APPENDIX J

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Geotechnical Investigation

Proposed Road Extension

Between Rean Drive and Kenaston Gardens

City of Toronto, Ontario

Prepared For:

Morrison Hershfield Limited

GeoPro Project No.: 16-1359-01

Report Date: November 18, 2016

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GeoPro CONSULTING LIMITED

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1 INTRODUCTION

GeoPro Consulting Limited (GeoPro) was retained by Morrison Hershfield Limited (the Client) to conduct a geotechnical investigation for the proposed road extension from Rean Drive to Kenaston Gardens, in the City of Toronto, Ontario. The total length of the proposed project is approximately 250 m.

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

This 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. Furthermore, 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 phase 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, 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 consultants in Ontario. Laboratory testing, for most part, 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 above form an integral part of the report and they must be considered in conjunction with this report.

2 FIELD AND LABORATORY WORK

2.1 Borehole and Core Investigation

Field work for the geotechnical investigation was carried out on September 28, 2016, during which time ten (10) boreholes (Boreholes BH1 to BH10) were advanced to a depth of about 2.0 m below the existing ground surface. The borehole locations are shown on Borehole Location Plan, Drawing 1.

The boreholes were advanced using truck-mounted continuous flight auger equipment supplied by a specialist drilling subcontractor and operated under the supervision of a GeoPro engineering staff. Soil samples were recovered at regular intervals of depth using a 50 mm O.D. split-spoon sampler driven into the soil in accordance with the Standard Penetration Test (SPT) procedure described in ASTM D1586 - 11 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.

Groundwater condition observations were made in the open boreholes during drilling and upon completion of drilling. All boreholes were backfilled and sealed upon completion of drilling.

It should be noted the elevations at the as-drilled borehole locations were not available at the time of preparing the report. The borehole locations plotted on the Borehole Location Plan, Drawing 1 were based on the measurement of the site features and should be considered to be approximate.

Seven (7) asphalt concrete samples were collected and submitted to Paracel Laboratories Ltd. and AGAT Laboratories for observation/testing of the presence of asbestos. The asbestos analysis results are provided in Appendix A.

2.2 Laboratory Testing

In the laboratory, each soil sample was examined as to its visual and textural characteristics by the project engineer. Moisture content determinations were carried out on all subsoil samples. Six samples of the granular base/subbase materials were analyzed for comparison with the City of Toronto Standard Specifications TS 1010 gradation requirements, and five subgrade soil samples were tested for grain size analysis to assess their drainage characteristics and frost susceptibility. The complete laboratory test results are attached in Figures 1 to 4.

3 SUBSURFACE CONDITIONS

The borehole locations are shown on Drawing 1. Notes on sample descriptions are presented in Enclosure No. 1A. Explanations of terms used in the boreholes logs are presented in Enclosure No. 1B. The subsurface conditions in the boreholes (Boreholes BH1 to BH10) are presented in the individual borehole logs (Enclosure Nos. 2 to 11 inclusive). Detailed descriptions of the major soil strata encountered in the boreholes drilled at the site are provided in the following.

3.1 Soil Conditions

Existing Pavement Structure

A flexible pavement structure was observed in all of the boreholes. The range and average thickness of pavement structure is summarized in the following table.

Section	Pavement Structure		
	Asphalt Concrete Range (Mean) (mm)	**Granular Base/Subbase Range (Mean) (mm)**	**Total Thickness (mm)**
Kenaston Gardens (BH1 and BH2)	220 – 280 (250)	390	610 - 670 (640)
Barberry Place (BH3 and BH4)	180 - 210 (195)	370 - 390 (380)	550 - 600 (575)
Private Road/Laneway (BH5 to BH9)	80 - 140 (104)	370 - 610 (466)	490 - 700 (570)
Rean Drive (BH10)	200	420	620

Fill Materials

Fill materials consisting of sand, sand and silt, sand and gravel, sandy silt and clayey silt were encountered below the granular base/subbase in all boreholes and extended to depths ranging from about 1.1 m to 2.0 m below the existing ground surface. Boreholes BH1, BH3 and BH10 were terminated in these fill materials. For cohesionless fill materials, SPT N values ranging from 6 to 53 blows per 300 mm penetration indicated a loose to very dense relative density. For cohesive fill materials, SPT N value of 29 blows per 300 mm penetration indicated a very stiff consistency. The in-situ moisture content measured in the soil samples ranged from approximately 5% to 19%.

Silty Fine Sand

Silty fine sand deposit was encountered below the fill materials in Borehole BH2 and extended to a depth of about 2.0 m below the existing ground surface. Borehole BH2 was terminated in this deposit. SPT N value of 65 blows per 300 mm penetration indicated a very dense relative density. The natural moisture content measured in this soil sample was approximately 8%.

Sandy Silt Till and Sand and Silt Till

Sandy silt till and sand and silt till deposits were encountered below the fill materials in Boreholes BH4 to BH9 and extended to a depth of about 2.0 m below the existing ground surface. Boreholes BH4 to BH9 were terminated in these deposits. SPT N values ranging from 14 to 49 blows per 300 mm penetration indicated a compact to dense relative density. The natural moisture content measured in the soil samples ranged from approximately 7% to 14%.

3.2 Groundwater Conditions

All the boreholes were open and dry upon the completion of drilling. It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to weather events.

4 LABORATORY TEST RESULTS

4.1 Grain Size Analysis Results

Sieve analyses were completed on six samples of the recovered granular base/subbase materials, and the results were compared to TS 1010 Granular A and Granular B Type I specifications. The grain size distribution curves for these samples are presented in Figures 1 and 2, and a summary of the results is provided in the following table.

Sample	TS 1010 Granular A	TS 1010 Granular B Type I
BH1 AS1	Does not meet TS 1010 due to excessive percentages passing all sieves	Does not meet TS 1010 due to excessive fines (15.3% passing 0.075 mm sieve)
BH3 AS1	Does not meet TS 1010 due to excessive percentages passing all sieves	Does not meet TS 1010 due to excessive fines (16.1% passing 0.075 mm sieve)
BH5 AS1	Does not meet TS 1010 due to excessive percentages passing all sieves	Does not meet TS 1010 due to excessive fines (13.7% passing 0.075 mm sieve)
BH6 AS1	Does not meet TS 1010 due to excessive percentages passing all sieves	Does not meet TS 1010 due to excessive fines (15.6% passing 0.075 mm sieve)
BH7 AS1	Does not meet TS 1010 due to excessive percentages passing most sieves	Does not meet TS 1010 due to excessive fines (14.7% passing 0.075 mm sieve)
BH9 AS1	Does not meet TS 1010 due to excessive percentages passing most sieves	Does not meet TS 1010 due to excessive fines (13.0% passing 0.075 mm sieve)

Grain size analysis of five subgrade samples confirmed the visual description of the subgrade soils. In addition, the soil was examined and compared to frost susceptibility characteristics in accordance with the MTO Pavement Design and Rehabilitation Manual. The summarized results are provided in the following table, and the grain size distribution curves of these samples are presented in Figures 3 and 4.

Soil Sample	Description	Susceptibility of Frost Heaving
BH1 SS3	Sandy Silt, some Clay	Low
BH3 SS2	Sand and Silt, some Clay, trace Gravel	Low
BH6 SS3	Sand and Silt, some Clay, trace Gravel	Low
BH7 SS2	Sand and Silt, some Clay, trace Gravel	Low
BH9 SS2	Sand and Silt, some Clay, trace Gravel	Low

4.2 Asbestos Analysis Results

Seven (7) asphalt concrete samples were submitted to Paracel Laboratories Ltd. (Paracel) and AGAT Laboratories (AGAT) in Mississauga, Ontario to determine if asbestos fibres are present in the existing asphalt concrete. To analyze for asbestos in asphalt samples, Paracel uses PLM visual estimation in accordance with EPA 600/R-93/116 method, and AGAT uses a method modified from EPA/NIOSH methodology protocols and typically expresses results using semi-qualitative ranges.

Based on the analytical results, no asbestos was identified in the seven asphalt samples that were analyzed. Therefore, the asphalt concrete in the pavement structure at this site would not be considered as an asbestos containing material. The existing asphalt concrete may be reused in recycled hot -mix asphalt mixtures. The asbestos analysis test results are attached in Appendix A.

5 DISCUSSION AND RECOMMENDATIONS

This report contains the findings of GeoPro's geotechnical investigation, together with 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 factors that may affect construction methods and costs. Subsurface conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction that 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. The construction methods discussed, however, express GeoPro's opinion only and are not intended to direct contractors on how to carry out construction. Contractors should also be aware that the data and interpretation presented in this report may not be sufficient to assess all factors that may have an effect on construction.

The design drawings of the project were not available when this report was prepared. Once the design drawings and detailed site plan are available, this report will be reviewed by GeoPro, and further recommendations will be provided as needed.

5.1 Site and Project Description

It is understood that this proposed new east-west street connection will be built between Rean Drive and Kenaston Gardens, within the vicinity of the southeast quadrant of the Sheppard Avenue East and Bayview Avenue intersection and north of Highway 401, in order to improve pedestrian and cycling access to the TTC's Bayview subway station and neighborhood amenities as well as shops and services along Sheppard Avenue East. Within the project limits, the road between Rean Drive and Barberry Place may need widening for west portion of the laneway and a new road extension will be constructed between Barberry Place and Kenaston Gardens.

5.2 Existing Pavement Condition

Based on our site investigation, the existing pavement between Rean Drive and Barberry Place consisted of asphalt concrete with an average thickness of about 104 mm (ranging from about 80 mm to 140 mm) overlying granular base and subbase materials with an average thickness of about 466 mm.

In general, the existing pavement on this section was observed to be in fair condition. The most significant distresses are intermittent low to medium severity transverse cracking, few low severity edge cracking, few low severity segregation and few low to medium severity patching.

This existing roadway was designed and constructed to an urban cross-section (curb and catchbasins). The overall surface drainage is generally considered to be fair. Observations along the length of the roadway indicate that the pavement surface water generally follows along the existing pavement grades and is being directed to the concrete curb and to catch basins. However, drainage is impaired by surface distresses, with unsealed cracks allowing surface water to infiltrate into the underlying pavement and subgrade. The catch basins were observed to be in fair to good condition.

5.3 Traffic Data Analysis

Proposed extension road from Rean Drive to Kenaston Gardens is considered to be a Local Throughway, the client provided estimated AADT of about 300 - 400 with assumed less than 3 percent heavy trucks.

The traffic data was interpreted by GeoPro to estimate the number of Equivalent Single Axle Loads (ESALs) for pavement design purposes. Traffic loading repetitions were determined for the 15-year pavement design life period that is considered typical for municipal pavements of this type. On this basis, the ESAL applications during the design period were calculated in accordance with the Appendix D of MTO MI-183 Adaption and Verification of AASHTO Pavement Design Guide for Ontario Conditions. This traffic data and the ESALs are presented in the following table.

Parameters	Traffic Data
AADT (2016)	400
Commercial Vehicle Percentage	3.0%
Annual Growth Rate	1.5%
Estimated Total Design ESALs (15-Year)	27,900

5.4 Pavement Design

The subgrade soils along the length of subject roadway section generally consisted of cohensionless silty sand/sandy silt till/sand and silt till to cohesive clayey silt based on GeoPro's borehole information. The resilient modulus of subgrade has been assumed to be 20 MPa. The pavement designs were developed based on the 1993 AASHTO Guide for Design of Pavement

Structures and MTO MI-183 Adaption and Verification of AASHTO Pavement Design Guide for Ontario Conditions. The pavement design parameters are summarized in the following table.

Design Parameters	Values
Design Life	15 Years
ESALs over Analysis Period	27,900
Initial Serviceability Index	4.2
Terminal Serviceability Index	2.0
Reliability Level, %	90
Overall Standard Deviation	0.45
Design Subgrade Resilient Modulus, MPa	20
Calculated Design Structure Number	69
Existing Pavements	
Layer Coefficient of Asphaltic Concrete	0.28
Layer Coefficient of Granular Base/Subbase Course	0.09
Drainage Coefficients of Base and Subbase Courses	0.9
Road Extension Section/Laneway Widening Area	
Layer Coefficient of Hot Mix Asphalt	0.42
Layer Coefficient of Granular Base Course	0.14
Layer Coefficient of Granular Subbase Course	0.09
Drainage Coefficients of Base and Subbase Courses	1.0

5.5 Pavement Design for Road Extension Section and Laneway Widening Area

Based on the expected traffic and the type and strength of subgrade soil, the proposed road extension section (between Barberry Place and Kenaston Gardens) and laneway widening area (west portion of the laneway between Rean Drive and Barberry Place) should be carried out in general accordance with City of Toronto Drawing T-216.02.6, Flexible Pavement for All Road Classifications, and the recommended pavement structures are shown in the following table.

Recommended Flexible Pavement Structures for Extension Road and Laneway Widening

Material		Thickness of Pavement, mm	
		Extension Road (between Barberry Place and Kenaston Road)	Widening Laneway (West portion of Laneway)
Hot-Mix Asphalt (TS 1150)	HL 3 Surface Course	40	40
	HL 8 Binder Course	60	60
	Granular A Base	150	150

Granular Material (TS 1010)	Granular B Type I Subbase	250	280 [1]
Total Thickness		500	530
Constructed Pavement Structural Number		86	88
Design Structural Number		69	69

Note 1: Minimum thickness of subbase; the subbase thickness should match the existing subbase depth of the adjacent pavement structure to be rehabilitated

The construction sequence should be carried out as follows:

- Completely remove the existing topsoil and any other obviously deleterious materials;
- Excavate subgrade to the depth required to accommodate the new pavement structure; the prepared subgrade should be carefully proof-rolled in the presence of the geotechnical engineer; any soft or wet areas or other obviously deleterious materials must be excavated and properly replaced with TS 1010 Granular B Type I material; the finished subgrade level in the widening area must be at least at the same elevation or lower than the subgrade elevation of existing adjacent pavement;
- Backfilling of sub-excavated areas and fine grading may be carried out using TS 1010 Granular B Type I. All backfill materials should be placed in uniform lifts not exceeding 200 mm loose thickness and compacted to at least 98 percent Standard Proctor Maximum Dry Density (SPMDD). The finished subgrade should be provided with a grade of 3 percent towards the positive drainages;
- Place a minimum of 250 mm (road extension section) and average 280 mm (laneway widening area) TS 1010 Granular B Type I subbase course; place in loose lifts not exceeding 200 mm thickness, compact to 100 percent of SPMDD; the subbase thickness should match the existing subbase depth of the adjacent pavement in widening area;
- Place 150 mm of TS 1010 Granular A base course compacted to 100 percent of SPMDD; and
- Place 100 mm thickness of hot-mix asphalt (one lift of 60 mm of TS 1150 HL 8 binder course and one lift of 40 mm of TS 1150 HL 3 surface course), produced and placed in accordance with TS 310. The surface of the completed pavement should be provided with a grade of 2 percent.

The constructed pavement Structural Number is 86/88, which is greater than the Design Structural Number (69). As such, the pavements are structurally adequate for the expected traffic loads in the 15-year design period.

5.6 Existing Pavement Rehabilitations

Based on the results of the pavement condition survey, the borehole information, laboratory testing, pavement structural capacity analysis and the assumed traffic, the existing pavement

structure between Rean Drive and Barberry Place is generally considered to be adequate to accommodate the anticipated traffic for the remaining design life of the pavement. The existing pavement can be left as is, or alternatively, a conventional partial-depth mill and hot-mix asphalt overlay with full-depth crack repairs and localized structural improvements is considered the most cost effective rehabilitation option for this section to address the primary distresses and to restore the functional serviceability or extend the design life of the pavement. A full-depth hot-mix asphalt resurfacing may be considered as an alternative option for this section as well.

5.6.1 Partial-depth Hot Mix Asphalt Resurfacing Option

The partial-depth hot-mix asphalt resurfacing along with localized structural improvements should be carried out in general conformance with the City of Toronto Drawing T-216.02.6, Flexible Pavement for All Road Classifications and the general procedures are provided as follows:

- Mill to remove 50 mm of the existing asphalt concrete and dispose of off-site (the existing asphalt concrete can be reused in recycled hot-mix asphalt mixtures);
- The milled surface should be provided with a continuous centre-to-edge cross fall of 2 percent;
- Complete full-depth repairs (in accordance with Section 5.6.3 below) to any areas exhibiting structural failure (high severity alligator cracking, longitudinal cracking and soft localized areas, for instance);
- Complete crack repairs to any longitudinal or transverse cracks that are observed to extend into the underlying asphalt concrete; and
- Place one 50 mm lift of TS 1150 HL 3 hot-mix asphalt, produced and placed in accordance with TS 310.

The milled surface should be properly cleaned (power broomed and/or washed, as necessary) and tack coated using SS-1 emulsified asphalt prior to placement of any new hot-mix asphalt.

This mill and overlay option should be adequate to restore the pavement ride quality, address the existing distresses and extend the design life. However, some reflective cracking should be expected to occur within the first two to three years that will require crack sealing to prevent the ingress of moisture into the pavement.

5.6.2 Full-depth Hot Mix Asphalt Resurfacing Option

Should a full-depth hot-mix asphalt resurfacing be considered for this section of the road, it should be carried out in general conformance with the City of Toronto Drawing T-216.02.6, Flexible Pavement for All Road Classifications and as follows:

- Remove the existing asphalt concrete completely (approximately average of 90 mm in the west/east portions and 130 mm in the middle portion) and disposal off-site (the existing asphalt concrete can be reused in recycled hot-mix asphalt mixtures);

- Regrade and re-compact the existing granular material to 100 percent of SPMDD; the granular base course should be properly prepared, shaped and graded to the designed elevation and to provide with a continuous centre-to-edge cross-fall of 2 percent. The prepared granular material surface should be carefully proof rolled in the presence of the geotechnical engineer, and any soft or wet areas or other obviously deleterious materials excavated and properly replaced with Granular A material; and
- Place a minimum of two lifts of hot-mix asphalt (one 60 mm lift of OPSS 1150 HL 8 binder course and one 40 mm lift of OPSS 1150 HL 3 surface course). The surface of the completed pavement should be provided with a grade of 2 percent.

