Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

GEOTECHNICAL INVESTIGATION AND DESIGN REPORT
AIRPORT ROAD IMPROVEMENTS
FROM KING STREET TO HUNTSMILL DRIVE
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL, ONTARIO

PREPARED FOR:

IBI Group
55 St. Clair Avenue West, 7th Floor
Toronto, Ontario
M4V 2Y7

File No. 1-17-0714
November 20, 2020

Distribution:

1 Copy - IBI Group
1 Copy - Terraprobe Inc., Brampton

Terraprobe Inc.

Greater Toronto
11 Indell Lane
Brampton, Ontario L6T 3Y3
(905) 796-2650 Fax: 796-2250
brampton@terraprobe.ca

Hamilton – Niagara
903 Barton Street, Unit 22
Stoney Creek, Ontario L8E 5P5
(905) 643-7560 Fax: 643-7559
stoneycreek@terraprobe.ca

Central Ontario
220 Bayview Drive, Unit 25
Barrie, Ontario L4N 4Y8
(705) 739-8355 Fax: 739-8369
barrie@terraprobe.ca

Northern Ontario
1012 Kelly Lake Rd., Unit 1
Sudbury, Ontario P3E 5P4
(705) 670-0460 Fax: 670-0558
sudbury@terraprobe.ca

www.terraprobe.ca

TABLE OF CONTENTS

1.0 INTRODUCTION

Terraprobe Inc. (Terraprobe) has been retained by IBI Group (IBI) on behalf of the Regional Municipality of Peel to provide geotechnical engineering services in support of the Schedule C Class Environmental Assessment for Airport Road between King Street and Huntsmill Drive, and also transportation improvements on Old Church Road between Airport Road and Marilyn Street, in the Town of Caledon, Regional Municipality of Peel, Ontario. A site location plan is provided as Figure 1 and site photographs are presented in Figures 2 to 9.

The scope of work for the geotechnical engineering services is outlined in Terraprobe's proposal titled *"Consulting Engineering Services for Airport Road, Schedule C Class Environmental Assessment, From King Street to Huntsmill Drive. Proposal Number: 2017-246P, The Regional Municipality of Peel, Ontario"* dated September 27, 2017.

The purpose of this study was to assess the pavement condition and to explore the subsurface conditions at the site, by borehole drilling, in-situ testing, falling weight deflectometer (FWD) testing, pavement coring and, laboratory testing on soil samples. The data obtained from this investigation was used to provide Borehole Location Plans, Pavement Borehole Logs, Pavement Core Logs, Log of Borehole Sheets, laboratory test results, a description of the subsurface conditions and design recommendations.

2.0 SITE AND PROJECT DESCRIPTION

The south limit of the project is approximately 100 m north of King Street, i.e. Sta. 9+965, and the north limit is approximately 300 m north of Huntsmill Drive, i.e. Sta. 17+370, with chainage increasing from south to north. The project also includes Old Church Road from Airport Road to Marilyn Street (eastern entry).

Within the project limits Airport Road is a paved two-lane arterial road that passes through the village of Caledon East. The road conforms to an urban section through Caledon east and is a rural section with partially paved shoulders outside of the village of Caledon East as further identified below:

- Rural cross section: between south project limit (Sta. 9+965) and approximately 200 m south of Hilltop Drive (Sta. 15+210);
- Urban cross section: approximately 200 m south of Hilltop Drive (Sta. 15+210) to Walker Road West (Sta. 16+300); and
- Rural cross section: between Walker Road West (Sta. 16+300) and north project limit (Sta. 17+370).

There are multiple culvert crossings that convey watercourse flows below Airport Road. Centreville Creek is a major watercourse that flows below Airport Road via a concrete structure built in 1960.

As part of this study, transportation improvements within the right-of-way on Old Church Road extending from Airport Road easterly to Marilyn Street, i.e., Sta. 1+540 are also being considered.

3.0 INVESTIGATION PROCEDURES

The fieldwork for this project was carried out on December 12, 2018 and during the period May 07 to June 03, 2019 after obtaining utility clearances and permits. The work was performed in accordance with the lane closure times specified by the Region of Peel and Town of Caledon. Details of the field investigations are presented below:

- Drilling seven boreholes on Airport Road close to existing culverts to depths ranging from 3.5 m to 10.7 m below ground surface;
- Drilling seventy-two 1.5 m deep pavement boreholes through the existing lanes and shoulders of Airport Road;
- Drilling six 1.8 m deep boreholes at the road widening areas of Airport Road;
- Drilling thirteen 1.5 m deep pavement boreholes through the existing lanes of intersecting roads with Airport Road within the project limit;
- Drilling five 1.5 m deep pavement boreholes through the existing lanes of Old Church Road;
- Asphalt concrete coring of Airport Road at eight locations; and
- Manually excavating seventy-four shallow test pits to estimate topsoil thickness in the road widening areas.

The borehole locations were marked in the field by Terraprobe's staff in relation to existing features shown on the drawings provided by IBI. The seven foundation boreholes were surveyed for coordinates and geodetic elevation with a Trimble R10 Receiver connected to the Global Navigation Satellite System. The approximate borehole locations and coordinates are shown on Figures 10 to 16.

The boreholes were drilled with truck-mounted drill rigs and also portable drilling equipment supplied and operated by specialist drilling contractors. Terraprobe's staff observed and recorded the drilling, sampling and in situ testing operations and logged the boreholes.

Ground water conditions in the open boreholes were observed during the drilling operations and standpipe piezometers consisting of a 50 mm diameter PVC pipe with a slotted screen were installed in Boreholes 24A, 64A and 80A to permit longer term ground water level monitoring. The boreholes were backfilled in accordance with current MTO procedures and Ontario Regulation 903 (as amended).

In the foundation boreholes, soil samples were obtained at intervals of 0.75 m and 1.5 m depth, using a 50 mm outer diameter (O.D.) split-spoon sampler in conjunction with the Standard Penetration Testing (SPT) procedures as specified in ASTM Method D 1586[1]. In the 1.5 m deep pavement boreholes drilled through the existing pavements, samples of soil and granular material were collected from auger cuttings. In the 1.8 m deep boreholes drilled at the road widening areas, samples of the overburden soils were obtained by advancing a split spoon sampler with portable hand operated vibratory equipment.

The recovered soil samples were visually inspected in the field, placed in labelled plastic containers and transferred to Terraprobe's Brampton laboratory for further examination and testing. The recovered soil samples were subjected to Visual Identification (VI) and select soil samples were subjected to a laboratory testing programme consisting of natural moisture content and grain size distribution analyses in accordance with MTO and/or ASTM Standards as appropriate. The results of the soil testing program are presented on the Log of Borehole Sheets in Appendix A and on the figures in Appendix B.

Soil samples and asphalt cores were also submitted to SGS Canada Inc. (SGS) for chemical testing to assess soil and asphalt disposal options for excess material generated during construction. The results of the chemical tests are provided in Appendix C.

Falling Weight Deflectometer (FWD) testing was also performed on Airport Road between the project limits by Engtec Consulting Inc. The FWD test results and the report is included in Appendix D.

