1	
Grey and black material	
Asbestos fibres	**None detected**
Naturally occurring organic fibres (cellulose)	5 – 10 %
Angular particles, fragments and other	90 – 95 %

1373971 – BH2	
Grey and black material	
Asbestos fibres	**None detected**
Naturally occurring organic fibres (cellulose)	1 – 5 %
Angular particles, fragments and other	> 95 %

Analysed by : Annie Garand
Annie Garand, Technician

Verified by : Martin Gravelle
Martin Gravelle, B.Sc. Chemist

CHIMISTE Martin Gravelle 2000-167

Notes : PLM has been known to miss asbestos in a small percentage of samples which contain asbestos. Therefore negative PLM results cannot be guaranteed. This analytical method is semi-quantitative. The applicability of this method varies between < 1 % and 100 % (v/v). Eurofins suggests that certain samples reported as « None detected », « traces » or « < 1% » be analysed by TEM. The present certificate relates only to the samples analysed. The present certificate may not be reproduced, except in full, without written approval by Eurofins. The laboratory is not responsible for the accuracy of results when requested to physically separate and analyse layered samples. The laboratory is not responsible for the representativeness of the samples submitted for analysis. Samples will be kept for a period of 60 days or according to the written request of the client.

EUROFINS POINTE-CLAIRE PARTICIPATES IN THE AIHA PAT PROGRAM FOR BULK ASBESTOS.

LIMITATIONS TO THE REPORT

This report is intended solely for the Client named. The report is prepared based on the work has been undertaken in accordance with normally accepted geotechnical engineering practices in Ontario.

The comments and recommendations given in this report are based on information determined at the limited number of the test hole and test pit locations. The boundaries between the various strata as shown on the borehole logs are based on non-continuous sampling and represent an inferred transition between the various strata and their lateral continuation rather than a precise plane of geological change. Subsurface and groundwater conditions between and beyond the test holes and test pits may differ significantly from those encountered at the test hole and test pit locations. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole and test pit locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

It should be noted that the results of the designated substance and chemical analysis refer only to the sample analyzed which was obtained from specific sampling location and sampling depth, and the presence of designated substance and soil chemistry may vary between and beyond the location and depth of the sample taken. Please note that the level of chemical testing outlined herein is meant to provide a broad indication of soil quality based on the limited soil samples tested. The analytical results contained in this report should not be considered a warranty with respect to the soil quality or the use of the soil for any specific purpose or the acceptability of the soils for any excess soil receiving sites.

The report reflects our best judgment based on the information available to GeoPro Consulting Limited at the time of preparation. Unless otherwise agreed in writing by GeoPro Consulting Limited, it shall not be used to express or imply warranty as to any other purposes. No portion of this report shall be used as a separate entity, it is written to be read in its entirety. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated.

The design recommendations given in this report are applicable only to the project designed and constructed completely in accordance with the details stated in this report. Otherwise, our responsibility is limited to interpreting the subsurface information at the borehole or test pit locations.

Should any comments and recommendations provided in this report be made on any construction related issues, they are intended only for the guidance of the designers. The number of test holes and test pits may not be sufficient to determine all the factors that may affect construction activities, methods and costs. Such as, the thickness of surficial topsoil or fill layers may vary significantly and unpredictably; the amount of the cobbles and boulders may vary significantly than what described in the report; unexpected water bearing zones/layers with various thickness and extent may be encountered in the fill and native soils. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and make their own conclusions as to how the subsurface conditions may affect their work and determine the proper construction methods.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. GeoPro Consulting Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.