5.6.3 Full-depth Base Repairs

All localized pavement areas found to be structurally deficient should be repaired using the following full-depth base repairs procedure prior to overlaying.

- After completion of the milling operations, carefully sawcut the limits of the area to be repaired and remove the existing asphalt concrete, granular base/subbase to the exposed subgrade. The exposed subgrade should be inspected and excavated as necessary to provide a competent subgrade for the specified base repair pavement structure. Any additional soft, wet or deteriorated subgrade material must be removed and replaced with approved subgrade material;
- Place sufficient TS 1010 granular subbase (Granular B Type II or 50 mm crushed aggregate) followed by 150 mm of Granular A or equivalent meeting TS 1010 Granular A requirements. The granular base and subbase should be place in loose lifts not exceeding 200 mm thickness, compact to 100 percent of SPMDD; and
- The hot-mix asphalt concrete binder and surface courses should be placed at the same time as the overlay of the remaining roadway sections (in accordance with the recommendations in Sections 5.6.1 and 5.6.2 provided above).

5.7 Drainage Improvements

Control of surface water is an important factor in achieving a good pavement service life. Therefore, we recommend that provisions be made to drain the new pavement subgrade and its granular layers. It is understood that the proposed extension road/widening area are anticipated to consist of typical urban section (concrete curb/gutter and catchbasins). To provide positive drainage across the pavement platform, the surface of pavement should be sloped at a grade of 2 percent and the pavement subgrade should be sloped at a grade of 3 percent towards the subdrains. Subdrains should be designed and constructed in accordance with T-216.02-8, *Roadway Subdrains*, and the subdrain pipe should be connected to a positive outlet.

5.8 General Pavement Recommendations

5.8.1 Pavement Materials

The following hot-mix asphalt mix types should be selected:

- HL 3 Surface Course; and
- HL 8 Binder Course

These hot mix asphalt mixes should be designed and produced in conformance with TS 1150 requirements.

Granular A and Granular B Type I material should be used as base course and subbase course, respectively. Both Granular A and Granular B Type I material should meet TS 1010 specifications.

5.8.2 Asphalt Cement Grade

Performance graded asphalt cement PGAC 58-28 conforming to TS 1101 requirements is recommended for the HMA binder and surface courses.

5.8.3 Tack Coat

A tack coat (SS1) should be applied to all construction joints prior to placing hot-mix asphalt to create an adhesive bond. Prior to placing hot-mix asphalt, SS1 tack coat must also be applied to all existing surfaces and between all new lifts in accordance with OPSS 308 requirements.

5.8.4 Compaction

All granular base and subbase materials should be placed in uniform lifts not exceeding 200 mm loose thickness and compacted to 100 percent of the material SPMDD at ±2 percent of the materials Optimum Moisture Content (OMC). Hot-mix asphalt should be placed and compacted in accordance with TS 310 specifications.

5.8.5 Pavement Tapers

At the limits of construction, appropriate tapering of the pavement thickness to match the existing pavement structure should be implemented in accordance with OPSS and the applicable local municipality specifications.

5.8.6 Subgrade Preparation

All topsoil, organics, soft/loose and otherwise disturbed soils should be stripped from the subgrade area. The exposed subgrade soils will be disturbed by construction traffic when wet;

especially if site work is carried out during periods of wet weather. Under inclement weather conditions, an adequate granular working surface may be required to facilitate construction traffic as well as to minimize subgrade disturbance and to protect its integrity.

Immediately prior to placing the granular subbase, the exposed subgrade should be compacted and then proofrolled with a heavy rubber tired vehicle (such as a loaded gravel truck) in conjunction with inspection by a geotechnical engineer from GeoPro. The subgrade should be inspected for signs of rutting or displacement. Areas displaying signs of rutting or displacement should be recompacted and retested, or the material should be subexcavated and replaced with well-compacted clean fill materials approved by the geotechnical engineer from GeoPro.

The fill materials may consist of either granular material or local inorganic soils provided that its moisture content is within ±2 percent of OMC. Fill should be placed and compacted in accordance with TS 501 and the final 300 mm of the subgrade should be compacted to 98 percent of SPMDD.

5.8.7 Construction

Once the subgrade has been inspected, proof-rolled and approved, the granular base and subbase course materials should be placed in layers not exceeding 200 mm (uncompacted loose lift thickness) and should be compacted to at least 98% of their respective SPMDD. The grading of the material should conform to City of Toronto Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS specifications, or as required by the local authorities. Frequent field density tests should be carried out on both the asphalt and granular base and subbase materials to ensure that the required degree of compaction is achieved.

5.8.8 Reuse and Disposal of Existing Pavement Materials

It should be noted that gradation analyses of the selected samples of the existing granular base and subbase materials do not meet the TS 1010 granular A and B Type I gradation specifications with excessive content of fines. Therefore, the existing excavated granular materials could not be reused as subbase/base materials, however, they can be reused as subgrade material to replace soft, wet or otherwise disturbed areas identified during proofrolling.

If deemed practical during construction, the existing asphalt may be pulverized and reused as granular base and subbase materials, provided it can be processed to meet the OPSS Granular A and B Type I gradation specifications. It should be noted that the process of pulverizing asphalt typically generates fines, and as such, the pulverized materials should only be utilized in the lower lift of the subbase. The existing asphalt could also be salvaged and utilized as Recycled Asphalt Pavement (RAP) in the production of the binder course of the new hot-mix asphalt.

5.8.9 Maintenance

Routine maintenance should be considered to extend the life of the pavement. Systematic routine preventative maintenance is strongly recommended for all newly constructed pavements. Crack routing and sealing will generally be required within 2 to 3 years after pavement construction. As the pavement ages, it will also be necessary to patch areas of medium to high severity distresses, such as potholes and ravelling.

6 CHEMICAL ANALYSIS OF SELECTED SOIL SAMPLES

6.1 Soil Sample Submission

At the time of the sampling, no obvious visual or olfactory evidence of environmental impact (i.e. staining or odours) was observed at the sampling locations.

In order to provide information on the chemical quality of the subsurface soils, the following soil samples were submitted to ALS Environmental Laboratories in Richmond Hill, Ontario ("ALS"), for chemical analyses:

- Seven (7) soil samples were submitted for analyses of the parameters including metals, inorganics, Polycyclic Aromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons (PHCs) and Volatile Organic Compounds (VOCs).
- A composite soil sample was submitted for Toxicity Characteristic Leaching Procedures (TCLP) analysis to characterize soil quality for landfill disposal purposes.

Sample ID	Soil Depth (mBGS)	Primary Soil	Analytical Parameters
BH1 SS2	0.76 – 1.22	Fine Sand to Clayey Silt Fill	Metals/Inorganics, PAHs
BH2 SS3	1.52 – 1.98	Silty Fine Sand	PHCs/VOCs
BH4 SS2	0.76 – 1.22	Clayey Silt Fill to Sandy Silt Till	Metals/Inorganics, PAHs
BH 5 SS2	0.76 – 1.22	Clayey Silt Fill	Metals/Inorganics, PAHs
BH6 SS3	1.52 – 1.98	Sand and Silt Till	PHCs/VOCs
BH8 SS2	0.76 - 1.22	Sandy Silt Fill	Metals/Inorganics, PAHs
BH10 SS2	0.76 – 1.22	Sand and Gravel Fill	Metals/Inorganics, PAHs
TCLP	Composite	-	Metals/Inorganics, VOCs, PAHs

A copy of the soil analytical results is provided in the Laboratory Certificates of Analysis, attached in Appendix B.

6.2 Soil Analytical Results

6.2.1 O.Reg. 153/04 Results

Seven (7) soil samples were analysed for the parameters including metals, inorganics, PAHs, PHCs and VOCs under Ontario Regulation 153/04 ("O. Reg. 153/04") as amended.

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 a comparison of the analytical results to the 2011 MOECC Standards, no exceedances were found for metals, PAHs, PHCs and VOCs in the soil samples analysed. However, exceedances were noted for Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR) in a number of soil samples analysed.

Based upon a comparison of the analytical results to the 2011 MOECC Standards, exceedance values detected in the soil samples are shown 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
BH1 SS2	SAR	8.91	2.4	5.0	12.0
BH4 SS2	EC	0.596 mS/cm	0.57 mS/cm	0.7 mS/cm	1.4 mS/cm
BH5 SS2	EC	1.22 mS/cm	0.57 mS/cm	0.7 mS/cm	1.4 mS/cm
	SAR	2.83	2.4	5.0	12.0
BH8 SS2	EC	2.26 mS/cm	0.57 mS/cm	0.7 mS/cm	1.4 mS/cm
	SAR	104	2.4	5.0	12.0
BH10 SS2	EC	1.99 mS/cm	0.57 mS/cm	0.7 mS/cm	1.4 mS/cm
	SAR	3.66	2.4	5.0	12.0

Note: R/P/I = Residential, Parkland and Institutional Property Use
I/C/C = Industrial, Commercial and Community property Use
0.57 = standard value exceeded by the analytical result

6.2.2 TCLP Results

One composite sample was tested for TCLP analysis of metals, inorganic, VOCs and PAHs. The results were compared with the standards for respective parameters specified in Leachate Quality Criteria - Schedule 4 of O. Reg. 558/00.

The concentrations of analyzed parameters were non-detectable or below the detection limits, which are below the standards specified in O. Reg. 558/00. Therefore, the tested composite soil sample would be considered as non-hazardous wastes.

6.3 Discussion of Analytical Results

Based on the results, the shallow soils may have been impacted by EC and/or SAR. It should be noted that the samples selected for analysis were taken from the boreholes located on the roadways. The elevated EC and SAR values in the tested soil samples may likely be attributed to the application of de-icing salt on the road. Based on the results of soil sample analysis, GeoPro will recommend the following disposal options:

1) The soils generated at the Site can be re-used for the on-site road development, provided that the soils will not be in contact with groundwater.

2) The soils generated near boreholes BH1, BH4 and BH5 at the same tested sample depths, could be re-used at a site which is not considered as an environmentally sensitive site and is developed for Industrial, Commercial and Community property use, would accept the soils based on the analytical results.

3) The soil generated near boreholes BH8 and BH10 could be disposed of as non-hazardous wastes at a licensed landfill site.

It should be noted that the results of the chemical analysis refer only to the soil sample analyzed which was obtained from specific sampling location and sampling depth, and the soil chemistry may vary between and beyond the location and depth of the sample 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, further chemical analyses should be carried out if deemed necessary.

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. Further, 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 I or Phase II 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 protocol, 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 site are available.

7 MONITORING AND TESTING

The geotechnical aspects of the final design drawings and specifications should be reviewed by this office 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 specification.

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 detailed 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

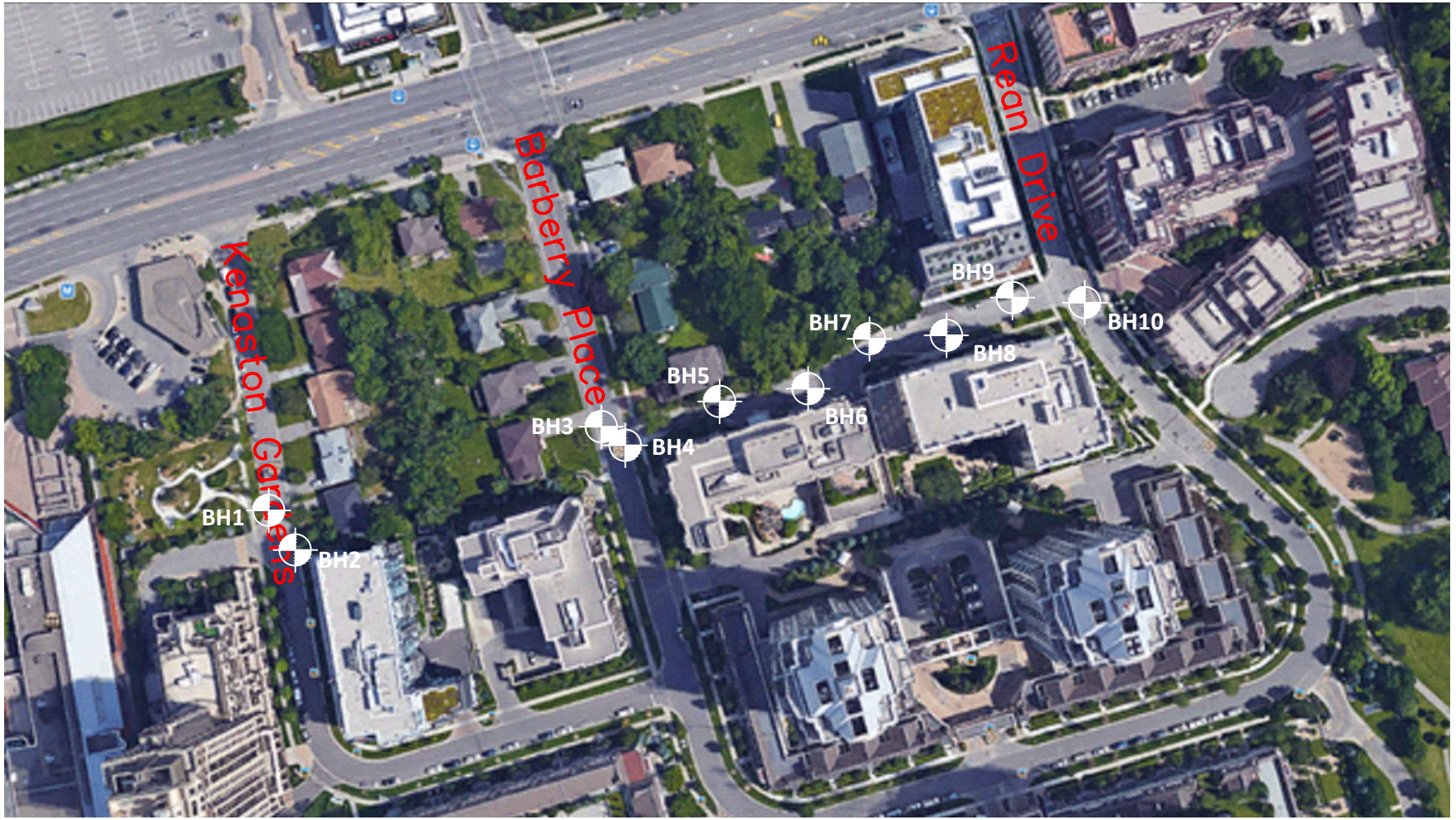
DRAFT

Jessica Yao, P.Eng.
Senior Geotechnical Engineer

DRAFT

David B. Liu, P.Eng., Principal

DRAWINGS



BH1 **Borehole Location**

Client:	**Morrison Hershfield**			Project No.: **16-1359**	Drawing No.: **1**
Drawn: **AC**		Approved: **DL**		Title: **Borehole Location Plan**	
Date: **July 2016**		Scale: **As shown**		Project: **Engineering Consulting Services Street Extension from Rean Drive to Kenaston Gardens City of Toronto**	
Original Size: **Letter**		Rev: **DL**		**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.

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Enclosure 1C: Explanation of Terms Used in the Rock Core Logs

Strength (ISRM)

Term	Grade	Description	Uniaxial Compressive Strength (MPa)	(psi)
Extremely weak rock	RO	Indented by thumbnail	0.25-1.0	36-145
Very weak	R1	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	1.0-5.0	145-725
Weak rock	R2	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	5.0-25	725-3625
Medium Strong	R3	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	25-50	3625-7250
Strong rock	R4	Specimen require more than one blow of geological hammer to fracture it	50-100	7250-14500
Very strong rock	R5	Specimen requires many blows of geological hammer to fracture it	100-250	14500-36250
Extremely strong rock	R6	Specimen can only be chipped with geological hammer	>250	>36250

Bedding

Term	Bed Thickness	
Very thickly bedded	>2 m	>6.5 ft
Thickly bedded	600 mm-2 m	2.00-6.50 ft
Medium bedded	200 mm-600 mm	0.65-2.00 ft
Thinly bedded	60 mm-200 mm	0.20-0.65 ft
Very thinly bedded	20 mm-60 mm	0.06-0.20 ft
Laminated	6 mm-20 mm	0.02-0.06 ft
Thinly laminated	<6 mm	<0.02 ft

TCR (Total Core Recovery)

Sum of lengths of rock core recovered from a core run, divided by the length of the core run and expressed as a percentage.

SCR (Solid Core Rocovery)

Sum length of solid, full diameter drill core recovered expressed as a percentage of the total length of the core run.

RQD (Rock Quality Designation, after Deere, 1968)

Sum of lengths of pieces of rock core measured along centreline of core equal to or greater than 100 mm from a core run, divided by the length of the core run and expressed as a percentage. Core fractured by drilling is considered intact. RQD normally quoted for N-size or H-size core.

RQD(%)	Rock Quality
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very poor

Weathering (ISRM)

Term	Grade	Description
Fresh	W1	No visible sign of rock material weathering
Slightly weathered	W2	Discolouration indicates weathering of rock material and discontinuity surface. All the rock material may be discoloured by weathering and may be somewhat weaker than in its fresh condition
Moderately weathered	W3	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a either as a continuous framework or as corestones
Highly weathered	W4	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a continuous framework or as corestones
Completely weathered	W5	All rock material is decomposed and/or disintegrated to a soil. The original mass structure is still largely intact
Residual soil	W6	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported

(FI) Fracture Index

Expressed as the number of discontinuities per 300mm (1 ft). Excludes drill-induced fractures and fragmented zones. Reported as ">25" if frequency exceeds 25 fractures/0.3m.

Broken Zone

Zone of full diameter core of very low RQD which may include some drill-induced fractures.

Fragmented Zone

Zone where core is less than full diameter and RQD = 0.