---

1 ASTM D1586 – Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of Soils.

A visual pavement condition evaluation was carried out in July, 2019 in accordance with the Ministry of Transportation of Ontario, (MTO) *Manual for Condition Rating of Flexible Pavements Distress Manifestations, SP-024*. The Pavement Condition Evaluation Forms are included in Appendix E.

4.0 SUBSURFACE CONDITIONS

Reference is made to the Borehole Logs and Record of Borehole Sheets in Appendix A. Details of the encountered soil stratigraphy are presented in this appendix. An overall description of the stratigraphy is given in the following paragraphs.

The stratigraphic boundaries shown on the Record of Borehole Sheets are inferred from non-continuous soil sampling and therefore represent transitions between soil types rather than exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

In summary, topsoil, a flexible pavement and fill material consisting of firm to very stiff silty clay, loose to compact sand and gravel, and very loose to dense silty sand were encountered at the site. The native overburden deposits consist of firm to hard silty clay till, very loose to very dense sand to sandy silt and, very soft to very stiff clayey silt.

4.1 Topsoil

Topsoil layers ranging in thickness from 40 mm to 250 mm were encountered in the test pits. Further details are provided in the Topsoil Thicknesses Sheet in Appendix A. Topsoil thickness will vary between and beyond the test pit locations.

4.2 Flexible Pavement

A flexible pavement consisting of asphaltic concrete, underlain by granular base/subbase was encountered at this site. The average pavement structure of Airport Road is summarized in the following table.

Station	Location	Average Thickness (mm)		
		HMA	Granular	Total
Sta. 10+000 to Sta. 15+210	Lane	235	525	760
	Shoulder	-	630	630
Sta. 15+210 to Sta. 16+300	Lane	150	525	675
	Shoulder*	-	-	-
Sta. 16+300 to Sta. 17+370	Lane	195	525	720
	Shoulder	-	650	650

* Urban Cross Section.

The grain size distribution plots of sixteen samples of the granular base/subbase material (compared to the Ontario Provincial Standards (OPSS) gradation specifications for Granular A and Granular B Type I), are depicted in Figures B1 and B2 in Appendix B. The natural water content of samples of the granular base/subbase material range from 1% to 8% by weight.

The pavement structure of intersecting side roads are summarized in the following table.

Road	Location	Average Thickness (mm)		
		HMA	Granular	Total
Castlederg Side Road	East Bound Lane	110	310	420
Boston Mills Road	East Bound Lane	-	350	350
Olde Base Line Road	West Bound Lane	140	360	500
Cranston Drive	West Bound Lane	150	400	550
Hilltop Drive	West Bound Lane	140	460	600
Marion Street	East Bound Lane	120	380	500
Larry Street	West Bound Lane	130	670	800
Emma Street	East Bound Lane	140	360	500
Parsons Avenue	East Bound Lane	130	770	900
Ivan Avenue	North Bound Lane	75	575	650
Old Church Road	East & West Bound Lanes	155	530	685
Walker Road West	West Bound Lane	125	475	600
Huntsmill Drive	West Bound Lane	150	200	350

4.2.1 Pavement Condition

A visual pavement condition survey of Airport Road was carried out in July 2019 in accordance with the procedures outlined in the Ministry of Transportation of Ontario (MTO) *Manual for Condition Rating of Flexible Pavements - Distress Manifestations (SP-024).* The Pavement Condition Evaluation Forms are included in Appendix E and the observed pavement distresses and evaluated pavement condition are summarized in the following table.

Section	Overall Condition	General Distresses
Airport Road Sta. 9+965 to Sta. 15+210	PCR* = 80 RCR** = 8.0 Good to Excellent	▪ Throughout slight ravelling and coarse aggregate loss; ▪ Frequent slight single and multiple longitudinal wheel track cracking; ▪ Frequent moderate single and multiple centre line cracking; ▪ Frequent slight alligator centre line cracking; ▪ Extensive slight single and multiple pavement edge cracking; ▪ Extensive slight alligator pavement edge cracking; and ▪ Frequent slight half, full and multiple transverse cracking.
Airport Road Sta. 15+210 to Sta. 16+300	PCR* = 70 RCR** = 7.0 Good	▪ Extensive slight ravelling and coarse aggregate loss; ▪ Frequent moderate wheel track rutting; ▪ Intermittent moderate distortion; ▪ Intermittent slight single and multiple longitudinal wheel track cracking; ▪ Intermittent slight single and multiple centre line cracking; ▪ Frequent slight half, full and multiple transverse cracking; and ▪ Intermittent slight random map cracking.
Airport Road Sta. 16+300 to Sta. 17+370	PCR* = 80 RCR** = 8.0 Good to Excellent	▪ Throughout slight ravelling and coarse aggregate loss; ▪ Intermittent slight single and multiple longitudinal wheel track cracking; ▪ Intermittent slight single and multiple centre line cracking; ▪ Frequent slight single and multiple pavement edge cracking; ▪ Frequent slight alligator pavement edge cracking; and ▪ Frequent slight half, full and multiple transverse cracking.

* PCR = Pavement Condition Rating. ** RCR = Ride Condition Rating.

4.2.2 Subgrade Soils

The pavement subgrade as encountered in the 1.5 m deep pavement boreholes, consist of silty clay to clayey silt, silty sand to silt, and gravelly sand to gravel soils.

The results of particle size analysis conducted on two samples of the silty clay to clayey silt material are shown in Figure B3 in Appendix B. The test results show a grain size distribution consisting of 0% gravel, 21% and 30% sand, 45% and 51% silt and, 19% and 34% clay size particles. Based on the particle size analysis, the silty clay to clayey silt subgrade soils have a low to moderate frost susceptibility (LSFH to MSFH) and the erodibility (K factor) of the two tested samples are 0.33 and 0.44. The moisture contents of two samples of the silty clay to clayey silt subgrade soils are 19% and 24% by weight.

The results of particle size analysis conducted on three samples of the silty sand to silt soils are shown in Figure B4 in Appendix B. The test results show a grain size distribution consisting of 0% to 7% gravel, 5% to 60% sand, 26% to 86% silt and, 7% to 9% clay size particles. Based on the particle size analysis, the silty sand to silt subgrade soils have a low to high frost susceptibility (LSFH to HSFH) and the erodibility (K factor) of the three tested samples range from 0.18 to 0.60. The moisture contents of the three samples of the silty sand to silt subgrade soils range from 9% to 19% by weight.

The result of particle size analysis conducted on a sample of the gravelly sand to gravel soils is shown in Figure B5 in Appendix B. The test results show a grain size distribution consisting of 23% gravel, 64% sand, 10% silt and, 3% clay size particles. Based on the particle size analysis, the gravelly sand to gravel material has a low frost susceptibility (LSFH) and its erodibility (K factor) is 0.05. The moisture content of a sample of the gravelly sand to gravel soils is 7% by weight.

4.3 Fill – Silty Clay

Silty clay fill was encountered at this site. The locations, thicknesses, depths and base elevations of the silty clay fill are summarized in the following table.