Discontinuity Spacing (ISRM)

Term	Average Spacing	
Extremely widely spaced	>6 m	>20.00 ft
Very widely spaced	2 m-6 m	6.50-20.00 ft
Widely spaced	600 mm-2 m	2.00-6.50 ft
Moderately spaced	200 mm-600 mm	0.65-2.00 ft
Closely spaced	60 mm-200 mm	0.20-0.65 ft
Very closely spaced	20 mm-60 mm	0.06-0.20 ft
Extremely closely spaced	<20 mm	>0.06 ft

Note: Excludes drill-induced fractures and fragmented rock.

Discontinuity Orientation

Discontinuity, fracture and bedding plane orientations are cited as the acute angle measured with respect to the core axis. Fractures perpendicular to the core axis are at 90° and those parallel to the core axis are at 0°.

LOG OF BOREHOLE BH1

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (280 mm)											
0.3	**GRANULAR BASE/SUBBASE:** (390 mm)		1	AS					○			
0.7	**FILL:** fine sand, trace gravel, trace to some silt, brown, moist, loose											
1.0	**FILL:** clayey silt, trace sand, trace gravel, brown, moist, firm		2	SS	6				○			
1.4	**FILL:** sand, trace silt, trace to some gravel, brown, moist, compact											
1.8	**FILL:** sandy silt, some clay, trace gravel, brown, moist, compact		3	SS	21				○			
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.											

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ○ ε_{f}=3% Strain at Failure

LOG OF BOREHOLE BH2

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (220 mm)										
0.2	**GRANULAR BASE/SUBBASE:** (390 mm)		1	AS					○		
0.6	**FILL:** sand and silt to sandy silt, trace clay, trace gravel, layers of silt, brown, moist, compact		2	SS	27				○		
1.4	**SILTY FINE SAND:** trace gravel, brown, moist, very dense		3	SS	65				○		
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH3

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (210 mm)										
0.2	**GRANULAR BASE/SUBBASE:** (390 mm)		1	AS					○		
0.6	**FILL:** sand and silt, some clay, trace gravel, brown, moist, compact to dense										
1			2	SS	10				○		
			3	SS	35				○		
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH4

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (180 mm)										
0.2	**GRANULAR BASE/SUBBASE:** (370 mm)		1	AS					○		
0.6	**FILL:** clayey silt, some sand, trace gravel, brown, moist, very stiff		2	SS	29				○		
1.1	**SANDY SILT TILL:** trace clay, trace gravel, brown, moist, compact to dense		3	SS	49				○		
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_{50}=3% Strain at Failure

LOG OF BOREHOLE BH5

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (90 mm)											
0.1	**GRANULAR BASE/SUBBASE:** (410 mm)		1	AS								
0.5	**FILL:** clayey silt, trace sand, trace gravel, trace organics, dark brown, moist, firm		2	SS	7							
1.4	**SAND AND SILT TILL:** trace clay, trace gravel, brown, moist, dense		3	SS	36							
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, × 3: Numbers refer to Sensitivity

○ ε=3% Strain at Failure

LOG OF BOREHOLE BH6

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (120 mm)										
0.1	**GRANULAR BASE/SUBBASE:** (370 mm)		1	AS					○		
0.5	**FILL:** sand and silt, some clay, trace gravel, trace cobbles and boulders, brown, moist, compact										
1			2	SS	23				○		
1.4	**SAND AND SILT TILL:** some clay, trace gravel, brown, moist, dense										
			3	SS	35				○		
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_{50}=3% Strain at Failure

LOG OF BOREHOLE BH7

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (140 mm)											
0.1	**GRANULAR BASE/SUBBASE:** (480 mm)		1	AS					○			
0.6	**FILL:** sand and silt, some clay, trace gravel, layers of clayey silt, brown, moist, compact											
1			2	SS	14				○			
1.1	**SAND AND SILT TILL:** some clay, trace gravel, brown, moist, compact to dense											
			3	SS	34				○			
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.											

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ○ ε_{f}=3% Strain at Failure

LOG OF BOREHOLE BH8

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (80 mm)										
0.1	**GRANULAR BASE/SUBBASE:** (460 mm)		1	AS					○		
0.5	**FILL:** sandy silt, trace clay, trace gravel, pockets of silty sand, layers of clayey silt, brown, moist, compact		2	SS	11				○		
1.4	**SANDY SILT TILL:** trace clay, trace gravel, brown, moist, dense		3	SS	31				○		
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

LOG OF BOREHOLE BH9

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (90 mm)										
0.1	**GRANULAR BASE/SUBBASE:** (610 mm)		1	AS					○		
0.7	**FILL:** sand and silt, some clay, trace gravel, layers of clayey silt, brown, moist, compact		2	SS	11				○		
1.4	**SANDY SILT TILL:** trace clay, trace gravel, brown, moist, dense		3	SS	36				○		
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.										

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

LOG OF BOREHOLE BH10

PROJECT: Geotechnical Investigation for Proposed Road Extension

CLIENT: Morrison Hershfield

PROJECT LOCATION: Between Rean Drive and Kenaston Gardens,Toronto, Ontario

DATUM: N/A

BH LOCATION: See Borehole Location Plan

DRILLING DATA

Method: Continuous Flight Auger

Diameter: 155mm/205mm

Date: Sep/28/2016

REF. NO.: 16-1359

ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	**ASPHALT CONCRETE:** (200 mm)											
0.2	**GRANULAR BASE/SUBBASE:** (420 mm)		1	AS								
0.6	**FILL:** sand and gravel, trace to some silt, brown, moist, very dense to compact		2	SS	53							
1			3	SS	17							
1.8	**FILL:** sand and silt, some gravel, brown, moist, compact											
2.0	**END OF THE BOREHOLE** Note: Borehole was open and dry upon completion of drilling.											

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ε_{f}=3% Strain at Failure

FIGURES

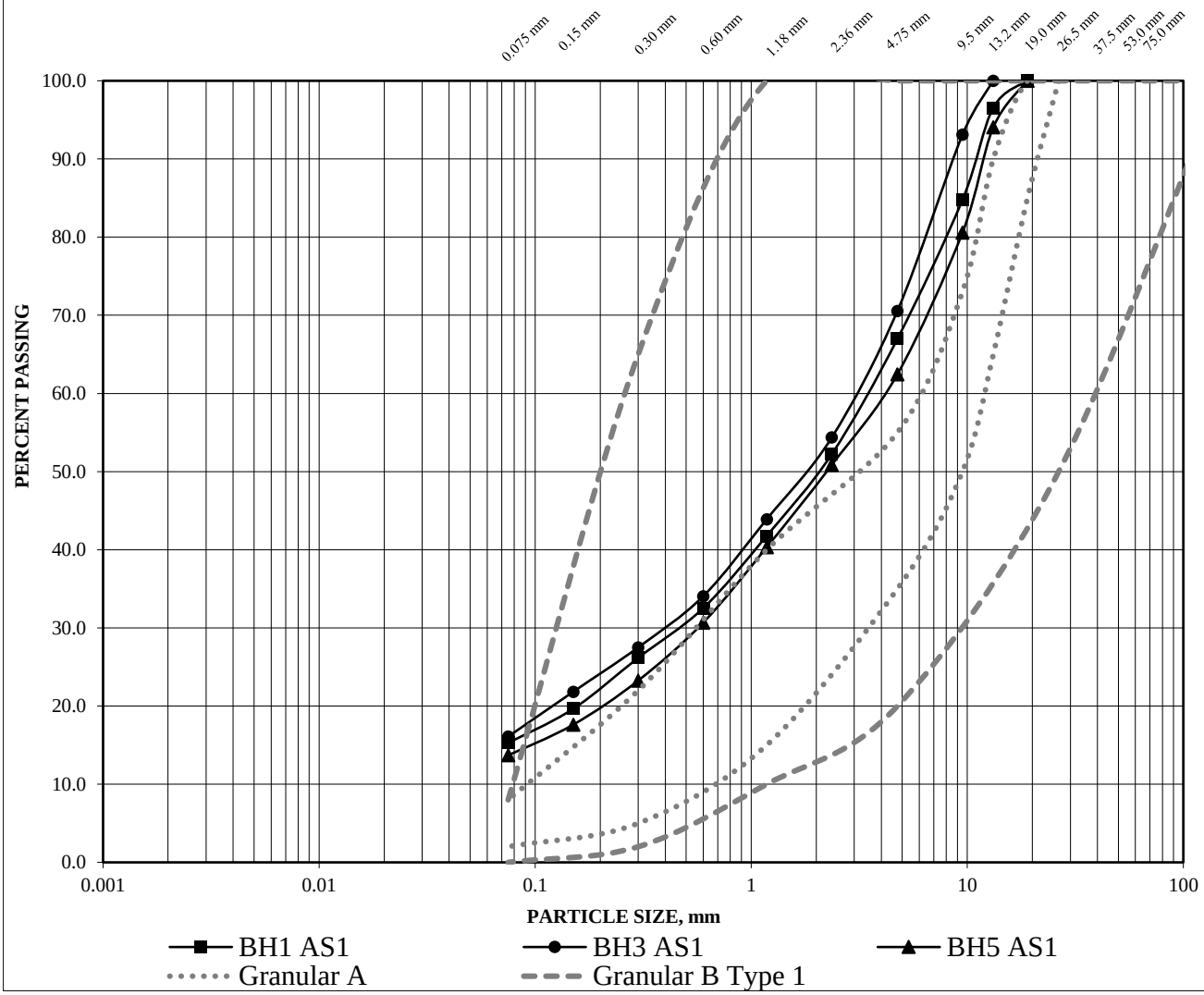
GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Figure 1

PARTICLE SIZE DISTRIBUTION

U.S. BUREAU	CLAY	SILT			VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL		
UNIFIED	FINES (SILT & CLAY)					FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL		COBBLES
M.I.T.	CLAY	SILT			SAND			GRAVEL				COBBLES
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE					



Project No.	16-1359
Project Name	Road Extension from Rean Drive to Kenaston Gardens, Toronto

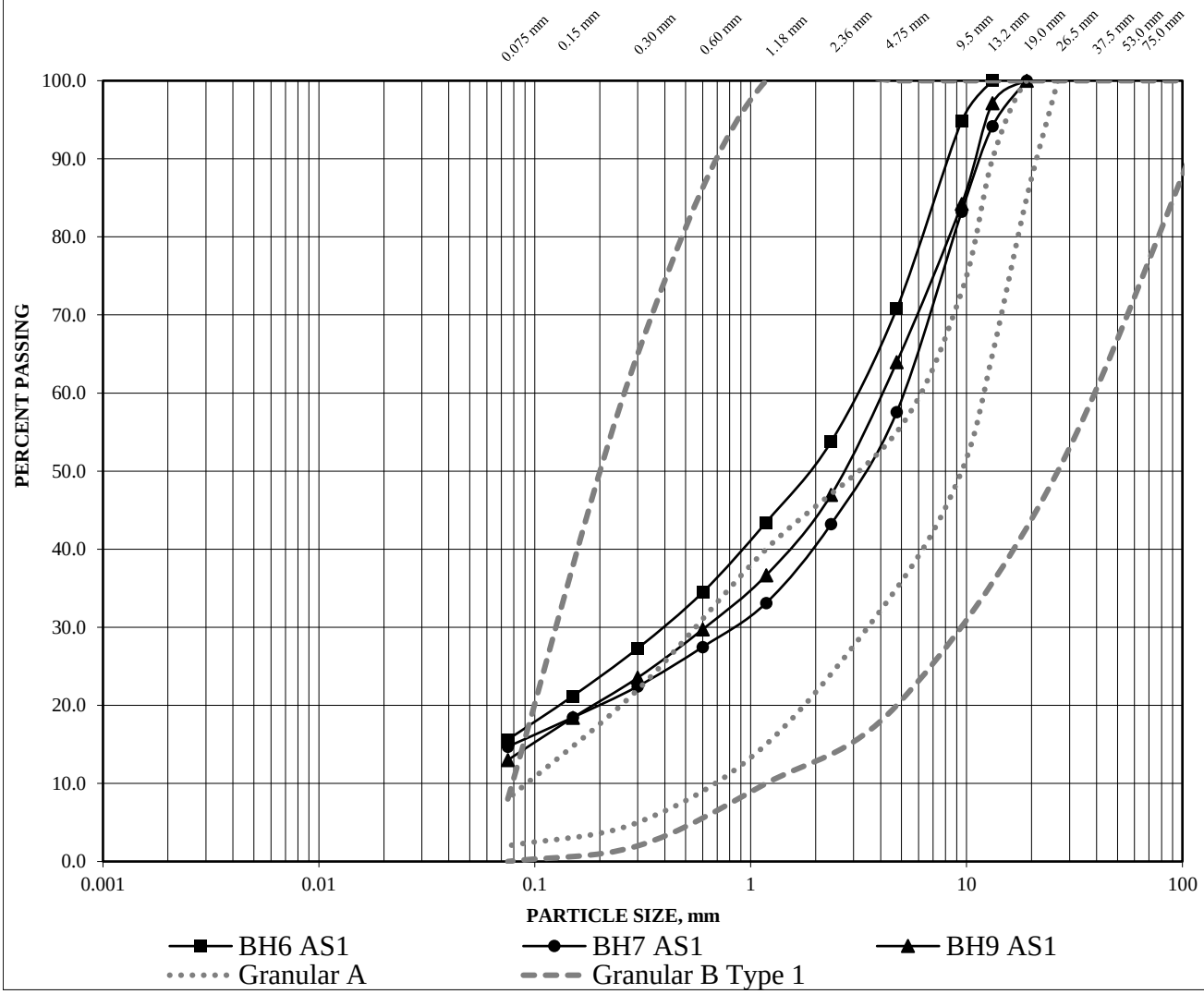
GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Figure 2

PARTICLE SIZE DISTRIBUTION

U.S. BUREAU	CLAY	SILT		VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL			
UNIFIED	FINES (SILT & CLAY)				FINE SAND	MEDIUM SAND		COARSE SAND	FINE GRAVEL	COARSE GRAVEL	COBBLES	
M.I.T.	CLAY	SILT			SAND			GRAVEL			COBBLES	
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE					



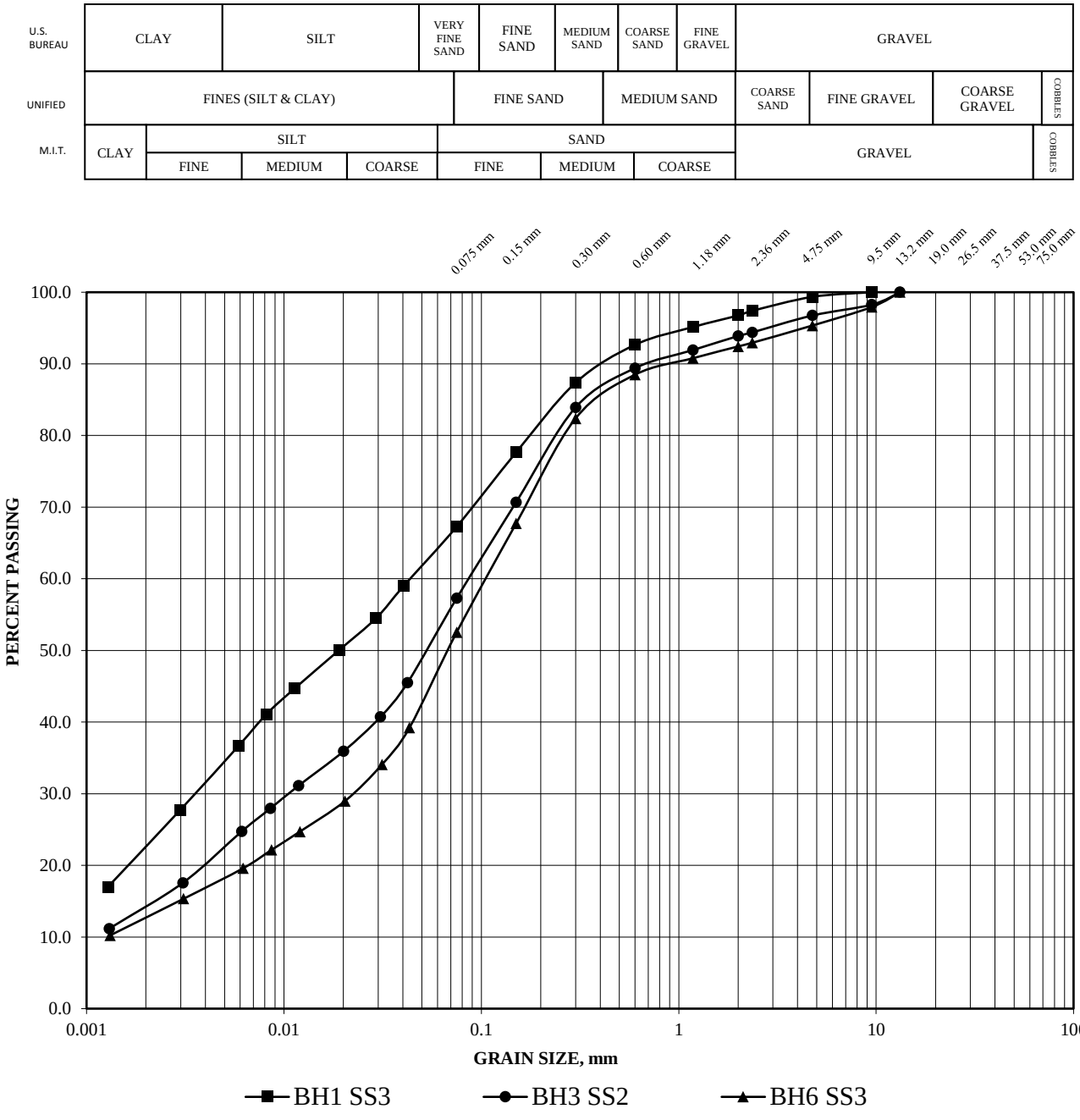
Project No.	16-1359
Project Name	Street Extension from Rean Drive to Kenaston Gardens, Toronto