Borehole No.	Fill Thickness (m)	Fill Depth (m)	Fill Base Elevation (m)
BH 1	1.5	2.4	273.4
BH 24	0.9	1.8	293.0
BH 24A	0.9	1.8	293.1

Standard Penetration tests carried out in the silty clay fill measured SPT N-values ranging from 6 to 16 blows for 0.3 m of penetration indicating a firm to very stiff consistency. The natural water content of two samples of the silty clay fill are 15% and 25% by weight.

The grain size distribution curve of a sample of the silty clay fill is depicted on Figure B6 in Appendix B. These results show a grain size distribution consisting of 0% gravel, 13% sand, 62% silt and, 25% clay size particles.

4.4 Fill – Sand and Gravel

A 1.4 m thick sand and gravel fill layer was encountered at Borehole 64 extending to a depth of 2.1 m below ground surface, i.e. elevation 286.4 m. Standard Penetration tests carried out in the sand and gravel fill material measured SPT N-values of 6 and 22 blows for 0.3 m of penetration indicating a loose to compact relative density. The natural water content of a sample of the sand and gravel fill material is 7% by weight.

4.5 Fill – Silty Sand

Silty sand fill was encountered at this site. The locations, thicknesses, depths and base elevations of the silty sand fill are summarized in the following table.

Borehole No.	Fill Thickness (m)	Fill Depth (m)	Fill Base Elevation (m)
BH 64A	1.8	2.1	286.6
BH 80	2.2	2.9	313.7
BH 80A	2.2	2.9	313.7

Standard Penetration tests carried out in the silty sand fill measured SPT N-values ranging from 2 to 45 blows for 0.3 m of penetration indicating a very loose to dense relative density. The natural water content of samples of the silty sand fill range from 6% to 17% by weight.

4.6 Peat

Layers of amorphous peat was encountered at two culvert locations at this site. The locations, thicknesses, depths and base elevations of the peat are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH64	0.8	2.9	285.6
BH 64A	1.6	3.7	285.0
BH 80	0.5	3.4	313.2
BH 80A	0.5	3.4	313.2

The natural water content of two samples of peat are 60% and 113% by weight.

4.7 Silty Clay Till

Silty clay till deposits were encountered at this site. The locations, thicknesses, depths and base elevations of the silty clay till deposits are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH 1	1.1	3.5*	272.3
BH 24	1.9	3.7	291.1
BH 24A	1.1	2.9	292.0

*Borehole termination depth

Standard Penetration tests carried out in the silty clay till deposits measured SPT N-values ranging from 8 to 53 blows for 0.3 m of penetration indicating a firm to hard consistency. The natural water content of two samples of the silty clay till deposits are 13% and 14% by weight.

The grain size distribution curve of a sample of the silty clay till deposit is depicted on Figure B7 in Appendix B. These results show a grain size distribution consisting of 3% gravel, 32% sand, 46% silt and, 19% clay size particles. Till soils can also be expected to contain random cobble and boulder inclusions.

4.8 Sand to Sandy Silt

Native deposits with a soil matrix composition that ranges from sand to sandy silt were encountered at this site. The locations, thicknesses, depths and base elevations of the sand to sandy silt deposits are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH 24	4.4	8.1*	286.7
BH 24A	5.2	8.1*	286.8
BH 64	2.3	5.2	283.3
	0.8	6.7	281.8
BH 64A	1.2	4.9	283.8
BH 80	2.9	8.1*	308.5
BH 80A	4.7	8.1*	308.5

*Borehole termination depth

Standard Penetration tests performed in the deposits of sand to sandy silt measured SPT N-values of 3 to more than 100 blows for 0.3 m of penetration, indicating a very loose to very dense relative density. The natural water content of samples of the sand to sandy silt deposits range from 3% to 34% by weight.

Five samples of the sand to sandy silt deposits were subjected to grain size distribution tests and the grain size distribution curves are illustrated in Figure B8 in Appendix B. The test results show a grain size distribution consisting of 0% to 8% gravel, 32% to 81% sand, 16% to 62% silt and, 2% to 6% clay size particles.

4.9 Clayey Silt

Clayey silt deposits were encountered at this site. The locations, thicknesses, depths and base elevations of the clayey silt deposits are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH 64	0.7	5.9	282.6
	4.0	10.7*	277.8
BH 64A	3.2	8.1*	280.6
BH 80	1.8	3.4	311.4

*Borehole termination depth

Standard Penetration tests carried out in the clayey silt deposits measured SPT N-values ranging from 0 (weight of hammer) to 19 blows for 0.3 m of penetration indicating a very soft to very stiff consistency. The natural water content of samples of the clayey silt deposits vary from 12% and 30% by weight.

The grain size distribution curves of three samples of the clayey silt deposits are depicted on Figure B9 in Appendix B. These results show a grain size distribution consisting of 0% gravel, 0% to 4% sand, 83% to 86% silt, and 10% to 17% clay size particles.

4.10 Ground Water Levels

Ground water conditions were observed in the boreholes during and upon completion of drilling. Boreholes 24A, 64A and 80A were instrumented with a 50 mm diameter standpipe piezometer. Summarized below are the ground water levels that were measured on separate visits after the completion of drilling.

Borehole No	Date	Water Levels	
		Depth (m)	Elevation (m)
24A	June 26, 2019 July 10, 2019	Dry* Dry	NA NA
64A	June 26, 2019 July 10, 2019	3.1 3.4	285.6 285.3
80A	June 26, 2019 July 11, 2019	2.0 2.2	314.6 314.4

*Piezometer flush mount casing observed to be destroyed during site visit.

The readings taken in the piezometer are stabilised water levels. However, the groundwater level can be expected to fluctuate seasonally and after severe weather events. The groundwater level will also be controlled by the free water level in the watercourses.

5.0 DISCUSSION AND ENGINEERING RECOMMENDATIONS

5.1 General

This section of the report presents interpretations of the factual geotechnical data and provides geotechnical design recommendations for preliminary designs. The discussions and recommendations presented herein are based on our understanding of the project and our interpretation of the factual data obtained from the subsurface investigations. If conditions are encountered during construction that are different than what is understood at the time this report was prepared, based on the subsurface conditions and testing described herein; Terraprobe must be consulted to update, supplement, or otherwise revise these recommendations as appropriate.

Where comments are made on construction, they are provided to highlight those aspects that could affect the design of the project, and for which special provisions or operational constraints may be required in the Contract Documents. Those requiring information on the aspects of construction should make their own interpretation and assessment of the geotechnical information provided, as such interpretation may affect proposed construction methods and techniques, equipment selection, scheduling, and the like.

The design recommendations provided herein are for preliminary civil designs for the following project components.

- Replacement of three existing culverts at Sta. 12+360, Sta. 15+750 and Sta. 17+145 with open footing or box concrete culverts;
- Replacement of an existing CSP culvert at Sta. 9+960 with a 700 mm CSP culvert;
- Rehabilitation of Airport Road between King Street and Huntsmill Drive, i.e. Sta. 10+000 to Sta. 17+370; and
- Active transportation improvements to Airport Road including intersection improvements and roundabouts as well as Old Church Road between Airport Road and Marilyn Street.

5.2 Consequence and Site Understanding Classification

Since Airport Road is an arterial road with a relatively high traffic volume, this transportation corridor if impacted; will also impact alternative transportation corridors and/or structures. Therefore, a “typical consequence level” is considered appropriate as outlined in Section 6.5 of the *Canadian Highway Bridge Design Code (CHBDC) S6-14*.