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Figure 3

GRAIN SIZE DISTRIBUTION



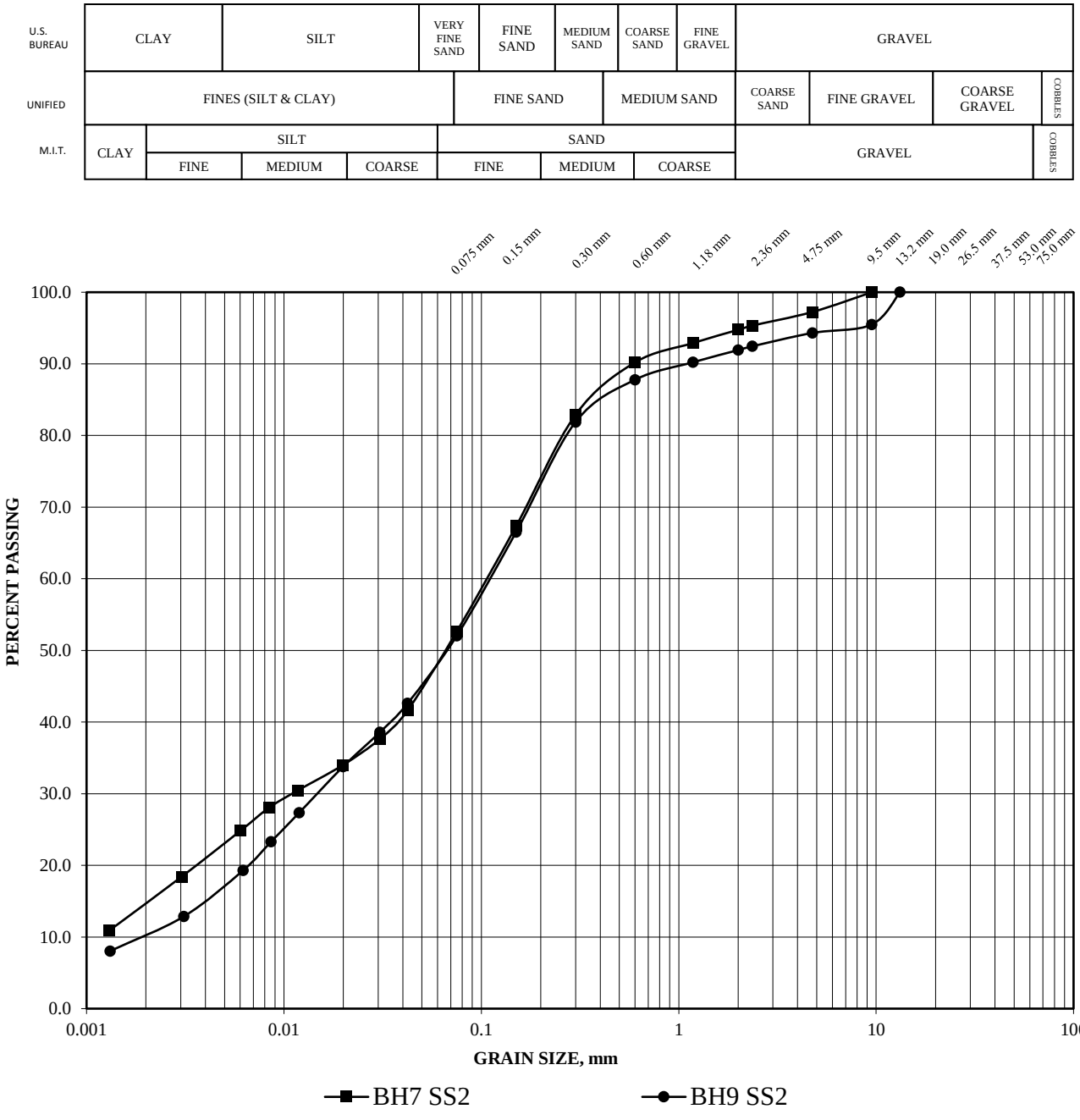
Project No.	16-1359
Project Name	Road Extension from Rean Dr. to Kenaston Gardens, Toronto

GeoPro Consulting Limited

Geotechnical-Hydrogeology-Environmental-Materials-Inspection

Figure 4

GRAIN SIZE DISTRIBUTION



Project No.	16-1359
Project Name	Road Extension from Rean Dr. to Kenaston Gardens, Toronto

APPENDIX A

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

15 - 6800 Kitimat Rd
Mississauga, ON, L5N 5M1
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

GeoPro Consulting Limited

40 Vogell Road, Unit 57
Richmond Hill, ON L4B 3N6
Attn: Bujing Guan

Client PO:
Project: 16-1359
Custody:

Report Date: 25-Oct-2016
Order Date: 19-Oct-2016

Order #: 1643268

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

Paracel ID	Client ID
1643268-01	BH1 Asphalt
1643268-02	BH2 Asphalt
1643268-03	BH3 Asphalt
1643268-05	BH6 Asphalt
1643268-06	BH7 Asphalt
1643268-07	BH9 Asphalt

Approved By:

Heather S.H. McGregor, BSc
Laboratory Director - Microbiology

PARACEL LABORATORIES LTD.

Order #: 1643268

Certificate of Analysis
Client: GeoPro Consulting Limited
Client PO:

Report Date: 25-Oct-2016
Order Date: 19-Oct-2016
Project Description: 16-1359

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1643268-01	28-Sep-16	sample homogenized	Grey	Asphalt	No	**Client ID: BH1 Asphalt** [AS-PRE]	
						Non-Fibers	100
1643268-02	28-Sep-16	sample homogenized	Grey	Asphalt	No	**Client ID: BH2 Asphalt** [AS-PRE]	
						Non-Fibers	100
1643268-03	28-Sep-16	sample homogenized	Grey	Asphalt	No	**Client ID: BH3 Asphalt** [AS-PRE]	
						Non-Fibers	100
1643268-05	28-Sep-16	sample homogenized	Grey	Asphalt	No	**Client ID: BH6 Asphalt** [AS-PRE]	
						Non-Fibers	100
1643268-06	28-Sep-16	sample homogenized	Grey	Asphalt	No	**Client ID: BH7 Asphalt** [AS-PRE]	
						Non-Fibers	100
1643268-07	28-Sep-16	sample homogenized	Grey	Asphalt	No	**Client ID: BH9 Asphalt** [AS-PRE]	
						Non-Fibers	100

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	1 - Mississauga	200863-0	25-Oct-16

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

Head Office
300-2319 St. Laurent Blvd.
Ottawa, Ontario K1G 4J8
p: 1-800-749-1947
e: paracel@paracellabs.com

Chain of Custody
(Lab Use Only)

Client Name: GeoPro Consulting Limited	Project Reference: 16-1359	**Turnaround Time:**	
Contact Name: Bujing Guan	Quote #:	☐ Immediate	☐ 1 Day
Address: Unit 57, 40 Vogell Road, Richmond Hill, Ontario	PO #:	☐ 4 Hour	☐ 2 Day
	Email Address: bguan@geoproconsulting.ca	☐ 8 Hour	☐ 3 Day
Telephone: 905-237-8336	dylanx@geoproconsulting.ca		☑ Regular
		Date Required:	

ASBESTOS & MOLD ANALYSIS

Matrix: ☐ Air ☑ Bulk ☐ Tape Lift ☐ Swab ☐ Other **Regulatory Guideline:**

Required Analyses: ☐ Microscopic Mold ☐ Culturable Mold ☐ Bacteria GRAM ☐ PCM ☐ PLM ☐ Chatfield ☐ TEM

Paracel Order Number: 1643268

	Sample ID	Sampling Date	Air Volume (L)	Analysis Required	Asbestos - Bulk: Matrix Description	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	BH1 Asphalt	2016/09/28		Asbestos	Asphalt	N	N	
2	BH2 Asphalt	2016/09/28		Asbestos	Asphalt	N	N	
3	BH3 Asphalt	2016/09/28		Asbestos	Asphalt	N	N	
4	BH5 Asphalt	2016/09/28		Asbestos	Asphalt	N	N	
5	BH6 Asphalt	2016/09/28		Asbestos	Asphalt	N	N	
6	BH7 Asphalt	2016/09/28		Asbestos	Asphalt	N	N	
7	BH9 Asphalt	2016/09/28		Asbestos	Asphalt	N	N	
8								
9								
10								
11								
12								
13								
14								
15								

*Each layer will be analyzed and charged separately **Homogenize = All layers are blended into a single uniform sample.

Comments:

Method of Delivery: RABBEX

Relinquished By (Sign):	Received at Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Dylan Xiao			
Date/Time: 2016/10/19	Date/Time:	Date/Time: 19-OCT-16 12:04	Date/Time: Oct 19/16 15:20

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GEOPRO CONSULTING LTD
40 VOGELL ROAD UNIT 25-27
RICHMOND HILL, ON L4B3N6
(905) 237-8336

ATTENTION TO: Bujing Guan

PROJECT: 16-1359

AGAT WORK ORDER: 16T151605

ASBESTOS REVIEWED BY: Whenhong Zou, Lab Analyst

DATE REPORTED: Oct 31, 2016

PAGES (INCLUDING COVER): 4

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16T151605

PROJECT: 16-1359

CLIENT NAME: GEOPRO CONSULTING LTD

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

Bulk Asbestos

DATE RECEIVED: 2016-10-21

DATE REPORTED: 2016-10-31

		SAMPLE DESCRIPTION:		BH10 Asphalt
		SAMPLE TYPE:		Asphalt
		DATE SAMPLED:		2016-09-28
Parameter	Unit	G / S	RDL	7953408
Asbestos (Bulk)	%		0.5	ND

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7953408 Condition of sample was satisfactory at time of arrival in laboratory. Analysis done at AGAT 5623 McAdam Road Mississauga location.

"ND" - Not Detected

Certified By: Wenhong Zou

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEOPRO CONSULTING LTD

AGAT WORK ORDER: 16T151605

PROJECT: 16-1359

ATTENTION TO: Bujing Guan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Asbestos (Bulk)	INORG 93-6010	EPA 600/R-93/116 & NIOSH 9002	PLM

AGAT Laboratories

BAG RED-Brn

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Report Information:

Company: GeoPro Consulting Limited
Contact: Bujing Guan
Address: Unit 57, 40 Vogell Road, Richmond Hill, Ontario
Phone: 905-237-8336 Fax: 905-248-3699
Reports to be sent to:
1. Email: bguan@geoproconsulting.ca
2. Email: jessica@geoproconsulting.ca

Project Information:

Project: 16-1359
Site Location: Toronto
Sampled By: Clement
AGAT Quote #: GeoPro PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table ____ (Indicate One)
☐ Ind/Com
☐ Res/Park
☐ Agriculture

Soil Texture (Check One)
☐ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm

Region ____ (Indicate One)

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other ____ (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Laboratory Use Only

Work Order #: 16T151605
Cooler Quantity:
Arrival Temperatures:
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions
BH10 Asphalt	28/09/16	AM	1 Bag	Asphalt	

(Check Applicable)

Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ NO_3/NO_2 ☐ Total N ☐ Hg ☐ pH ☐ SAR	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3/NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	Asphalt for Asbestos
															X

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Bujing Xiao	21/10/2016				
	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
	2016/10/21	6:05			

Page 1 of 1

N°: T 020631

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT

Document ID: DW-FR-1511-010 Date Issued: November 2, 2015

APPENDIX B

Morrison Hershfield Limited (Toronto)
ATTN: CINDY ZHAO
235 Yorkland Blvd
Suite 600
Toronto ON M2J 1T1

Date Received: 05-OCT-16
Report Date: 14-OCT-16 14:34 (MT)
Version: FINAL

Client Phone: 416-499-3110

Certificate of Analysis

Lab Work Order #: L1839952

Project P.O. #:	NOT SUBMITTED
Job Reference:	16-1359
C of C Numbers:	15-573718
Legal Site Desc:	N/A

Emerson Perez, B.S.E
Account Manager

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1839952-1	L1839952-2	L1839952-3	L1839952-4	L1839952-5
					Sampled Date	28-SEP-16	28-SEP-16	28-SEP-16	28-SEP-16	28-SEP-16
					Sampled Time	-	-	-	-	-
					Sample ID	BH1 SS2	BH4 SS2	BH5 SS2	BH8 SS2	BH10 SS2
Grouping	Analyte	Unit	Guide Limits #1	#2						
Physical Tests	Conductivity	mS/cm	0.7	0.7		0.280	0.596	1.22	2.26	1.99
	% Moisture	%	-	-		6.03	12.4	9.39	9.82	7.72
	pH	pH units	-	-		7.92	7.88	7.54	8.09	11.57
Cyanides	Cyanide, Weak Acid Diss	ug/g	0.051	0.051		<0.050	<0.050	<0.050	<0.050	<0.050
Saturated Paste Extractables	SAR	SAR	5	5		8.91	SAR:INC Incalculable - Low Cations	2.83	SAR:Q 104	SAR:Q 3.66
	Calcium (Ca)	mg/L	-	-		1.6	<1.0	117	1.8	191
	Magnesium (Mg)	mg/L	-	-		1.3	<1.0	8.7	<1.0	<1.0
	Sodium (Na)	mg/L	-	-		62.3	140	118	512	184
Metals	Antimony (Sb)	ug/g	7.5	7.5		<1.0	<1.0	<1.0	<1.0	<1.0
	Arsenic (As)	ug/g	18	18		1.5	2.2	4.5	2.1	1.4
	Barium (Ba)	ug/g	390	390		26.2	62.9	100	67.6	25.4
	Beryllium (Be)	ug/g	4	5		<0.50	<0.50	0.61	<0.50	<0.50
	Boron (B)	ug/g	120	120		<5.0	6.9	8.4	6.1	6.2
	Boron (B), Hot Water Ext.	ug/g	1.5	1.5		<0.10	<0.10	0.34	0.26	0.24
	Cadmium (Cd)	ug/g	1.2	1.2		<0.50	<0.50	<0.50	<0.50	<0.50
	Chromium (Cr)	ug/g	160	160		7.9	16.3	23.9	14.6	9.4
	Cobalt (Co)	ug/g	22	22		3.5	5.8	7.8	5.4	1.9
	Copper (Cu)	ug/g	140	180		5.8	10.8	17.0	13.0	4.0
	Lead (Pb)	ug/g	120	120		33.8	32.5	22.6	51.4	3.7
	Mercury (Hg)	ug/g	0.27	1.8		<0.0050	0.0072	0.0333	0.0105	<0.0050
	Molybdenum (Mo)	ug/g	6.9	6.9		<1.0	<1.0	<1.0	<1.0	<1.0
	Nickel (Ni)	ug/g	100	130		6.0	12.2	17.7	11.0	4.9

Guide Limit #1: T3-Soil-Res/Park/Inst. Property Use (Coarse)
Guide Limit #2: T3-Soil-Res/Park/Inst. Property Use (Fine)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.

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

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1839952-1	L1839952-2	L1839952-3	L1839952-4	L1839952-5
					Sampled Date	28-SEP-16	28-SEP-16	28-SEP-16	28-SEP-16	28-SEP-16
					Sampled Time	-	-	-	-	-
					Sample ID	BH1 SS2	BH4 SS2	BH5 SS2	BH8 SS2	BH10 SS2
Grouping	Analyte	Unit	Guide Limits #1	#2						
Metals	Selenium (Se)	ug/g	2.4	2.4		<1.0	<1.0	<1.0	<1.0	<1.0
	Silver (Ag)	ug/g	20	25		<0.20	<0.20	<0.20	<0.20	<0.20
	Thallium (Tl)	ug/g	1	1		<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U)	ug/g	23	23		<1.0	<1.0	<1.0	<1.0	<1.0
	Vanadium (V)	ug/g	86	86		17.3	25.7	34.4	26.8	18.8
	Zinc (Zn)	ug/g	340	340		17.2	29.5	51.7	28.8	26.8
Speciated Metals	Chromium, Hexavalent	ug/g	8	10		<0.20	0.22	<0.20	0.25	0.66
Polycyclic Aromatic Hydrocarbons	Acenaphthene	ug/g	7.9	58		<0.050	<0.050	<0.050	<0.050	<0.050
	Acenaphthylene	ug/g	0.15	0.17		<0.050	<0.050	<0.050	<0.050	<0.050
	Anthracene	ug/g	0.67	0.74		<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(a)anthracene	ug/g	0.5	0.63		<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(a)pyrene	ug/g	0.3	0.3		<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(b)fluoranthene	ug/g	0.78	0.78		<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(g,h,i)perylene	ug/g	6.6	7.8		<0.050	<0.050	<0.050	<0.050	<0.050
	Benzo(k)fluoranthene	ug/g	0.78	0.78		<0.050	<0.050	<0.050	<0.050	<0.050
	Chrysene	ug/g	7	7.8		<0.050	<0.050	<0.050	<0.050	<0.050
	Dibenzo(ah)anthracene	ug/g	0.1	0.1		<0.050	<0.050	<0.050	<0.050	<0.050
	Fluoranthene	ug/g	0.69	0.69		<0.050	<0.050	<0.050	<0.050	<0.050
	Fluorene	ug/g	62	69		<0.050	<0.050	<0.050	<0.050	<0.050
	Indeno(1,2,3-cd)pyrene	ug/g	0.38	0.48		<0.050	<0.050	<0.050	<0.050	<0.050
	1+2-Methylnaphthalenes	ug/g	0.99	3.4		<0.042	<0.042	<0.042	<0.042	<0.042
	1-Methylnaphthalene	ug/g	0.99	3.4		<0.030	<0.030	<0.030	<0.030	<0.030

Guide Limit #1: T3-Soil-Res/Park/Inst. Property Use (Coarse)
Guide Limit #2: T3-Soil-Res/Park/Inst. Property Use (Fine)

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

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1839952-1	L1839952-2	L1839952-3	L1839952-4	L1839952-5
					Sampled Date	28-SEP-16	28-SEP-16	28-SEP-16	28-SEP-16	28-SEP-16
					Sampled Time	-	-	-	-	-
					Sample ID	**BH1 SS2**	**BH4 SS2**	**BH5 SS2**	**BH8 SS2**	**BH10 SS2**
Grouping	Analyte	Unit	Guide Limits #1	#2						
Polycyclic Aromatic Hydrocarbons	2-Methylnaphthalene	ug/g	0.99	3.4		<0.030	<0.030	<0.030	<0.030	<0.030
	Naphthalene	ug/g	0.6	0.75		<0.050	<0.050	<0.050	<0.050	<0.050
	Phenanthrene	ug/g	6.2	7.8		<0.050	<0.050	<0.050	<0.050	<0.050
	Pyrene	ug/g	78	78		<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: 2-Fluorobiphenyl	%	-	-		91.1	97.8	100.3	97.2	97.4
	Surrogate: p-Terphenyl d14	%	-	-		87.7	95.1	98.6	94.9	93.8

Guide Limit #1: T3-Soil-Res/Park/Inst. Property Use (Coarse)
Guide Limit #2: T3-Soil-Res/Park/Inst. Property Use (Fine)

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.