A “typical degree of site and prediction model understanding” has been utilized given the scope of the foundation investigation and laboratory testing programme. The consequence factor (ψ) and geotechnical resistance factors (Φ_{gu} & Φ_{gs}) used for designs and stipulated in Clause 6.5.2 and Clause 6.9 of the CHBDC S6-14, are based on a “typical consequence level” and a “typical degree of site and prediction model understanding”.

5.3 Seismic Design

5.3.1 Seismic Site Classification

Ground conditions for seismic site characterization were established based on the field investigation and laboratory testing data. The energy-corrected average penetration resistance, $\overline{N}_{60}$, as well as the subsurface conditions, were used to define the seismic site classification in accordance with Table 4.1 of the CHBDC. Based on this methodology and the borehole data, the structures at 12+360 and Sta. 17+145 shall be designed based on Site Class D and, the structure at Sta. 15+750 shall be designed based on Site Class E.

5.3.2 Spectral Response Values

The CHBDC requires that the seismic hazard values associated with the design earthquake be established based on the National Building Code of Canada (NBCC). These values, Peak Ground Acceleration (PGA), Peak Ground Velocity (PGV) and Spectral Acceleration (Sa) can be obtained from the Geological Survey of Canada (GSC) *"2015 National Building Code of Canada Seismic Hazard Calculator"* and are for a reference ground condition of Site Class C.

In accordance with Section 4.4.3.3 of the CHBDC, the NBCC values were adjusted to reflect local site conditions i.e. Site Class D for the structures at 12+360 and Sta. 17+145 and Site Class E for the structure at Sta. 15+750. As per Section 4.4.3.3 of the CHBDC, the value of PGA_{ref} for use with Tables 4.2 to 4.9 was taken as 80% of the PGA since the Sa(0.2)/PGA ratio is less than 2.0. PGA_{ref} values of 0.063 to 0.067 for the 2,475 year return were used. The NBCC spectral response values and the site specific design values are provided in the following tables.

NBCC Seismic Hazard Values 2% Exceedance in 50 years (2,475 Year Return Period)							
PGA (g)	**PGV (m/s)**	**Sa (0.2) (g)**	**Sa (0.5) (g)**	**Sa (1.0) (g)**	**Sa (2.0) (g)**	**Sa (5.0) (g)**	**Sa (10.0) (g)**
0.084	0.068	0.137	0.085	0.049	0.025	0.006	0.003
Site Specific Design Seismic Hazard Values (Structures at Sta. 12+360 & Sta. 17+145-Site Class D) 2% Exceedance in 50 years (2,475 Year Return Period)							
0.108	0.100	0.170	0.125	0.076	0.040	0.009	0.004
Site Specific Design Seismic Hazard Values Site (Structure at Sta. 15+750-Class E) 2% Exceedance in 50 years (2,475 Year Return Period)							
0.152	0.168	0.225	0.210	0.138	0.073	0.018	0.008

6.0 CULVERTS

6.1 Geotechnical Resistances - Structures at Sta. 12+360 & Sta. 17+145

From a geotechnical perspective, it is recommended that the new culverts be supported on spread footings. This foundation scheme has a high probability of acceptable structural performance and requires relatively shallow excavations.

The recommended founding depths and geotechnical resistances for footings (minimum footing width of 1.5 m) founded on undisturbed competent native soils are tabulated below:

Borehole Number	Existing Ground Surface Elevation (m)	Recommended Bottom of Footing Level Below Existing Ground Surface (m)	Founding Elevation (m)	Factored Geotechnical Resistance at ULS (kPa)	Factored Geotechnical Resistance at SLS (kPa) (25 mm Settlement)	Ground Bearing Surface
Culvert at Sta. 12+360						
BH 24	294.8	Below 2.8	Below 292.0	300	250	Silty Clay Till
BH 24A	294.9	Below 2.9	Below 292.0	175	150	Silty Sand to Sandy Silt

Borehole Number	**Existing Ground Surface Elevation (m)**	**Recommended Bottom of Footing Level Below Existing Ground Surface (m)**	**Founding Elevation (m)**	**Factored Geotechnical Resistance at ULS (kPa)**	**Factored Geotechnical Resistance at SLS (kPa) (25 mm Settlement)**	**Ground Bearing Surface**
Culvert at Sta. 17+145						
BH 80	316.6	Below 3.4	Below 313.2	175	150	Clayey Silt
BH 80A	316.6	Below 3.4	Below 313.2	175	150	Silty Sand to Sand and Silt

Keep excavations dry. Expeditiously pour a 75 mm thick layer of lean concrete (mud mat) on the bearing surface after approval by a geotechnical engineer. Soft/weak soils if encountered at the bearing surface must be removed and replaced with OPSS Granular "A" compacted to 95% Standard Proctor Maximum Dry Density.

The factored ULS and SLS values tabulated above are for vertical, concentric loads only. Effects of load inclination and eccentricity should be taken into account as outlined in Clause 6.10 of the CHBDC S6-14.

The SLS values provided correspond to a total settlement of 25 mm or less. The estimated total settlements are based on the assumption that the founding soils will be undisturbed during construction and that there will be no significant grade raise above the current road profile.

6.2 Geotechnical Resistances - Structure at Sta. 15+750

We understand that the existing 4.3 m wide culvert will be replaced with a single span structure with a span measuring 12.2 m in width. The soil deposits as encountered in boreholes 64 and 64A are weak/loose and, total settlements exceeding 25 mm are expected if the structure is founded on these native deposits. Therefore, we recommend that the new structure be supported on deep foundations.

It is likely that the new structure can be supported on Chance helical piles, a specialty product manufactured by Chance Anchors and distributed and installed by EBS Engineering and Construction. Because of the specialized nature of this pile type, the final design and type will be the Contractor's responsibility. However, for preliminary design purposes the recommended geotechnical resistance at the Ultimate Limit State (ULS) and the geotechnical reactions at the Serviceability Limit State (SLS) are 155 kN and 115 kN respectively.

The existing borehole data is inadequate for deep foundation designs (H-piles or Helical Piles). Therefore, further investigations are required within the footprint area of the new structure abutments to explore the depth of competent strata and to provide geotechnical recommendations for foundation designs.

6.3 Horizontal Geotechnical Resistances

The ultimate geotechnical horizontal resistance should be evaluated in accordance with Clause 6.10.5 of the CHBDC S6-14, applying the appropriate consequence and degree of site understanding factors as noted in Section 6.2.

In accordance with Clause 6.5.2, Clause 6.9, and Clause 6.10.5 of the CHBDC S6-14, the factored ultimate geotechnical horizontal resistance within the ground, close to the ground-structure interface and; the factored ultimate geotechnical horizontal shear resistance at the interface between the footing and the ground, shall be derived based on the following effective angle of internal friction values (ϕ').

- Structures at Sta. 12+360 & Sta. 17+145:
  Silty Clay Till – internal friction angle $\phi' = 29^o$;
  Sand to Sandy Silt – internal friction angle $\phi' = 30^o$; and
  Clayey Silt – internal friction angle $\phi' = 28^o$.