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Guideline						
Ontario Regulation 153/04 - April 15, 2011 Standards - T3-Soil-Res/Park/Inst. Property Use (Coarse)						
L1839952-1	BH1 SS2	Saturated Paste Extractables	SAR	8.91	5	SAR
L1839952-3	BH5 SS2	Physical Tests	Conductivity	1.22	0.7	mS/cm
L1839952-4	BH8 SS2	Physical Tests	Conductivity	2.26	0.7	mS/cm
		Saturated Paste Extractables	SAR	104	5	SAR
L1839952-5	BH10 SS2	Physical Tests	Conductivity	1.99	0.7	mS/cm
Ontario Regulation 153/04 - April 15, 2011 Standards - T3-Soil-Res/Park/Inst. Property Use (Fine)						
L1839952-1	BH1 SS2	Saturated Paste Extractables	SAR	8.91	5	SAR
L1839952-3	BH5 SS2	Physical Tests	Conductivity	1.22	0.7	mS/cm
L1839952-4	BH8 SS2	Physical Tests	Conductivity	2.26	0.7	mS/cm
		Saturated Paste Extractables	SAR	104	5	SAR
L1839952-5	BH10 SS2	Physical Tests	Conductivity	1.99	0.7	mS/cm

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

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
SAR:Q	Qualified SAR value: actual SAR is lower but is incalculable due to Na, Ca or Mg below detection limit.
SAR:INC	SAR is incalculable due to Ca and Mg below detection limit.

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).

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)

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

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

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

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PAH-511-WT	Soil	PAH-O.Reg 153/04 (July 2011)	SW846 3510/8270

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. Depending on the analytical GC/MS column used benzo(j)fluoranthene may chromatographically co-elute with benzo(b)fluoranthene or benzo(k)fluoranthene.

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).

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

Chain of Custody Numbers:

15-573718

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

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: L1839952 Report Date: 14-OCT-16

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	**Soil**							
Batch R3568371								
WG2407473-4 DUP		**L1839952-2**						
Boron (B), Hot Water Ext.		<0.10	<0.10	RPD-NA	ug/g	N/A	30	11-OCT-16
WG2407473-2 IRM		**HOTB-SAL_SOIL5**						
Boron (B), Hot Water Ext.			88.4		%		70-130	11-OCT-16
WG2407473-3 LCS								
Boron (B), Hot Water Ext.			108.1		%		70-130	11-OCT-16
WG2407473-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	11-OCT-16
CN-WAD-R511-WT	**Soil**							
Batch R3568929								
WG2406078-3 DUP		**L1840284-4**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	11-OCT-16
WG2406078-2 LCS								
Cyanide, Weak Acid Diss			102.1		%		80-120	11-OCT-16
WG2406078-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	11-OCT-16
WG2406078-4 MS		**L1840284-4**						
Cyanide, Weak Acid Diss			113.1		%		70-130	11-OCT-16
CR-CR6-IC-WT	**Soil**							
Batch R3569013								
WG2405936-3 CRM		**WT-SQC012**						
Chromium, Hexavalent			87.9		%		70-130	12-OCT-16
WG2405936-4 DUP		**L1840284-4**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	12-OCT-16
WG2405936-2 LCS								
Chromium, Hexavalent			99.4		%		80-120	12-OCT-16
WG2405936-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	12-OCT-16
EC-WT	**Soil**							
Batch R3569904								
WG2408316-4 DUP		**WG2408316-3**						
Conductivity		1.47	1.51		mS/cm	2.8	20	13-OCT-16
WG2408948-2 LCS								
Conductivity			97.4		%		90-110	13-OCT-16
WG2408316-1 MB								
Conductivity			<0.0040		mS/cm		0.044	13-OCT-16
HG-200.2-CVAA-WT	**Soil**							

Quality Control Report

Workorder: L1839952 Report Date: 14-OCT-16

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-200.2-CVAA-WT	**Soil**							
Batch R3569141								
WG2408321-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			96.9		%		70-130	12-OCT-16
WG2408321-6 DUP		**WG2408321-5**						
Mercury (Hg)		0.0094	0.0092		ug/g	2.2	40	12-OCT-16
WG2408321-3 LCS								
Mercury (Hg)			105.5		%		80-120	12-OCT-16
WG2408321-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	12-OCT-16
Batch R3569142								
WG2408322-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			94.9		%		70-130	12-OCT-16
WG2408322-6 DUP		**WG2408322-5**						
Mercury (Hg)		0.0200	0.0182		ug/g	9.3	40	12-OCT-16
WG2408322-3 LCS								
Mercury (Hg)			103.0		%		80-120	12-OCT-16
WG2408322-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	12-OCT-16
MET-200.2-CCMS-WT	**Soil**							
Batch R3569847								
WG2408321-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			111.8		%		70-130	12-OCT-16
Arsenic (As)			119.2		%		70-130	12-OCT-16
Barium (Ba)			129.4		%		70-130	12-OCT-16
Beryllium (Be)			104.4		%		70-130	12-OCT-16
Cadmium (Cd)			116.5		%		70-130	12-OCT-16
Chromium (Cr)			120.3		%		70-130	12-OCT-16
Cobalt (Co)			113.6		%		70-130	12-OCT-16
Copper (Cu)			110.1		%		70-130	12-OCT-16
Lead (Pb)			93.2		%		70-130	12-OCT-16
Molybdenum (Mo)			105.6		%		70-130	12-OCT-16
Nickel (Ni)			115.1		%		70-130	12-OCT-16
Selenium (Se)			103.1		%		70-130	12-OCT-16
Silver (Ag)			108.6		%		70-130	12-OCT-16
Thallium (Tl)			101.2		%		70-130	12-OCT-16
Uranium (U)			112.1		%		70-130	12-OCT-16
Vanadium (V)			119.9		%		70-130	12-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3569847								
WG2408321-2 CRM		**WT-CANMET-TILL1**						
Zinc (Zn)			110.3		%		70-130	12-OCT-16
WG2408321-6 DUP		**WG2408321-5**						
Antimony (Sb)		0.29	0.29		ug/g	0.0	30	12-OCT-16
Arsenic (As)		8.85	9.14		ug/g	3.2	30	12-OCT-16
Barium (Ba)		108	114		ug/g	4.9	40	12-OCT-16
Beryllium (Be)		0.81	0.82		ug/g	0.8	30	12-OCT-16
Boron (B)		13.6	14.6		ug/g	7.1	30	12-OCT-16
Cadmium (Cd)		0.033	0.036		ug/g	6.8	30	12-OCT-16
Chromium (Cr)		23.7	24.4		ug/g	2.8	30	12-OCT-16
Cobalt (Co)		15.4	15.3		ug/g	1.1	30	12-OCT-16
Copper (Cu)		44.4	43.8		ug/g	1.4	30	12-OCT-16
Lead (Pb)		10.3	26.7	DUP-H	ug/g	88	40	12-OCT-16
Molybdenum (Mo)		0.51	0.53		ug/g	2.3	40	12-OCT-16
Nickel (Ni)		30.2	30.4		ug/g	0.7	30	12-OCT-16
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	12-OCT-16
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	12-OCT-16
Thallium (Tl)		0.109	0.112		ug/g	2.2	30	12-OCT-16
Uranium (U)		0.487	0.495		ug/g	1.6	30	12-OCT-16
Vanadium (V)		33.5	34.8		ug/g	3.7	30	12-OCT-16
Zinc (Zn)		65.2	64.3		ug/g	1.4	30	12-OCT-16
WG2408321-4 LCS								
Antimony (Sb)			104.3		%		80-120	12-OCT-16
Arsenic (As)			93.8		%		80-120	12-OCT-16
Barium (Ba)			95.0		%		80-120	12-OCT-16
Beryllium (Be)			95.4		%		80-120	12-OCT-16
Boron (B)			95.3		%		80-120	12-OCT-16
Cadmium (Cd)			96.6		%		80-120	12-OCT-16
Chromium (Cr)			93.7		%		80-120	12-OCT-16
Cobalt (Co)			94.2		%		80-120	12-OCT-16
Copper (Cu)			92.2		%		80-120	12-OCT-16
Lead (Pb)			94.6		%		80-120	12-OCT-16
Molybdenum (Mo)			95.4		%		80-120	12-OCT-16
Nickel (Ni)			94.6		%		80-120	12-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3569847								
WG2408321-4 LCS								
Selenium (Se)			93.1		%		80-120	12-OCT-16
Silver (Ag)			94.0		%		80-120	12-OCT-16
Thallium (Tl)			94.9		%		80-120	12-OCT-16
Uranium (U)			92.5		%		80-120	12-OCT-16
Vanadium (V)			96.7		%		80-120	12-OCT-16
Zinc (Zn)			89.2		%		80-120	12-OCT-16
WG2408321-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	12-OCT-16
Arsenic (As)			<0.10		mg/kg		0.1	12-OCT-16
Barium (Ba)			<0.50		mg/kg		0.5	12-OCT-16
Beryllium (Be)			<0.10		mg/kg		0.1	12-OCT-16
Boron (B)			<5.0		mg/kg		5	12-OCT-16
Cadmium (Cd)			<0.020		mg/kg		0.02	12-OCT-16
Chromium (Cr)			<0.50		mg/kg		0.5	12-OCT-16
Cobalt (Co)			<0.10		mg/kg		0.1	12-OCT-16
Copper (Cu)			<0.50		mg/kg		0.5	12-OCT-16
Lead (Pb)			<0.50		mg/kg		0.5	12-OCT-16
Molybdenum (Mo)			<0.10		mg/kg		0.1	12-OCT-16
Nickel (Ni)			<0.50		mg/kg		0.5	12-OCT-16
Selenium (Se)			<0.20		mg/kg		0.2	12-OCT-16
Silver (Ag)			<0.10		mg/kg		0.1	12-OCT-16
Thallium (Tl)			<0.050		mg/kg		0.05	12-OCT-16
Uranium (U)			<0.050		mg/kg		0.05	12-OCT-16
Vanadium (V)			<0.20		mg/kg		0.2	12-OCT-16
Zinc (Zn)			<2.0		mg/kg		2	12-OCT-16
Batch R3569848								
WG2408322-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			103.9		%		70-130	12-OCT-16
Arsenic (As)			106.0		%		70-130	12-OCT-16
Barium (Ba)			115.1		%		70-130	12-OCT-16
Beryllium (Be)			92.9		%		70-130	12-OCT-16
Cadmium (Cd)			99.6		%		70-130	12-OCT-16
Chromium (Cr)			103.3		%		70-130	12-OCT-16
Cobalt (Co)			103.5		%		70-130	12-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3569848								
WG2408322-2 CRM		**WT-CANMET-TILL1**						
Copper (Cu)			98.3		%		70-130	12-OCT-16
Lead (Pb)			87.5		%		70-130	12-OCT-16
Molybdenum (Mo)			114.3		%		70-130	12-OCT-16
Nickel (Ni)			121.4		%		70-130	12-OCT-16
Selenium (Se)			90.0		%		70-130	12-OCT-16
Silver (Ag)			105.1		%		70-130	12-OCT-16
Thallium (Tl)			96.4		%		70-130	12-OCT-16
Uranium (U)			106.0		%		70-130	12-OCT-16
Vanadium (V)			111.1		%		70-130	12-OCT-16
Zinc (Zn)			98.5		%		70-130	12-OCT-16
WG2408322-6 DUP		**WG2408322-5**						
Antimony (Sb)		0.20	0.27	J	ug/g	0.08	0.2	12-OCT-16
Arsenic (As)		1.97	2.01		ug/g	1.9	30	12-OCT-16
Barium (Ba)		104	99.5		ug/g	4.5	40	12-OCT-16
Beryllium (Be)		0.45	0.42		ug/g	5.1	30	12-OCT-16
Boron (B)		9.0	8.8		ug/g	2.5	30	12-OCT-16
Cadmium (Cd)		0.395	0.380		ug/g	4.1	30	12-OCT-16
Chromium (Cr)		38.2	39.6		ug/g	3.8	30	12-OCT-16
Cobalt (Co)		5.38	5.19		ug/g	3.6	30	12-OCT-16
Copper (Cu)		15.4	19.8		ug/g	25	30	12-OCT-16
Lead (Pb)		28.1	27.9		ug/g	1.0	40	12-OCT-16
Molybdenum (Mo)		0.60	0.62		ug/g	3.6	40	12-OCT-16
Nickel (Ni)		11.8	11.6		ug/g	1.8	30	12-OCT-16
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	12-OCT-16
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	12-OCT-16
Thallium (Tl)		0.110	0.106		ug/g	4.4	30	12-OCT-16
Uranium (U)		0.591	0.606		ug/g	2.6	30	12-OCT-16
Vanadium (V)		32.3	31.7		ug/g	1.9	30	12-OCT-16
Zinc (Zn)		118	115		ug/g	2.8	30	12-OCT-16
WG2408322-4 LCS								
Antimony (Sb)			112.8		%		80-120	12-OCT-16
Arsenic (As)			98.6		%		80-120	12-OCT-16
Barium (Ba)			100.0		%		80-120	12-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R3569848								
WG2408322-4 LCS								
Beryllium (Be)			96.2		%		80-120	12-OCT-16
Boron (B)			94.5		%		80-120	12-OCT-16
Cadmium (Cd)			97.2		%		80-120	12-OCT-16
Chromium (Cr)			98.3		%		80-120	12-OCT-16
Cobalt (Co)			98.3		%		80-120	12-OCT-16
Copper (Cu)			95.3		%		80-120	12-OCT-16
Lead (Pb)			102.1		%		80-120	12-OCT-16
Molybdenum (Mo)			96.8		%		80-120	12-OCT-16
Nickel (Ni)			96.7		%		80-120	12-OCT-16
Selenium (Se)			96.2		%		80-120	12-OCT-16
Silver (Ag)			97.8		%		80-120	12-OCT-16
Thallium (Tl)			97.4		%		80-120	12-OCT-16
Uranium (U)			95.8		%		80-120	12-OCT-16
Vanadium (V)			100.8		%		80-120	12-OCT-16
Zinc (Zn)			90.6		%		80-120	12-OCT-16
WG2408322-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	12-OCT-16
Arsenic (As)			<0.10		mg/kg		0.1	12-OCT-16
Barium (Ba)			<0.50		mg/kg		0.5	12-OCT-16
Beryllium (Be)			<0.10		mg/kg		0.1	12-OCT-16
Boron (B)			<5.0		mg/kg		5	12-OCT-16
Cadmium (Cd)			<0.020		mg/kg		0.02	12-OCT-16
Chromium (Cr)			<0.50		mg/kg		0.5	12-OCT-16
Cobalt (Co)			<0.10		mg/kg		0.1	12-OCT-16
Copper (Cu)			<0.50		mg/kg		0.5	12-OCT-16
Lead (Pb)			<0.50		mg/kg		0.5	12-OCT-16
Molybdenum (Mo)			<0.10		mg/kg		0.1	12-OCT-16
Nickel (Ni)			<0.50		mg/kg		0.5	12-OCT-16
Selenium (Se)			<0.20		mg/kg		0.2	12-OCT-16
Silver (Ag)			<0.10		mg/kg		0.1	12-OCT-16
Thallium (Tl)			<0.050		mg/kg		0.05	12-OCT-16
Uranium (U)			<0.050		mg/kg		0.05	12-OCT-16
Vanadium (V)			<0.20		mg/kg		0.2	12-OCT-16
Zinc (Zn)			<2.0		mg/kg		2	12-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT	**Soil**							
Batch R3566916								
WG2406238-3 DUP		**L1840366-2**						
% Moisture		5.50	5.94		%	7.8	20	08-OCT-16
WG2406238-2 LCS								
% Moisture			101.9		%		90-110	08-OCT-16
WG2406238-1 MB								
% Moisture			<0.10		%		0.1	08-OCT-16
PAH-511-WT	**Soil**							
Batch R3570715								
WG2406304-4 DUP		**WG2406304-3**						
1-Methylnaphthalene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	14-OCT-16
2-Methylnaphthalene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	14-OCT-16
Acenaphthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Acenaphthylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Anthracene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Benzo(a)anthracene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Benzo(a)pyrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Benzo(b)fluoranthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Benzo(g,h,i)perylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Benzo(k)fluoranthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Chrysene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Dibenzo(ah)anthracene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Fluoranthene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Fluorene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Indeno(1,2,3-cd)pyrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Naphthalene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Phenanthrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
Pyrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	14-OCT-16
WG2406304-2 LCS								
1-Methylnaphthalene			96.2		%		50-140	14-OCT-16
2-Methylnaphthalene			97.5		%		50-140	14-OCT-16
Acenaphthene			95.2		%		50-140	14-OCT-16
Acenaphthylene			93.9		%		50-140	14-OCT-16
Anthracene			99.3		%		50-140	14-OCT-16
Benzo(a)anthracene			96.2		%		50-140	14-OCT-16
Benzo(a)pyrene			99.7		%		50-140	14-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-511-WT	**Soil**							
Batch R3570715								
WG2406304-2 LCS								
Benzo(b)fluoranthene			92.7		%		50-140	14-OCT-16
Benzo(g,h,i)perylene			98.2		%		50-140	14-OCT-16
Benzo(k)fluoranthene			89.1		%		50-140	14-OCT-16
Chrysene			106.6		%		50-140	14-OCT-16
Dibenzo(ah)anthracene			93.5		%		50-140	14-OCT-16
Fluoranthene			91.9		%		50-140	14-OCT-16
Fluorene			95.0		%		50-140	14-OCT-16
Indeno(1,2,3-cd)pyrene			80.3		%		50-140	14-OCT-16
Naphthalene			101.9		%		50-140	14-OCT-16
Phenanthrene			102.0		%		50-140	14-OCT-16
Pyrene			97.8		%		50-140	14-OCT-16
WG2406304-1 MB								
1-Methylnaphthalene			<0.030		ug/g		0.03	14-OCT-16
2-Methylnaphthalene			<0.030		ug/g		0.03	14-OCT-16
Acenaphthene			<0.050		ug/g		0.05	14-OCT-16
Acenaphthylene			<0.050		ug/g		0.05	14-OCT-16
Anthracene			<0.050		ug/g		0.05	14-OCT-16
Benzo(a)anthracene			<0.050		ug/g		0.05	14-OCT-16
Benzo(a)pyrene			<0.050		ug/g		0.05	14-OCT-16
Benzo(b)fluoranthene			<0.050		ug/g		0.05	14-OCT-16
Benzo(g,h,i)perylene			<0.050		ug/g		0.05	14-OCT-16
Benzo(k)fluoranthene			<0.050		ug/g		0.05	14-OCT-16
Chrysene			<0.050		ug/g		0.05	14-OCT-16
Dibenzo(ah)anthracene			<0.050		ug/g		0.05	14-OCT-16
Fluoranthene			<0.050		ug/g		0.05	14-OCT-16
Fluorene			<0.050		ug/g		0.05	14-OCT-16
Indeno(1,2,3-cd)pyrene			<0.050		ug/g		0.05	14-OCT-16
Naphthalene			<0.050		ug/g		0.05	14-OCT-16
Phenanthrene			<0.050		ug/g		0.05	14-OCT-16
Pyrene			<0.050		ug/g		0.05	14-OCT-16
Surrogate: 2-Fluorobiphenyl			99.4		%		50-140	14-OCT-16
Surrogate: p-Terphenyl d14			96.0		%		50-140	14-OCT-16
WG2406304-5 MS		**WG2406304-3**						
1-Methylnaphthalene			98.5		%		50-140	14-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-511-WT	**Soil**							
Batch R3570715								
WG2406304-5 MS		**WG2406304-3**						
2-Methylnaphthalene			100.4		%		50-140	14-OCT-16
Acenaphthene			98.2		%		50-140	14-OCT-16
Acenaphthylene			98.8		%		50-140	14-OCT-16
Anthracene			104.0		%		50-140	14-OCT-16
Benzo(a)anthracene			103.3		%		50-140	14-OCT-16
Benzo(a)pyrene			101.9		%		50-140	14-OCT-16
Benzo(b)fluoranthene			95.0		%		50-140	14-OCT-16
Benzo(g,h,i)perylene			101.0		%		50-140	14-OCT-16
Benzo(k)fluoranthene			92.0		%		50-140	14-OCT-16
Chrysene			107.8		%		50-140	14-OCT-16
Dibenzo(ah)anthracene			98.0		%		50-140	14-OCT-16
Fluoranthene			96.9		%		50-140	14-OCT-16
Fluorene			100.4		%		50-140	14-OCT-16
Indeno(1,2,3-cd)pyrene			87.7		%		50-140	14-OCT-16
Naphthalene			103.5		%		50-140	14-OCT-16
Phenanthrene			102.7		%		50-140	14-OCT-16
Pyrene			102.9		%		50-140	14-OCT-16
PH-WT	**Soil**							
Batch R3567123								
WG2406081-1 DUP		**L1840284-4**						
pH		7.92	7.90	J	pH units	0.02	0.3	08-OCT-16
WG2406771-1 LCS								
pH			7.04		pH units		6.7-7.3	08-OCT-16
SAR-R511-WT	**Soil**							
Batch R3569757								
WG2408316-4 DUP		**WG2408316-3**						
Calcium (Ca)		28.8	32.5		mg/L	12	30	13-OCT-16
Sodium (Na)		365	361		mg/L	1.1	30	13-OCT-16
Magnesium (Mg)		101	115		mg/L	13	30	13-OCT-16
WG2408316-2 IRM		**WT SAR1**						
Calcium (Ca)			81.0		%		70-130	12-OCT-16
Sodium (Na)			91.1		%		70-130	12-OCT-16
Magnesium (Mg)			83.7		%		70-130	12-OCT-16
WG2408316-1 MB								

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R3569757								
WG2408316-1 MB								
Calcium (Ca)			<1.0		mg/L		1	12-OCT-16
Sodium (Na)			<1.0		mg/L		1	12-OCT-16
Magnesium (Mg)			<1.0		mg/L		1	12-OCT-16

Quality Control Report

Workorder: L1839952 Report Date: 14-OCT-16

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

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
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
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.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 - 573718

Page of

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply
Company:	Morrison Hershfield	Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Cindy Zhao	Quality Control (QC) Report with Report ☐ YES ☐ NO	PRIORITY (Business Days): 4 day [P4] ☐ / 3 day [P3] ☐ / 2 day [P2] ☐ — EMERGENCY: 1 Business day [E1] ☐ / Same Day, Weekend or Statutory holiday [E0] ☐
Phone:	416 499 3110 ext 1011124	☑ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	125 Commerce Valley Drive West	Email 1 or Fax czhao@morrisonhershfield.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Markham, Ontario	Email 2 bguan@geoproconsulting.ca	
Postal Code:	L3T 7W4	Email 3	
Invoice To	Same as Report To ☑ YES ☐ NO	**Invoice Distribution**	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:	Morrison Hershfield	Email 1 or Fax czhao@morrisonhershfield.com	
Contact:	Cindy Zhao	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	Q 24800	AFE/Cost Center:	PO#
Job #:	16-1359	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1839952	ALS Contact:	Sampler:

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/Inorganics	PAH	Number of Containers
-1	BH1 SS2	28-09-16	AM	Soil	✓	✓	2
-2	BH4 SS2	28-09-16	AM	Soil	✓	✓	2
-3	BH5 SS2	28-09-16	AM	Soil	✓	✓	2
-4	BH8 SS2	28-09-16	AM	Soil	✓	✓	2
-5	BH10 SS2	28-09-16	AM	Soil	✓	✓	2
	TCLP	28-09-16	AM	Soil	✓	✓	1

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 3 ~~RPI~~ RPI (MS/MS).

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
6.3 °C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Will Sun	2016-10-05	16:25		05-OCT-16	16:25			

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**.

Morrison Hershfield Limited (Toronto)
ATTN: CINDY ZHAO
235 Yorkland Blvd
Suite 600
Toronto ON M2J 1T1

Date Received: 05-OCT-16
Report Date: 13-OCT-16 15:47 (MT)
Version: FINAL

Client Phone: 416-499-3110

Certificate of Analysis

Lab Work Order #: L1839995

Project P.O. #: NOT SUBMITTED
Job Reference: 16-1359
C of C Numbers: 15-573718
Legal Site Desc:

Emerson Perez, B.S.E
Account Manager

WASTE - Federal & Provincial Waste Regulations (MAR, 2008)

					ALS ID	L1839995-1
					Sampled Date	28-SEP-16
					Sampled Time	-
					Sample ID	TCLP
Grouping	Analyte	Unit	Guide Limits #1	#2		
Sample Preparation	Initial pH	pH units	-	-		9.88
	Final pH	pH units	-	-		5.90
TCLP Extractables	Acenaphthene	mg/L	-	-		<0.0050
	Acenaphthylene	mg/L	-	-		<0.0050
	Anthracene	mg/L	-	-		<0.0050
	Benzo(a)anthracene	mg/L	-	-		<0.0050
	Benzo(a)pyrene	mg/L	0.001	-		<0.0010
	Benzo(b)fluoranthene	mg/L	-	-		<0.0050
	Benzo(g,h,i)perylene	mg/L	-	-		<0.0050
	Cyanide, Weak Acid Diss	mg/L	20	-		<0.10
	Fluoride (F)	mg/L	150.0	-		<10
	Nitrate and Nitrite as N	mg/L	1000	-		<4.0
	Nitrate-N	mg/L	-	-		<2.0
	Nitrite-N	mg/L	-	-		<2.0
TCLP Metals	Arsenic (As)	mg/L	2.5	-		<0.050
	Barium (Ba)	mg/L	100	-		<0.50
	Boron (B)	mg/L	500	-		<2.5
	Cadmium (Cd)	mg/L	0.5	-		<0.0050
	Chromium (Cr)	mg/L	5.0	-		<0.050
	Lead (Pb)	mg/L	5.0	-		<0.050
	Mercury (Hg)	mg/L	0.1	-		<0.00010
	Selenium (Se)	mg/L	1.0	-		<0.025

Guide Limit #1: Ontario Ministry of the Environment, General Waste Control Regulation No. 347/90
Guide Limit #2: Polychlorinated Biphenyls (PCBs) - Ontario Regulation 347/90

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.

ANALYTICAL REPORT

WASTE - Federal & Provincial Waste Regulations (MAR, 2008)

					ALS ID	L1839995-1
					Sampled Date	28-SEP-16
					Sampled Time	-
					Sample ID	TCLP
Grouping	Analyte	Unit	Guide Limits #1	#2		
TCLP Metals	Silver (Ag)	mg/L	5.0	-		<0.0050
	Uranium (U)	mg/L	10	-		<0.25
Polycyclic Aromatic Hydrocarbons	Benzo(k)fluoranthene	mg/L	-	-		<0.0050
	Chrysene	mg/L	-	-		<0.0050
	Dibenzo(ah)anthracene	mg/L	-	-		<0.0050
	Fluoranthene	mg/L	-	-		<0.0050
	Fluorene	mg/L	-	-		<0.0050
	Indeno(1,2,3-cd)pyrene	mg/L	-	-		<0.0050
	Naphthalene	mg/L	-	-		<0.0050
	Phenanthrene	mg/L	-	-		<0.0050
	Pyrene	mg/L	-	-		<0.0050
	Quinoline	mg/L	-	-		<0.0050
	Surrogate: d10-Acenaphthene	%	-	-		91.8
	Surrogate: d12-Chrysene	%	-	-		93.3
	Surrogate: d8-Naphthalene	%	-	-		87.3
	Surrogate: d10-Phenanthrene	%	-	-		95.8

Guide Limit #1: Ontario Ministry of the Environment, General Waste Control Regulation No. 347/90
Guide Limit #2: Polychlorinated Biphenyls (PCBs) - Ontario Regulation 347/90

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.

ANALYTICAL REPORT

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit	Guideline

Federal & Provincial Waste Regulations (MAR, 2008) - Ontario Ministry of the Environment, General Waste Control Regulation No. 347/90

(No parameter exceedances)

Federal & Provincial Waste Regulations (MAR, 2008) - Polychlorinated Biphenyls (PCBs) - Ontario Regulation 347/90

(No parameter exceedances)

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
CN-TCLP-WT	Waste	Cyanide for O. Reg 347	APHA 4500CN C E
F-TCLP-WT	Waste	Fluoride (F) for O. Reg 347	APHA 4110 B-Ion Chromatography
HG-TCLP-WT	Waste	Mercury (CVAA) for O.Reg 347	SW846 7470A
LEACH-TCLP-WT	Waste	Leachate Procedure for Reg 347	EPA 1311
		Inorganic and Semi-Volatile Organic contaminants are leached from waste samples in strict accordance with US EPA Method 1311, "Toxicity Characteristic Leaching Procedure" (TCLP). Test results are reported in leachate concentration units (normally mg/L).	
MET-TCLP-WT	Waste	O.Reg 347 TCLP Leachable Metals	EPA 200.8
N2N3-TCLP-WT	Waste	Nitrate/Nitrite-N for O. Reg 347	APHA 4110 B-Ion Chromatography
PAH-TCLP-WT	Waste	PAH for O. Reg 347	SW846 8270 (PAH)
		Samples are leached according to TCLP protocol and then the aqueous leachate is extracted and the resulting extracts are analyzed on GC/MSD. Depending on the analytical GC/MS column used benzo(j)fluoranthene may chromatographically co-elute with benzo(b)fluoranthene or benzo(k)fluoranthene.	

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

Chain of Custody Numbers:

15-573718

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

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: L1839995 Report Date: 13-OCT-16

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CN-TCLP-WT	**Waste**							
Batch R3568388								
WG2407756-3 DUP		**L1840345-1**						
Cyanide, Weak Acid Diss		<0.10	<0.10	RPD-NA	mg/L	N/A	20	11-OCT-16
WG2407756-2 LCS								
Cyanide, Weak Acid Diss			111.3		%		70-130	11-OCT-16
WG2407756-1 MB								
Cyanide, Weak Acid Diss			<0.10		mg/L		0.1	11-OCT-16
WG2407756-4 MS		**L1840345-1**						
Cyanide, Weak Acid Diss			110.9		%		50-150	11-OCT-16
F-TCLP-WT	**Waste**							
Batch R3569057								
WG2408042-3 DUP		**L1839356-1**						
Fluoride (F)		<10	<10	RPD-NA	mg/L	N/A	30	11-OCT-16
WG2408042-2 LCS								
Fluoride (F)			99.9		%		70-130	11-OCT-16
WG2408042-1 MB								
Fluoride (F)			<10		mg/L		10	11-OCT-16
WG2408042-4 MS		**L1839356-1**						
Fluoride (F)			95.8		%		50-150	11-OCT-16
HG-TCLP-WT	**Waste**							
Batch R3569145								
WG2408550-3 DUP		**L1840472-1**						
Mercury (Hg)		<0.00010	<0.00010	RPD-NA	mg/L	N/A	50	12-OCT-16
WG2408550-2 LCS								
Mercury (Hg)			98.4		%		70-130	12-OCT-16
WG2408550-1 MB								
Mercury (Hg)			<0.00010		mg/L		0.0001	12-OCT-16
WG2408550-4 MS		**L1840472-1**						
Mercury (Hg)			96.0		%		50-140	12-OCT-16
MET-TCLP-WT	**Waste**							
Batch R3568941								
WG2408050-4 DUP		**WG2408050-3**						
Silver (Ag)		<0.0050	<0.0050	RPD-NA	mg/L	N/A	40	11-OCT-16
Arsenic (As)		<0.050	<0.050	RPD-NA	mg/L	N/A	40	11-OCT-16
Boron (B)		<2.5	<2.5	RPD-NA	mg/L	N/A	40	11-OCT-16
Barium (Ba)		<0.50	0.52	RPD-NA	mg/L	N/A	40	11-OCT-16
Cadmium (Cd)		<0.0050	<0.0050	RPD-NA	mg/L	N/A	40	11-OCT-16
Chromium (Cr)		<0.050	<0.050	RPD-NA	mg/L	N/A	40	11-OCT-16

Quality Control Report

Workorder: L1839995 Report Date: 13-OCT-16

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TCLP-WT	**Waste**							
Batch R3568941								
WG2408050-4 DUP		**WG2408050-3**						
Lead (Pb)		<0.050	<0.050	RPD-NA	mg/L	N/A	40	11-OCT-16
Selenium (Se)		<0.025	<0.025	RPD-NA	mg/L	N/A	40	11-OCT-16
Uranium (U)		<0.25	<0.25	RPD-NA	mg/L	N/A	40	11-OCT-16
WG2408050-2 LCS								
Silver (Ag)			97.8		%		70-130	11-OCT-16
Arsenic (As)			98.8		%		70-130	11-OCT-16
Boron (B)			98.7		%		70-130	11-OCT-16
Barium (Ba)			104.5		%		70-130	11-OCT-16
Cadmium (Cd)			99.5		%		70-130	11-OCT-16
Chromium (Cr)			96.9		%		70-130	11-OCT-16
Lead (Pb)			99.9		%		70-130	11-OCT-16
Selenium (Se)			102.1		%		70-130	11-OCT-16
Uranium (U)			98.4		%		70-130	11-OCT-16
WG2408050-1 MB								
Silver (Ag)			<0.0050		mg/L		0.005	11-OCT-16
Arsenic (As)			<0.050		mg/L		0.05	11-OCT-16
Boron (B)			<2.5		mg/L		2.5	11-OCT-16
Barium (Ba)			<0.50		mg/L		0.5	11-OCT-16
Cadmium (Cd)			<0.0050		mg/L		0.005	11-OCT-16
Chromium (Cr)			<0.050		mg/L		0.05	11-OCT-16
Lead (Pb)			<0.050		mg/L		0.05	11-OCT-16
Selenium (Se)			<0.025		mg/L		0.025	11-OCT-16
Uranium (U)			<0.25		mg/L		0.25	11-OCT-16
WG2408050-5 MS		**WG2408050-3**						
Silver (Ag)			116.1		%		50-150	11-OCT-16
Arsenic (As)			101.5		%		50-150	11-OCT-16
Boron (B)			103.8		%		50-150	11-OCT-16
Barium (Ba)			115.0		%		50-150	11-OCT-16
Cadmium (Cd)			101.0		%		50-150	11-OCT-16
Chromium (Cr)			98.9		%		50-150	11-OCT-16
Lead (Pb)			96.0		%		50-150	11-OCT-16
Selenium (Se)			99.5		%		50-150	11-OCT-16
Uranium (U)			98.4		%		50-150	11-OCT-16
N2N3-TCLP-WT	**Waste**							