Along the interface between a shallow foundation and ground, an effective friction angle (δ_i') equivalent to 2/3 of the soil's effective angle of internal friction (ϕ') shall be used.

6.4 Design Frost Depth

Footings should be founded at a minimum depth of 1.2 m of earth cover below the lowest surrounding grade to provide adequate protection against frost penetration, as per OPSD 3090.101. In addition, footings should extend below any existing fill and surficial organic materials, where present.

6.5 Lateral Earth Pressure

6.5.1 Static Conditions

Earth pressures are generally calculated using the following expression:

$P_h = K(\gamma h + q)$
P_h = horizontal pressure on the wall (kPa)
K = lateral earth pressure coefficient
γ = unit weight of retained soil (kN/m^3)
h = depth below top of fill where pressure is computed (m)
q = value of any surcharge (kPa)

Earth pressures acting on the structure should be computed in accordance with Clause 6.12 of the CHBDC S6-14 and according to Clause 6.12.3 of the CHBDC S6-14; a compaction surcharge should also be added. For soils with an angle of internal friction ranging from 30º to 35º the magnitude should be 12 kPa at the top of the fill decreasing linearly to 0 kPa at a depth of 1.7 m; or decreasing linearly to 0 kPa at a depth of 2.0 m for soils with an angle of internal friction that exceeds 35º. Compaction equipment including hand operated vibratory equipment should comply with OPSS.MUNI 501.

Backfilling against the structures shall be carried out in accordance with OPSS 902 and granular backfill should be placed to the extents shown in OPSD 3101.150. During all stages of backfill placement the differential backfill height shall not be greater than 500 mm. The backfill material should be placed in loose lifts not exceeding 150 mm thick and compacted to at least 95% of the materials Standard Proctor Maximum Dry Density (SPMDD).

The lateral earth pressure coefficients are dependent on the material used as backfill and typical values are provided in the following table.

Wall Condition	**Lateral Earth Pressure Coefficient (K)**			
	OPSS Granular A or OPSS Granular B Type II ϕ = 35°; γ = 22.8 kN/m^3		OPSS Granular B Type I ϕ = 32°; γ = 21.2 kN/m^3	
	Horizontal Surface Behind Wall	Sloping Surface Behind Wall (2H:1V)	Horizontal Surface Behind Wall	Sloping Surface Behind Wall (2H:1V)
Active (Unrestrained Wall)	0.27	0.38*	0.30	0.46*
At rest (Restrained Wall)	0.43	-	0.47	-
Passive (Movement Towards Soil Mass)	3.70	-	3.25	-

* For wing walls.

The lateral earth pressure coefficients provided in the table above are “ultimate” values that require certain structural movements for the respective conditions to be mobilized. The values to use in design can be estimated from Figure C6.16 in the Commentary to the CHBDC S6.1-14.

6.5.2 Seismic Conditions

In accordance with Section 4.6 of the CHBDC, seismic loads must be considered in the design. The designs shall take into consideration:

- The wall should be designed to withstand the combined static lateral loads plus the earthquake induced loads;
- The horizontal seismic coefficient (k_h) used to calculate the seismic active pressure coefficient is taken as 1.0 times the PGA for structures that do not permit lateral yielding and 0.5 times PGA for structures that permit lateral yielding; and
- Where sloping backfill exists above the top of the wall, the weight of the backfill above the top of the wall should be treated as a surcharge when calculating the lateral earth pressure under seismic conditions.

The Mononobe-Okabe (M-O) method was used to calculate the active earth pressure coefficients for yielding and non-yielding walls assuming that the angle of friction between the wall and backfill material is 0.5 ϕ. The seismic active earth pressure coefficients tabulated below may be used for designs.

		Seismic Active Earth Pressure Coefficients (K)	
Location	**Wall Condition**	OPSS Granular A or OPSS Granular B Type II $\phi = 35^\circ$; $\delta = 17.5^\circ$ $\gamma = 22.8$ kN/m^3	OPSS Granular B Type I $\phi = 32^\circ$; $\delta = 16.0^\circ$ $\gamma = 21.2$ kN/m^3
		Horizontal Surface Behind Wall	Horizontal Surface Behind Wall
Structures at Sta. 12+360 & Sta. 17+145	K_{AE} (Yielding Wall)	0.28	0.31
	K_{AE} (Non-Yielding Wall)	0.31	0.35
Structure at Sta. 15+750	K_{AE} (Yielding Wall)	0.29	0.33
	K_{AE} (Non-Yielding Wall)	0.34	0.38

6.6 Erosion Protection

Erosion protection should be provided at the forward and side slopes of the culverts as well as at the culvert inlets and outlets. Design of an erosion protection scheme will depend on hydrologic, hydraulic, and/or other watercourse parameters.

A clay seal can be provided such that water flow is channelled through the culvert and does not seep through the backfill around and underneath the structure. The clay seal should extend to cover all the granular backfill materials, should be a continuous layer around the culvert inlet and outlet, should have a minimum compacted thickness of 0.6 m, and should extend at least 1 m above the high water level. The clay seal should also be protected by a layer of rip-rap. Material used for the clay seal should conform to the requirements stipulated in OPSS.MUNI 1205. Alternatively, concrete cut-off and head walls can be constructed at the culvert inlet and outlet to protect the granular backfill and prevent seepage around the culvert.

We recommend that a qualified geomorphology/hydraulics engineer be consulted to design the specifics of the channels i.e. thickness and extent of protection and scour depth. Footings must also be placed below the scour depth.

7.0 EMBANKMENTS

7.1 Embankment Construction

The existing road platform may be widened in some areas. No stability problems are anticipated for up to 4.0 m high embankments provided that the side slope geometry is 2 Horizontal to 1 Vertical (2H:1V) or flatter.

Embankments constructed with local earth fill will also settle during construction (fill compression) and, the magnitude of this settlement is expected to be about 1% of the fill height. Provided that non-cohesive earth fill is used, this settlement should be immediate in nature and essentially be complete shortly after construction is complete.

Materials used for embankment construction should be placed in lifts not exceeding 300 mm (before compaction), and each lift should be uniformly compacted to at least 95 % of the material's SPMDD. Embankment construction should be carried out in accordance with OPSS.MUNI 206 and OPSS.MUNI 501. Borrow material must meet the requirements of OPSS.MUNI 212 and bonding between existing fill and new fill should be carried out by benching in accordance with OPSD 208.010.

It is recommended that any deleterious material, soft/loose and other unsuitable soils be removed within an envelope given by an imaginary slope not steeper than 1H:1V from the toe of the widened embankment. The exposed subgrade should be inspected, approved, and properly compacted from the surface in accordance with OPSS MUNI 501.

7.2 Erosion Protection

Proper erosion control measures should be implemented both during construction and permanently. Temporary erosion and sediment control must be provided in accordance with OPSS 805 and slopes must be reinstated with permanent erosion protection in accordance with OPSS 803 and OPSS.MUNI 804. It is also imperative that the slopes be designed as much as practical to prevent surface water runoff from flowing directly down the face of the slope. This can be accomplished by directing surface water runoff to armoured outfalls/outlets and in the case of cut slopes, constructing swales at the crest of the cut to intercept surface water runoff.

8.0 GROUND WATER CONTROL

While the design of the dewatering system is the Contractor's responsibility, provided herein are general approaches to ground water control. Surface water and ground water control will be necessary to enable construction below the ground water table. Around the perimeter of the excavations, an interceptor perimeter trench should also be installed to prevent surface water from entering the excavations.

The Ontario Ministry of Environment and Climate Change (MOECC) requires a Permit to Take Water (PTTW) for any ground water and storm water takings in excess of 400 m^3/day. If the ground water and storm water taking is between 50 m^3/day and 400 m^3/day, then the activity must be registered on the Environmental Activity and Sector Registry (EASR).

The hydraulic conductivity of the subgrade soils at the culvert locations were estimated from slug test results, grain size distribution curves and our experience and judgement. The estimated ground water elevations and hydraulic conductivities tabulated below may be used for the calculation of ground water seepage into excavations when excavation geometry details are available.

Location	Estimated Ground water Elevation (m)	Estimated Hydraulic Conductivity (m/s)	
Structure at Sta. 12+360	293.0	Silty Clay Till	$1x10^{-8}$
		Silty Sand to Sandy Silt	$1x10^{-6}$
Structure at Sta. 15+750	286.5	Silty Sand to Sand & Silt	$5x10^{-5}$
		Clayey Silt	$1x10^{-7}$
		Sand	$1x10^{-4}$
Structure at Sta. 17+145	314.5	Silty Sand to Sand & Silt	$5x10^{-5}$
		Clayey Silt	$1x10^{-7}$

The assessment shall also include provisions for a two-year storm event.

9.0 EXCAVATIONS

All excavations shall be carried out in accordance with the guidelines outlined in the *Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects*. Where workers must enter excavations deeper than 1.2 m, the trench walls must be suitably sloped and/or braced in accordance with the OHSA. Within the envisaged depths of temporary excavations, the OHSA soil classifications for this site are:

- Fill Soils – Type 3 soil above the ground water table and Type 4 soil below the ground water table;
- Silty Clay Till – Type 3 soils;
- Sand to Sandy Silt – Type 4 soils;
- Clayey Silt – Type 4 soils.

The side slopes of temporary excavations may be formed no steeper than 1H:1V for Type 3 soils and 3H:1V or flatter for Type 4 soils. Excavations should be undertaken in accordance with OPSS 902.

10.0 TEMPORARY PROTECTION SYSTEMS

Temporary protection systems should be designed in accordance with OPSS.MUNI 539 by a licensed Professional Engineer experienced in shoring design. The shape of the soil pressure distribution diagram behind a temporary protection system depends upon the type of soil to be supported and the amount of movement that can be permitted. The sequence of work will also alter the shape of the pressure diagram during the various construction phases.

Earth pressure computations must also take into account the groundwater level. Above the groundwater level, earth pressure is computed using the bulk unit weight of the retained soil. Below the groundwater level, the earth pressures are computed using the submerged unit weight of the soil. A hydrostatic pressure is also applied if the retained soil is not fully drained.

Flexible shoring should be designed based on the active earth pressure coefficient (K_a). In this case, the performance level should be Level 2 – Angular Distortion 1:200 but shall not be more than 25 mm. Where limited shoring movement (Performance Level 1A or 1B) is required the design should be based on the at rest earth pressure coefficient (K_o). For “kick out” design the lateral resistance should be computed based on the passive earth pressure coefficient (K_p). It should be noted that the lateral earth pressure coefficients chosen for design require certain movements for the active and passive conditions to be mobilized.

The appropriate lateral earth pressure parameters for use in the design of structures subject to unbalanced earth pressures are provided in the following table. These are guideline values and, selection of the appropriate design parameters is the responsibility of the shoring designer. The lateral earth pressure coefficients assume that the ground surface behind the temporary protection system is horizontal. Where the retained ground is sloping, the lateral earth pressure coefficients must be adjusted to account for the slope and, these lateral earth pressure coefficients can be estimated from the equations provided on Figures C6.17 and C6.18 of the CHBDC S6.1-14.

Stratigraphic Unit	**Friction Angle ϕ (degrees)**	**Unit Weight γ (kN/m³)**	**Active Earth Pressure Coefficient**	**At - Rest Earth Pressure Coefficient**	**Passive Earth Pressure Coefficient**
			K_a	**K_o**	**K_p**
Existing Fill	29	19	0.35	0.52	2.88
Silty Clay Till	29	21	0.35	0.52	2.88
Sand to Sandy Silt	30	20	0.33	0.50	3.00
Clayey Silt	28	19	0.36	0.53	2.77

The lateral earth pressure coefficients tabulated above are ultimate values and require specific movements for the active and passive conditions to be mobilized. The values to use in design can be estimated from Figure C6.16 in the CHBDC S6.1-14.

11.0 PAVEMENT DESIGN

The pavement design recommendations provided herein are related to the following aspects of this project:

- Rehabilitation and localized widening of Airport Road to accommodate intersection improvements between Sta. 9+965 and Sta. 17+370;
- Improvements to the intersections within the project limits by implementing either a roundabout configuration or an improved signalized intersection;
- Rehabilitation of Old Church Road between Sta. 1+100 and Sta. 1+600; and
- Active transportation improvements to Airport Road including intersection improvements and roundabouts.

11.1 Traffic Data

The traffic data provided by IBI and the derived Equivalent Single Axle Loads (ESALs) are tabulated below. The ESAL calculations are provided in Tables F1, F2 and F3 in Appendix F.

Traffic Volume and Pavement Design Parameters	**Location**		
	Airport Rd. (Road Widening)	**Airport Rd. (Roundabouts)**	**Old Church Road**
AADT	Yr. 2017 – 9,000 Yr. 2019 – 9,307 Yr. 2021 – 9,624 Yr. 2041 – 13,456	Yr. 2017 – 9,000 Yr. 2019 – 9,307 Yr. 2021 – 9,624 Yr. 2041 – 13,456	Yr. 2017 – 6,000 Yr. 2019 – 6,205 Yr. 2021 – 6,416 Yr. 2041 – 8,971
Percent Commercial Vehicles	8%	8%	8%
Annual Growth Rate	1.69%	1.69%	1.69%
Directional Split	0.5	1.0	0.5
Cumulative ESALs for Design Period	4,708,200	9,409,320	3,143,520

11.2 Pavement Designs

The pavements were designed based on the traffic information interpreted by IBI and the data obtained from the field investigations. The following references and guidelines were used for the pavement designs.

- MTO's "Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions, MI-183", March 19, 2008;
- American Association of State Highway and Transportation Officials, "*AASHTO Guide for Design of Pavement Structures*", 1993; and
- *"Procedures for Estimating Traffic Loads for Pavement Designs,"* Hajek. J., 1995.

The pavement design parameters are summarized in the following table.