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
N2N3-TCLP-WT	**Waste**							
Batch R3569057								
WG2408042-3 DUP		**L1839356-1**						
Nitrate-N		<2.0	<2.0	RPD-NA	mg/L	N/A	30	11-OCT-16
Nitrite-N		<2.0	<2.0	RPD-NA	mg/L	N/A	30	11-OCT-16
WG2408042-2 LCS								
Nitrate-N			102.1		%		70-130	11-OCT-16
Nitrite-N			101.0		%		70-130	11-OCT-16
WG2408042-1 MB								
Nitrate-N			<2.0		mg/L		2	11-OCT-16
Nitrite-N			<2.0		mg/L		2	11-OCT-16
WG2408042-4 MS		**L1839356-1**						
Nitrate-N			98.3		%		50-150	11-OCT-16
Nitrite-N			98.4		%		50-150	11-OCT-16
PAH-TCLP-WT	**Waste**							
Batch R3570158								
WG2408514-5 DUP		**WG2408514-3**						
Acenaphthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Acenaphthylene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Anthracene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Benzo(a)anthracene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Benzo(a)pyrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	13-OCT-16
Benzo(b)fluoranthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Benzo(g,h,i)perylene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Benzo(k)fluoranthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Chrysene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Dibenzo(ah)anthracene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Fluoranthene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Fluorene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Indeno(1,2,3-cd)pyrene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Naphthalene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Phenanthrene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Pyrene		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
Quinoline		<0.0050	<0.0050	RPD-NA	mg/L	N/A	50	13-OCT-16
WG2408514-2 LCS								
Acenaphthene			94.9		%		50-130	13-OCT-16
Acenaphthylene			97.1		%		50-130	13-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TCLP-WT	**Waste**							
Batch R3570158								
WG2408514-2 LCS								
Anthracene			98.3		%		50-130	13-OCT-16
Benzo(a)anthracene			99.9		%		50-140	13-OCT-16
Benzo(a)pyrene			101.8		%		60-140	13-OCT-16
Benzo(b)fluoranthene			96.1		%		50-140	13-OCT-16
Benzo(g,h,i)perylene			99.2		%		50-140	13-OCT-16
Benzo(k)fluoranthene			97.0		%		50-150	13-OCT-16
Chrysene			99.7		%		50-140	13-OCT-16
Dibenzo(ah)anthracene			100.7		%		50-140	13-OCT-16
Fluoranthene			97.0		%		50-150	13-OCT-16
Fluorene			96.0		%		50-150	13-OCT-16
Indeno(1,2,3-cd)pyrene			96.6		%		50-140	13-OCT-16
Naphthalene			96.8		%		50-130	13-OCT-16
Phenanthrene			100.1		%		50-130	13-OCT-16
Pyrene			103.9		%		50-140	13-OCT-16
Quinoline			106.1		%		50-150	13-OCT-16
WG2408514-1 MB								
Acenaphthene			<0.0050		mg/L		0.005	13-OCT-16
Acenaphthylene			<0.0050		mg/L		0.005	13-OCT-16
Anthracene			<0.0050		mg/L		0.005	13-OCT-16
Benzo(a)anthracene			<0.0050		mg/L		0.005	13-OCT-16
Benzo(a)pyrene			<0.0010		mg/L		0.001	13-OCT-16
Benzo(b)fluoranthene			<0.0050		mg/L		0.005	13-OCT-16
Benzo(g,h,i)perylene			<0.0050		mg/L		0.005	13-OCT-16
Benzo(k)fluoranthene			<0.0050		mg/L		0.005	13-OCT-16
Chrysene			<0.0050		mg/L		0.005	13-OCT-16
Dibenzo(ah)anthracene			<0.0050		mg/L		0.005	13-OCT-16
Fluoranthene			<0.0050		mg/L		0.005	13-OCT-16
Fluorene			<0.0050		mg/L		0.005	13-OCT-16
Indeno(1,2,3-cd)pyrene			<0.0050		mg/L		0.005	13-OCT-16
Naphthalene			<0.0050		mg/L		0.005	13-OCT-16
Phenanthrene			<0.0050		mg/L		0.005	13-OCT-16
Pyrene			<0.0050		mg/L		0.005	13-OCT-16
Quinoline			<0.0050		mg/L		0.005	13-OCT-16
Surrogate: d8-Naphthalene			91.1		%		50-150	13-OCT-16

Quality Control Report

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-TCLP-WT	**Waste**							
Batch R3570158								
WG2408514-1 MB								
Surrogate: d10-Phenanthrene			99.9		%		50-150	13-OCT-16
Surrogate: d12-Chrysene			99.7		%		50-150	13-OCT-16
Surrogate: d10-Acenaphthene			95.2		%		50-150	13-OCT-16
WG2408514-4 MS		**WG2408514-3**						
Acenaphthene			91.8		%		50-150	13-OCT-16
Acenaphthylene			93.5		%		50-150	13-OCT-16
Anthracene			95.4		%		50-150	13-OCT-16
Benzo(a)anthracene			98.2		%		50-150	13-OCT-16
Benzo(a)pyrene			97.9		%		50-150	13-OCT-16
Benzo(b)fluoranthene			91.2		%		50-150	13-OCT-16
Benzo(g,h,i)perylene			94.8		%		50-150	13-OCT-16
Benzo(k)fluoranthene			92.2		%		50-150	13-OCT-16
Chrysene			98.2		%		50-150	13-OCT-16
Dibenzo(ah)anthracene			95.2		%		50-150	13-OCT-16
Fluoranthene			93.5		%		50-150	13-OCT-16
Fluorene			94.0		%		50-150	13-OCT-16
Indeno(1,2,3-cd)pyrene			92.6		%		50-150	13-OCT-16
Naphthalene			92.5		%		50-150	13-OCT-16
Phenanthrene			96.1		%		50-150	13-OCT-16
Pyrene			101.0		%		50-150	13-OCT-16
Quinoline			102.9		%		50-150	13-OCT-16

Quality Control Report

Workorder: L1839995 Report Date: 13-OCT-16

Client: Morrison Hershfield Limited (Toronto)
235 Yorkland Blvd Suite 600
Toronto ON M2J 1T1
Contact: CINDY ZHAO

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
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

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.

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: 15 - 573718

Page of

Report To	Contact and company name below will appear on the final report
Company:	Morrison Hershfield
Contact:	Cindy Zhao
Phone:	416 499 3110 ext 1011124
	Company address below will appear on the final report
Street:	125 Commerce Valley Drive West
City/Province:	Markham, Ontario
Postal Code:	L3T 7W4
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Morrison Hershfield
Contact:	Cindy Zhao

Project Information

ALS Account # / Quote #:	Q 24800
Job #:	16-1359
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only)	L1839995

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: czhao@morrisonhershfield.com
Email 2: bgwan@geoproconsulting.ca
Email 3:

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: czhao@morrisonhershfield.com
Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

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

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.

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/Inorganics	PAH	Number of Containers
	BH1 SS2	28-09-16	AM	Soil	✓	✓	2
	BH4 SS2	28-09-16	AM	Soil	✓	✓	2
	BH5 SS2	28-09-16	AM	Soil	✓	✓	2
	BH8 SS2	28-09-16	AM	Soil	✓	✓	2
	BH10 SS2	28-09-16	AM	Soil	✓	✓	2
(1)	TCLP	28-09-16	AM	Soil	✓	✓	1

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 3 ~~RPI~~

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
6.3 °C	

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
Will Sun	2016-10-05	16:45

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
	05 OCT 16	16 25

FINAL SHIPMENT RECEPTION (lab use only)

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**

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

Date Received: 05-OCT-16
Report Date: 13-OCT-16 15:46 (MT)
Version: FINAL

Client Phone: 905-237-8336

Certificate of Analysis

Lab Work Order #: L1839783

Project P.O. #: NOT SUBMITTED
Job Reference: 16-1359
C of C Numbers: 15-573719
Legal Site Desc:

Emerson Perez, B.S.E
Account Manager

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1839783-1	L1839783-2
					Sampled Date	28-SEP-16	28-SEP-16
					Sampled Time	-	-
					Sample ID	BH2 SS3	BH6 SS3
Grouping	Analyte	Unit	Guide Limits #1	#2			
Physical Tests	% Moisture	%	-	-		7.21	7.32
Volatile Organic Compounds	Acetone	ug/g	0.5	-		<0.50	<0.50
	Benzene	ug/g	0.02	-		<0.0068	<0.0068
	Bromodichloromethane	ug/g	0.05	-		<0.050	<0.050
	Bromoform	ug/g	0.05	-		<0.050	<0.050
	Bromomethane	ug/g	0.05	-		<0.050	<0.050
	Carbon tetrachloride	ug/g	0.05	-		<0.050	<0.050
	Chlorobenzene	ug/g	0.05	-		<0.050	<0.050
	Dibromochloromethane	ug/g	0.05	-		<0.050	<0.050
	Chloroform	ug/g	0.05	-		<0.050	<0.050
	1,2-Dibromoethane	ug/g	0.05	-		<0.050	<0.050
	1,2-Dichlorobenzene	ug/g	0.05	-		<0.050	<0.050
	1,3-Dichlorobenzene	ug/g	0.05	-		<0.050	<0.050
	1,4-Dichlorobenzene	ug/g	0.05	-		<0.050	<0.050
	Dichlorodifluoromethane	ug/g	0.05	-		<0.050	<0.050
	1,1-Dichloroethane	ug/g	0.05	-		<0.050	<0.050
	1,2-Dichloroethane	ug/g	0.05	-		<0.050	<0.050
	1,1-Dichloroethylene	ug/g	0.05	-		<0.050	<0.050
	cis-1,2-Dichloroethylene	ug/g	0.05	-		<0.050	<0.050
	trans-1,2-Dichloroethylene	ug/g	0.05	-		<0.050	<0.050
	Methylene Chloride	ug/g	0.05	-		<0.050	<0.050
	1,2-Dichloropropane	ug/g	0.05	-		<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.

ANALYTICAL REPORT

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1839783-1	L1839783-2
					Sampled Date	28-SEP-16	28-SEP-16
					Sampled Time	-	-
					Sample ID	BH2 SS3	BH6 SS3
Grouping	Analyte	Unit	Guide Limits #1	#2			
Volatile Organic Compounds	cis-1,3-Dichloropropene	ug/g	-	-		<0.030	<0.030
	trans-1,3-Dichloropropene	ug/g	-	-		<0.030	<0.030
	1,3-Dichloropropene (cis & trans)	ug/g	0.05	-		<0.042	<0.042
	Ethylbenzene	ug/g	0.05	-		<0.018	<0.018
	n-Hexane	ug/g	0.05	-		<0.050	<0.050
	Methyl Ethyl Ketone	ug/g	0.5	-		<0.50	<0.50
	Methyl Isobutyl Ketone	ug/g	0.5	-		<0.50	<0.50
	MTBE	ug/g	0.05	-		<0.050	<0.050
	Styrene	ug/g	0.05	-		<0.050	<0.050
	1,1,1,2-Tetrachloroethane	ug/g	0.05	-		<0.050	<0.050
	1,1,2,2-Tetrachloroethane	ug/g	0.05	-		<0.050	<0.050
	Tetrachloroethylene	ug/g	0.05	-		<0.050	<0.050
	Toluene	ug/g	0.2	-		<0.080	<0.080
	1,1,1-Trichloroethane	ug/g	0.05	-		<0.050	<0.050
	1,1,2-Trichloroethane	ug/g	0.05	-		<0.050	<0.050
	Trichloroethylene	ug/g	0.05	-		<0.010	<0.010
	Trichlorofluoromethane	ug/g	0.25	-		<0.050	<0.050
	Vinyl chloride	ug/g	0.02	-		<0.020	<0.020
	o-Xylene	ug/g	-	-		<0.020	<0.020
	m+p-Xylenes	ug/g	-	-		<0.030	<0.030
	Xylenes (Total)	ug/g	0.05	-		<0.050	<0.050
	Surrogate: 4-Bromofluorobenzene	%	-	-		101.0	101.1

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.

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1839783-1	L1839783-2
					Sampled Date	28-SEP-16	28-SEP-16
					Sampled Time	-	-
					Sample ID	BH2 SS3	BH6 SS3
Grouping	Analyte	Unit	Guide Limits #1	#2			
Volatile Organic Compounds	Surrogate: 1,4-Difluorobenzene	%	-	-		111.1	110.7
Hydrocarbons	F1 (C6-C10)	ug/g	25	-		<5.0	<5.0
	F1-BTEX	ug/g	25	-		<5.0	<5.0
	F2 (C10-C16)	ug/g	10	-		<10	<10
	F3 (C16-C34)	ug/g	240	-		<50	<50
	F4 (C34-C50)	ug/g	120	-		<50	<50
	Total Hydrocarbons (C6-C50)	ug/g	-	-		<72	<72
	Chrom. to baseline at nC50		-	-		YES	YES
	Surrogate: 2-Bromobenzotrifluoride	%	-	-		88.9	85.5
	Surrogate: 3,4-Dichlorotoluene	%	-	-		96.6	95.2

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.

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						
(No parameter exceedances)						

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
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.

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)	MOE DECPH-E3398/CCME TIER 1

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by 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).

MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
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.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

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

Chain of Custody Numbers:

15-573719

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

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: L1839783 Report Date: 13-OCT-16

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

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-HS-511-WT	**Soil**							
Batch R3568210								
WG2405867-4 DUP		**WG2405867-3**						
F1 (C6-C10)		<5.0	<5.0	RPD-NA	ug/g	N/A	50	11-OCT-16
WG2405867-2 LCS								
F1 (C6-C10)			93.4		%		80-120	11-OCT-16
WG2405867-1 MB								
F1 (C6-C10)			<5.0		ug/g		5	11-OCT-16
Surrogate: 3,4-Dichlorotoluene			109.9		%		60-140	11-OCT-16
WG2405867-7 MS		**WG2405867-6**						
F1 (C6-C10)			80.8		%		60-140	11-OCT-16
F2-F4-511-WT	**Soil**							
Batch R3569839								
WG2408136-3 CRM		**ALS PHC2 IRM**						
F2 (C10-C16)			86.1		%		70-130	12-OCT-16
F3 (C16-C34)			93.4		%		70-130	12-OCT-16
F4 (C34-C50)			92.8		%		70-130	12-OCT-16
WG2408136-5 DUP		**WG2408136-4**						
F2 (C10-C16)		<10	<10	RPD-NA	ug/g	N/A	30	12-OCT-16
F3 (C16-C34)		<50	<50	RPD-NA	ug/g	N/A	30	12-OCT-16
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	30	12-OCT-16
WG2408136-2 LCS								
F2 (C10-C16)			81.5		%		80-120	12-OCT-16
F3 (C16-C34)			93.9		%		80-120	12-OCT-16
F4 (C34-C50)			91.6		%		80-120	12-OCT-16
WG2408136-1 MB								
F2 (C10-C16)			<10		ug/g		10	12-OCT-16
F3 (C16-C34)			<50		ug/g		50	12-OCT-16
F4 (C34-C50)			<50		ug/g		50	12-OCT-16
Surrogate: 2-Bromobenzotrifluoride			88.8		%		60-140	12-OCT-16
MOISTURE-WT	**Soil**							
Batch R3566916								
WG2406238-3 DUP		**L1840366-2**						
% Moisture		5.50	5.94		%	7.8	20	08-OCT-16
WG2406238-2 LCS								
% Moisture			101.9		%		90-110	08-OCT-16
WG2406238-1 MB								
% Moisture			<0.10		%		0.1	08-OCT-16

Quality Control Report

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

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3568210								
WG2405867-4 DUP		**WG2405867-3**						
1,1,1,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,1,2,2-Tetrachloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,1,1-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,1,2-Trichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,1-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,1-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,2-Dibromoethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,2-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,2-Dichloroethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,2-Dichloropropane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,3-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
1,4-Dichlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Acetone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	11-OCT-16
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	11-OCT-16
Bromodichloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Bromoform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Bromomethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Carbon tetrachloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Chlorobenzene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Chloroform		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
cis-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
cis-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	11-OCT-16
Dibromochloromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Dichlorodifluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	11-OCT-16
n-Hexane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Methylene Chloride		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
MTBE		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	11-OCT-16
Methyl Ethyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	11-OCT-16
Methyl Isobutyl Ketone		<0.50	<0.50	RPD-NA	ug/g	N/A	40	11-OCT-16
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	11-OCT-16
Styrene		<0.050	<0.050		ug/g			11-OCT-16

Quality Control Report

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

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3568210								
WG2405867-4 DUP		**WG2405867-3**						
Styrene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Tetrachloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	11-OCT-16
trans-1,2-Dichloroethylene		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
trans-1,3-Dichloropropene		<0.030	<0.030	RPD-NA	ug/g	N/A	40	11-OCT-16
Trichloroethylene		<0.010	<0.010	RPD-NA	ug/g	N/A	40	11-OCT-16
Trichlorofluoromethane		<0.050	<0.050	RPD-NA	ug/g	N/A	40	11-OCT-16
Vinyl chloride		<0.020	<0.020	RPD-NA	ug/g	N/A	40	11-OCT-16
WG2405867-2 LCS								
1,1,1,2-Tetrachloroethane			102.0		%		60-130	11-OCT-16
1,1,2,2-Tetrachloroethane			116.9		%		60-130	11-OCT-16
1,1,1-Trichloroethane			111.0		%		60-130	11-OCT-16
1,1,2-Trichloroethane			111.2		%		60-130	11-OCT-16
1,1-Dichloroethane			113.0		%		60-130	11-OCT-16
1,1-Dichloroethylene			104.6		%		60-130	11-OCT-16
1,2-Dibromoethane			112.7		%		70-130	11-OCT-16
1,2-Dichlorobenzene			105.8		%		70-130	11-OCT-16
1,2-Dichloroethane			120.8		%		60-130	11-OCT-16
1,2-Dichloropropane			116.5		%		70-130	11-OCT-16
1,3-Dichlorobenzene			102.5		%		70-130	11-OCT-16
1,4-Dichlorobenzene			107.4		%		70-130	11-OCT-16
Acetone			139.3		%		60-140	11-OCT-16
Benzene			114.2		%		70-130	11-OCT-16
Bromodichloromethane			115.3		%		50-140	11-OCT-16
Bromoform			107.9		%		70-130	11-OCT-16
Bromomethane			108.3		%		50-140	11-OCT-16
Carbon tetrachloride			111.2		%		70-130	11-OCT-16
Chlorobenzene			106.2		%		70-130	11-OCT-16
Chloroform			115.5		%		70-130	11-OCT-16
cis-1,2-Dichloroethylene			112.8		%		70-130	11-OCT-16
cis-1,3-Dichloropropene			124.6		%		70-130	11-OCT-16
Dibromochloromethane			114.9		%		60-130	11-OCT-16
Dichlorodifluoromethane			75.2		%		50-140	11-OCT-16

Quality Control Report

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

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3568210								
WG2405867-2 LCS								
Ethylbenzene			95.4		%		70-130	11-OCT-16
n-Hexane			113.4		%		70-130	11-OCT-16
Methylene Chloride			119.9		%		70-130	11-OCT-16
MTBE			108.8		%		70-130	11-OCT-16
m+p-Xylenes			98.8		%		70-130	11-OCT-16
Methyl Ethyl Ketone			137.9		%		60-140	11-OCT-16
Methyl Isobutyl Ketone			133.4		%		60-140	11-OCT-16
o-Xylene			98.3		%		70-130	11-OCT-16
Styrene			98.3		%		70-130	11-OCT-16
Tetrachloroethylene			96.3		%		60-130	11-OCT-16
Toluene			100.4		%		70-130	11-OCT-16
trans-1,2-Dichloroethylene			113.9		%		60-130	11-OCT-16
trans-1,3-Dichloropropene			118.8		%		70-130	11-OCT-16
Trichloroethylene			105.5		%		60-130	11-OCT-16
Trichlorofluoromethane			106.2		%		50-140	11-OCT-16
Vinyl chloride			93.3		%		60-140	11-OCT-16
WG2405867-1 MB								
1,1,1,2-Tetrachloroethane			<0.050		ug/g		0.05	11-OCT-16
1,1,2,2-Tetrachloroethane			<0.050		ug/g		0.05	11-OCT-16
1,1,1-Trichloroethane			<0.050		ug/g		0.05	11-OCT-16
1,1,2-Trichloroethane			<0.050		ug/g		0.05	11-OCT-16
1,1-Dichloroethane			<0.050		ug/g		0.05	11-OCT-16
1,1-Dichloroethylene			<0.050		ug/g		0.05	11-OCT-16
1,2-Dibromoethane			<0.050		ug/g		0.05	11-OCT-16
1,2-Dichlorobenzene			<0.050		ug/g		0.05	11-OCT-16
1,2-Dichloroethane			<0.050		ug/g		0.05	11-OCT-16
1,2-Dichloropropane			<0.050		ug/g		0.05	11-OCT-16
1,3-Dichlorobenzene			<0.050		ug/g		0.05	11-OCT-16
1,4-Dichlorobenzene			<0.050		ug/g		0.05	11-OCT-16
Acetone			<0.50		ug/g		0.5	11-OCT-16
Benzene			<0.0068		ug/g		0.0068	11-OCT-16
Bromodichloromethane			<0.050		ug/g		0.05	11-OCT-16
Bromoform			<0.050		ug/g		0.05	11-OCT-16
Bromomethane			<0.050		ug/g		0.05	11-OCT-16

Quality Control Report

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

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3568210								
WG2405867-1 MB								
Carbon tetrachloride			<0.050		ug/g		0.05	11-OCT-16
Chlorobenzene			<0.050		ug/g		0.05	11-OCT-16
Chloroform			<0.050		ug/g		0.05	11-OCT-16
cis-1,2-Dichloroethylene			<0.050		ug/g		0.05	11-OCT-16
cis-1,3-Dichloropropene			<0.030		ug/g		0.03	11-OCT-16
Dibromochloromethane			<0.050		ug/g		0.05	11-OCT-16
Dichlorodifluoromethane			<0.050		ug/g		0.05	11-OCT-16
Ethylbenzene			<0.018		ug/g		0.018	11-OCT-16
n-Hexane			<0.050		ug/g		0.05	11-OCT-16
Methylene Chloride			<0.050		ug/g		0.05	11-OCT-16
MTBE			<0.050		ug/g		0.05	11-OCT-16
m+p-Xylenes			<0.030		ug/g		0.03	11-OCT-16
Methyl Ethyl Ketone			<0.50		ug/g		0.5	11-OCT-16
Methyl Isobutyl Ketone			<0.50		ug/g		0.5	11-OCT-16
o-Xylene			<0.020		ug/g		0.02	11-OCT-16
Styrene			<0.050		ug/g		0.05	11-OCT-16
Tetrachloroethylene			<0.050		ug/g		0.05	11-OCT-16
Toluene			<0.080		ug/g		0.08	11-OCT-16
trans-1,2-Dichloroethylene			<0.050		ug/g		0.05	11-OCT-16
trans-1,3-Dichloropropene			<0.030		ug/g		0.03	11-OCT-16
Trichloroethylene			<0.010		ug/g		0.01	11-OCT-16
Trichlorofluoromethane			<0.050		ug/g		0.05	11-OCT-16
Vinyl chloride			<0.020		ug/g		0.02	11-OCT-16
Surrogate: 1,4-Difluorobenzene			116.5		%		50-140	11-OCT-16
Surrogate: 4-Bromofluorobenzene			106.6		%		50-140	11-OCT-16
WG2405867-5 MS		**WG2405867-3**						
1,1,1,2-Tetrachloroethane			103.9		%		50-140	11-OCT-16
1,1,2,2-Tetrachloroethane			116.7		%		50-140	11-OCT-16
1,1,1-Trichloroethane			114.9		%		50-140	11-OCT-16
1,1,2-Trichloroethane			113.3		%		50-140	11-OCT-16
1,1-Dichloroethane			117.2		%		50-140	11-OCT-16
1,1-Dichloroethylene			109.1		%		50-140	11-OCT-16
1,2-Dibromoethane			114.1		%		50-140	11-OCT-16
1,2-Dichlorobenzene			106.4		%		50-140	11-OCT-16

Quality Control Report

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

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
VOC-511-HS-WT	**Soil**							
Batch R3568210								
WG2405867-5 MS		**WG2405867-3**						
1,2-Dichloroethane			124.1		%		50-140	11-OCT-16
1,2-Dichloropropane			118.8		%		50-140	11-OCT-16
1,3-Dichlorobenzene			102.7		%		50-140	11-OCT-16
1,4-Dichlorobenzene			107.4		%		50-140	11-OCT-16
Acetone			152.2	K	%		50-140	11-OCT-16
Benzene			116.7		%		50-140	11-OCT-16
Bromodichloromethane			117.6		%		50-140	11-OCT-16
Bromoform			109.3		%		50-140	11-OCT-16
Bromomethane			108.5		%		50-140	11-OCT-16
Carbon tetrachloride			115.1		%		50-140	11-OCT-16
Chlorobenzene			107.1		%		50-140	11-OCT-16
Chloroform			119.2		%		50-140	11-OCT-16
cis-1,2-Dichloroethylene			114.8		%		50-140	11-OCT-16
cis-1,3-Dichloropropene			115.9		%		50-140	11-OCT-16
Dibromochloromethane			117.4		%		50-140	11-OCT-16
Dichlorodifluoromethane			86.0		%		50-140	11-OCT-16
Ethylbenzene			95.5		%		50-140	11-OCT-16
n-Hexane			121.2		%		50-140	11-OCT-16
Methylene Chloride			123.9		%		50-140	11-OCT-16
MTBE			111.2		%		50-140	11-OCT-16
m+p-Xylenes			98.6		%		50-140	11-OCT-16
Methyl Ethyl Ketone			139.5		%		50-140	11-OCT-16
Methyl Isobutyl Ketone			133.2		%		50-140	11-OCT-16
o-Xylene			98.5		%		50-140	11-OCT-16
Styrene			97.5		%		50-140	11-OCT-16
Tetrachloroethylene			95.8		%		50-140	11-OCT-16
Toluene			103.8		%		50-140	11-OCT-16
trans-1,2-Dichloroethylene			114.7		%		50-140	11-OCT-16
trans-1,3-Dichloropropene			108.8		%		50-140	11-OCT-16
Trichloroethylene			106.5		%		50-140	11-OCT-16
Trichlorofluoromethane			112.9		%		50-140	11-OCT-16
Vinyl chloride			97.5		%		50-140	11-OCT-16

Quality Control Report

Workorder: L1839783 Report Date: 13-OCT-16

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

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
K	Matrix Spike recovery outside ALS DQO due to sample matrix effects.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

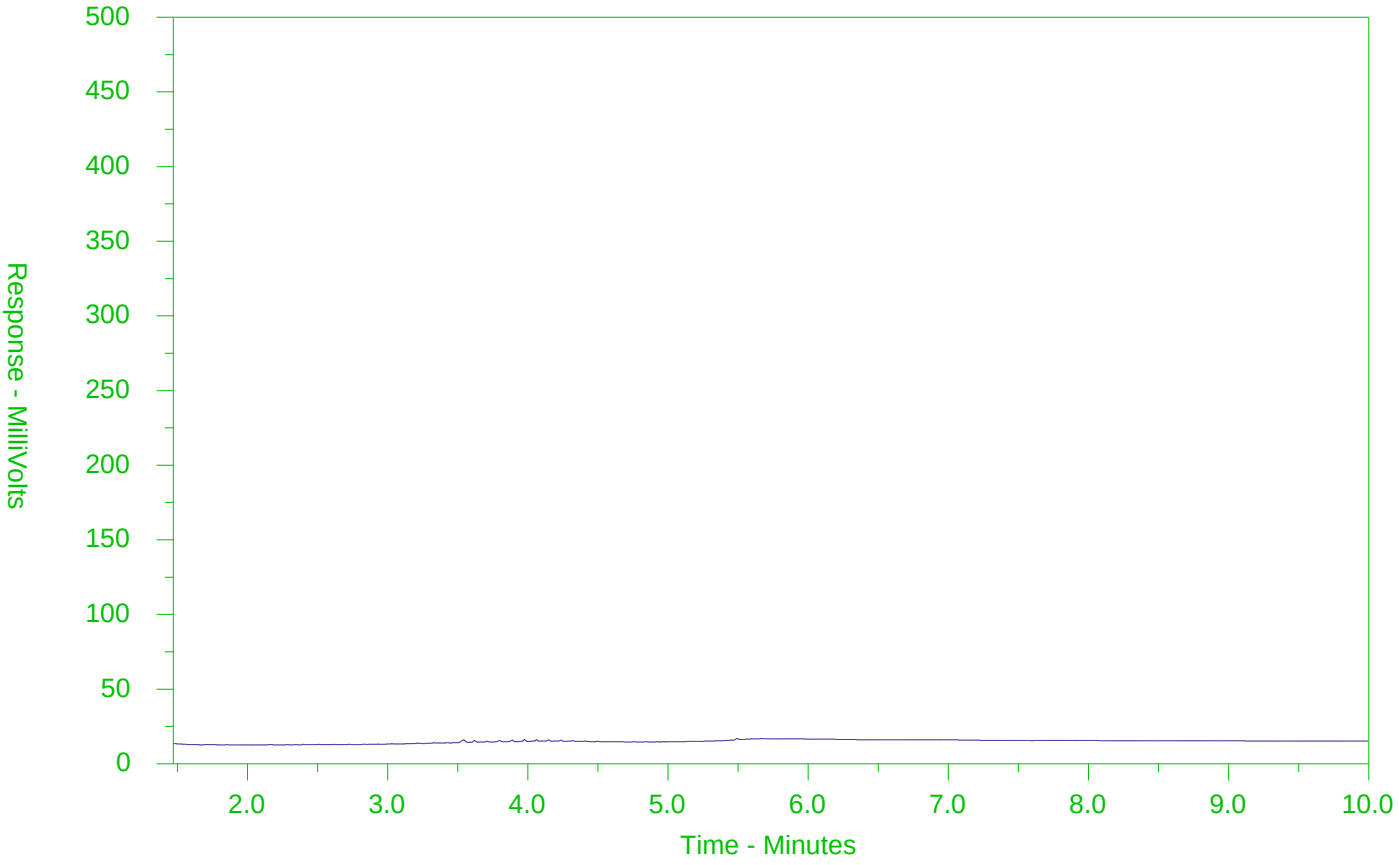
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where 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: L1839783-1
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.

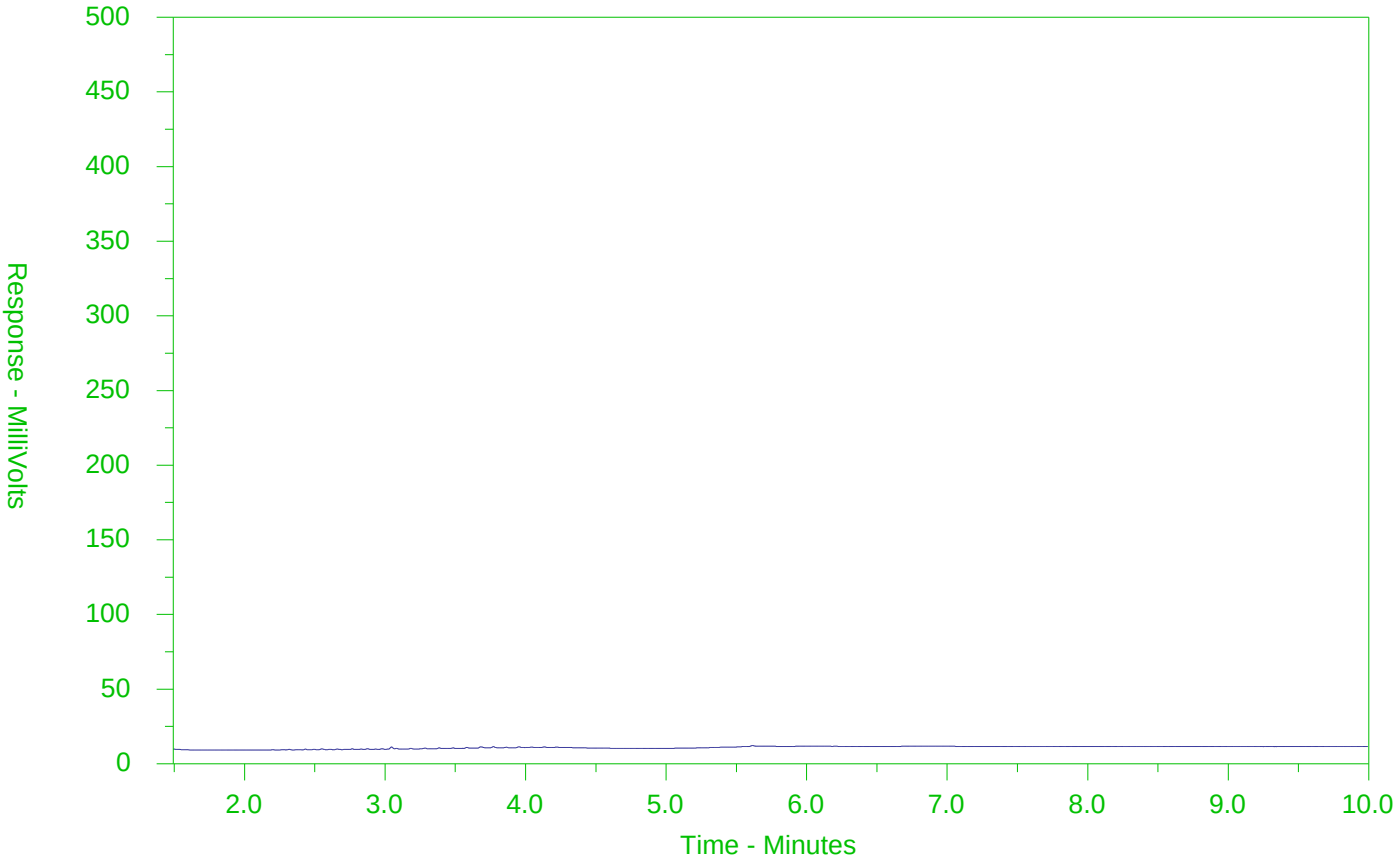
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products and four n-alkane hydrocarbon marker compounds. Retention times may vary between samples, but general patterns and distributions will remain similar.

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.

CCME F2-F4 HYDROCARBON DISTRIBUTION REPORT

ALS Sample ID: L1839783-2
Client Sample ID: BH6 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.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 15 - 573719

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	GeoPro Consulting
Contact:	Bujing Guan
Phone:	905 237 8336
Company address below will appear on the final report	
Street:	40 Vogell Road
City/Province:	Richmond Hill, Ontario
Postal Code:	

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	905 248 3699
Email 2	bguan@geoproconsulting.ca
Email 3	

Invoice To		
	Same as Report To	☑ YES ☐ NO
	Copy of Invoice with Report	☐ YES ☐ NO
Company:	GeoPro Consulting	
Contact:	Bujing Guan	

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

Project Information	
ALS Account # / Quote #:	Q 58286
Job #:	16-1359
PO / AFE:	
LSD:	

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): L1839783

ALS Contact: | Sampler:

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: dd-mmm-yy hh:mm

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

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	PHC	VOC	Number of Containers
1	BH2 SS3	28-09-2016	AM	Soil	✓	✓	3
2	BH6 SS3	28-09-2016	AM	Soil	✓	✓	3

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		
6.3 °C					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
[illegible]	2016-10-05	16:??	[illegible]	05-OCT-16	16:25			

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**.

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.

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.

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.