Design Parameters	**Values**	
Initial/Terminal Serviceability Index	P_i = 4.4	P_t = 2.2
Design Period (years)	20	
Estimated Cumulative Design ESAL's	Airport Rd. – Road widening Airport Rd. – Roundabouts Old Church Road	4,708,500 9,409,500 3,143,600
Desired Reliability (R) and Standard Deviation (SD)	R = 85%	SD = 0.44
Estimated Resilient Modulus of Subgrade Soil (MPa)	30 to 50	
Layer Coefficients of Hot Mix Asphalt (HMA)	New HMA = 0.42 Existing HMA = 0.2	
Layer Coefficients of Granular Material	New Gran. A = 0.14 New Gran B Type I = 0.09 Existing Granular = 0.12 and 0.09	
Drainage Coefficients	m = 1 (new granular base and subbase) m = 0.9 (existing granular base and subbase)	

11.3 Pavement Structure

11.3.1 New Construction (Widening Areas)

For the design ESALs tabulated in Section 9.2, the recommended pavement structures are:

Pavement Component/Parameter	**Airport Rd. (Road Widening)**	**Airport Rd. (Roundabouts)**
HMA Surface Course HL-1	50	50
HMA Binder Course HDBC	100*	100*
Granular A	150	150
Granular 'B' Type I Subbase Course	450	550
Structural Number Provided	125	134
Design Structural Number	122	133

* 2x50 mm thick lifts of upper and lower binder courses.

Partially paved shoulders shall be paved by extending the top two lifts of HMA i.e. 50 mm HL-1 and 50 mm of HDBC over the shoulders.

11.3.2 Rehabilitation

The structural capacity of the existing pavement was analysed using AASHTO's pavement overlay design procedure. Designs were carried out for a service life extension of 20 years. Tabulated below are the recommended rehabilitation techniques at corresponding sections of Airport Road and Old Church Road

Road	Section	Rehabilitation Technique	Structural Number Provided	Design Structural Number
Airport Road	Sta. 0+0965 to Sta. 15+210	Mill existing HMA partial depth of 50 mm and repave with 50 mm HL-1 Surface Course.	105	103
	Sta. 15+210 to Sta. 16+300	Remove existing HMA full depth and repave with 50 mm HL-1 Surface Course and 2x50 mm lifts of HDBC Binder Course.	110	103
	Sta. 16+300 to Sta. 17+370	Remove existing HMA full depth and repave with 50 mm HL-1 Surface Course and 2x50 mm lifts of HDBC Binder Course.	110	103
Old Church Road	Sta. 1+100 to Sta. 1+600	Remove existing HMA full depth. Add Granular A as required to achieve top of base design elevation and repave with 50 mm HL-1 Surface Course and 2x50 mm lifts of HDBC Binder Course.	111	109

11.4 Material Types

The following mix types as specified in OPSS 1150 and Region of Peel specifications are considered suitable for this project.

- HL-1 Surface Course; and
- HDBC Binder Course.

Granular A material should be used for the granular base and Granular B Type I is recommended as subbase material. The Granular A and Granular B Type I material shall meet the OPSS.MUNI 1010 specifications.

11.5 Padding

HL3 HS is recommended as padding where grade adjustments require HMA thicknesses that are less than 50 mm. Padding should be placed in lifts not exceeding 50 mm thick.

11.6 Asphalt Cement Grade

Performance graded asphalt cement PG 64-28 conforming to Region of Peel specifications and OPSS MUNI 1101 is recommended for the surface course and upper binder course. The Region of Peel also recommends that PG 64-28 be used for the lower binder course.

Asphalt cement used in the manufacture of hot mix asphalt surface and binder courses should not contain Vacuum Tower Asphalt Extenders (VTAE), Refined Engine Oil Bottoms (REOB) or Waste Engine Oil

Residue (WEOR). Therefore, we recommend testing the Asphalt Cement properties and attributes in accordance with the test requirements outlined in OPSS Special Provision No. 111F09.

11.7 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.

11.8 Pavement Tapers

At the limits of construction, appropriate tapering of the pavement thickness to match the existing pavement structure should be implemented.

11.9 Compaction

Asphalt concrete should be placed and compacted in accordance with OPSS 310 and Region of Peel specifications. Granular base and subbase materials should be placed in 150 mm lifts and compacted to 100% of the material's Standard Proctor Maximum Dry Density (SPMDD) at ±2% of its Optimum Moisture Content (OMC) in accordance with OPSS.MUNI 501.

11.10 Drainage

11.10.1 Subdrains

Urban sections will require subdrains placed beneath the curb in accordance with the Region of Peel Standards 5-2-15A and 5-2-15B. Rural sections shall be constructed in accordance with OPSD 200.010. To provide positive surface water run-off as well as drainage across the pavement platform, the pavement surface should be sloped (normally 2%) and the pavement subgrade should be sloped at 3% towards the sides.

11.10.2 Pipe Culverts

Minor pipe culverts shall be installed in accordance with OPSD 802.010. Granular A material is recommended for embedment/bedding and cover to these pipes. Clean native soils can also be used as cover provided that these soils are placed below the design frost depth. Granular frost tapers will be required when the frost line is below the top of culvert.

11.11 Stripping

For estimating purposes assume an average topsoil stripping depth of 150 mm. Full depth removal of the topsoil and any other deleterious material is required prior to constructing the pavements.

11.12 Pavement Removals

Refer to the tabulated average pavement thicknesses in Section 5.2 for the appropriate asphalt and granular thickness to use for estimating purposes.

11.13 Reuse of Existing Granular Material

The grain size analyses of samples of the pavement granular material indicates that the sampled material generally does not meet the OPSS.MUNI 1010 gradation requirements for Granular A and Granular B Type I material.

Therefore, granular material salvaged from under the existing pavement and shoulders is not recommended for re-use to construct the pavement base and subbase. This granular material can be used as non-structural fill elsewhere, provided that it is free of topsoil and other deleterious material.

11.14 Subgrade Preparation (New Construction and Widening)

All topsoil, organics, soft/loose and otherwise disturbed soils should be removed from the subgrade areas. The design subgrade is expected to consist of fine grained soils or granular soils such as silty sands and gravelly sands. The fine grained soils (such as silty clays and clayey silts) will be weakened by construction traffic when wet, especially if site work is carried out during periods of wet weather. During these weather conditions, an adequate granular working surface would be required in order to minimize subgrade disturbance. Subgrade preparation and fill construction should not be done in the winter.

Immediately prior to placing the granular base course, the subgrade soils should be compacted and then proofrolled with a heavy rubber tired vehicle (such as a loaded gravel truck). 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 excavated and replaced with well-compacted and clean fill.

The fill may consist of either granular material or local inorganic soils provided that their moisture contents are within ±2% of optimum. Fill material should be placed and compacted in accordance with OPSS MUNI 501 and the upper 300 mm thick layer of the subgrade soils should be compacted to 98% of the material's Standard Proctor Maximum Dry Density (SPMDD).

11.15 Fill Materials

Borrow material shall comply with the OPSS.MUNI 212 specification. The placement of borrow material must be carefully monitored and it must be properly compacted as specified in OPSS.MUNI 501 to ensure adequate pavement support. Mixing of materials from different sources is not recommended due to the risks associated with differential settlement, drainage problems and frost heave. Further verification and approval of fill material will be required during construction.

Soils of low to medium frost susceptibility can be used as fill up to the proposed pavement design subgrade elevation. Soils with high frost susceptibility are not recommended for re-use within a zone extending to a maximum depth of 1.2 m below the proposed pavement design subgrade. These soils should be segregated and used elsewhere.

At the time of construction, the moisture content of the fill material shall be within ±2% of its Optimum Moisture Content (OMC). Reconditioning of the fill material to achieve optimum moisture content may be required prior to placement.

11.15.1 Soil Erodibility

Refer to the pavement borehole logs for the derived “K” factors. The soil erodibility of the subgrade soils ranges from low to high based on “K” factors of 0.05 to 0.60.

11.15.2 Frost Penetration and Frost Susceptibility

For design purposes assume a frost penetration depth of 1.2 m. Based on MTO’s *Pavement Design and Rehabilitation Manual, SDO 90-01,* the frost susceptibility of the subgrade soils ranges from low to high (LSFH to HSFH).

12.0 SOIL CHEMISTRY

The testing carried out is intended to provide an overview of the soil quality and may not be adequate for the design of a soil management plan for construction because the actual quality of the excavated soils could vary between and beyond the boreholes. The actual acceptance criteria for surplus soil will vary with the receiving site and therefore additional sampling/testing will likely be required during construction to confirm disposal or re-use options. Debris or stained/odorous soils, that are encountered during excavation, should be segregated, and re-evaluated for disposal or re-use as fill and may require additional chemical analysis. If the excavated material is to be disposed of off-site, it is the contractor’s responsibility to make arrangements and to identify a soil receiver that will accept excess soils.

12.1 Metals and Inorganics

To assess options for reuse or disposal of excess material that will be generated during construction, eight soil samples were submitted to SGS for chemical characterization with respect to general inorganic parameters including metals, pH, sodium adsorption ration (SAR) and electrical conductivity (EC). Based on visual and/or olfactory screening of soil samples, these nominal parameters are analysed when there are no indications of environmental impacts. The Certificates of Analysis are included in Appendix C.

The analytical results were compared to Table 1 (Agricultural) of the *MOE Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act*, April 15, 2011. Summarized in the following table are the borehole numbers and samples where the tested parameters exceeded the guideline value.

Borehole No	**Approx. Station**	**Location**	**Sample Depth (m)**	**Exceedances**			
				EC	**SAR**	**Chromium VI**	**Lead**
BH 1	9+965	SBL	0.3 – 0.9	✓	✓	-	-
BH 24	12+360	NBSH	0.0 – 0.9	✓	✓	-	-
BH 24A	12+360	SBSH	1.5 – 2.0	✓	✓	-	-
BH 59	15+200	NBL	0.3 – 0.9	✓	✓	-	-
BH 64	15+740	NBL	0.9 – 1.2	✓	✓	✓	-
BH 74	16+600	NBL	0.2 – 0.9	✓	✓	-	✓
BH 80	17+145	SBL	0.7 – 1.2	✓	✓	-	-

12.2 Petroleum Hydrocarbons

Eight soil samples were tested for petroleum hydrocarbons (F1 to F4 and F4G fractions, Semi-Volatile Organic compounds and Volatile Organic compounds). The analytical results were compared to Table 1 (Agricultural) of the *MOE Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act*, April 15, 2011. The locations of the tested samples and the exceedances are summarized in the following table.

Borehole No	Approx. Station	Location	Sample Depth (m)	Exceedances		Notes
				F4 (C34 to C50)	Trichloroethylene	
BH 103	13+875	NBL	0.7 – 1.0	-	-	No Exceedances
BH 41	13+915	NBL	0.9 – 1.5	-	-	No Exceedances
BH 44	14+120	NBL	0.9 – 1.5	-	-	No Exceedances
BH 45	14+140	SB-Off Rd.	0.8 – 1.2	-	✓*	*Exceedances Recorded for Multiple Parameters, Refer to Appendix C for Details
BH 104	14+560	NBSH	0.4 – 1.5	-	-	No Exceedances
BH 66	15+890	NBL	1.4 – 1.5	-	✓	-
BH 105	16+135	SBL	0.9 – 1.5	✓	-	-
BH 77	16+900	NBL	0.6 – 1.5	-	-	No Exceedances

12.3 Metals and Inorganics, VOCs, PCBs (TCLP)

Two soil samples were submitted to SGS for chemical characterization in accordance with the Ontario Ministry of Environment (MOE) Toxicity Characterization Leachate Procedure (TCLP) with respect to general inorganic parameters including metals, pH, sodium adsorption ratio (SAR) and electrical conductivity (EC), volatile organic compounds (VOCs) and total PCBs.

The analytical results were compared to Ontario Regulation 558. Comparison of the test results to the MOE Standard indicates that the tested soil parameters were below the guideline values.

12.4 Asbestos

Three asphalt cores were tested for the presence of asbestos and the reported test results indicate that no asbestos was detected. The Asbestos test results are provided in Appendix C.

13.0 LIMITATIONS AND RISK

13.1 Procedures

This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Terraprobe and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained by Terraprobe.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with the most stringent level of care may fail to detect certain conditions. Terraprobe has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations. The conditions that Terraprobe has interpreted to exist between sampling points can differ from those that actually exist.

It may not be possible to drill a sufficient number of boreholes or sample and report them in a way that would provide all the subsurface information that could affect construction costs, techniques, equipment, and scheduling. Contractors bidding on or undertaking work on the project should be directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their own investigations and their own interpretations of the factual investigation results, cognizant of the risks implicit in the subsurface investigation activities so that they may draw their own conclusions as to how the subsurface conditions may affect them.

13.2 Changes in Site and Scope

It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions. Ground water levels are particularly susceptible to seasonal fluctuations.

The discussion and recommendations are based on the factual data obtained from investigations made by Terraprobe and are intended for use by the owner and its retained designers in the design phase of the project. If there are changes to the project scope and development features the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant or complete for the revised project. Terraprobe should be retained to review the implications of such changes with respect to the contents of this report.

This report was prepared for the express use of the Region of Peel, IBI Group and its retained design consultants. This report is copyright of Terraprobe Inc. and no part of this report may be reproduced by any means, in any form, without the prior written permission of Terraprobe Inc. The Region of Peel, IBI Group and their retained design consultants are authorized users with permission to extract or summarize text from this report as well as the Falling Weight Deflectometer Report provided that these reports are referenced.

Terraprobe Inc.

Sepideh D-Monfared.

LICENSED PROFESSIONAL ENGINEER
S.DAMAVANDINEJAD MONFARED
100523519
Nov 20, 2020
PROVINCE OF ONTARIO

Sepideh D-Monfared, MESc, P.Eng.
Geotechnical Engineer

Rehman Abdul.

LICENSED PROFESSIONAL ENGINEER
R.A. ABDUL
Nov 20, 2020
PROVINCE OF ONTARIO

Principal, Senior Geotechnical Engineer

REFERENCES

American Association of State Highway Officials, *AASHTO Guide for Design of Pavement Structures*, 1993.

ASTM D1586 - 08a, *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*, 2008.

Bowles, J.E., 1984. *Physical and Geotechnical Properties of Soils*, Second Edition. McGraw Hill Book Company, New York.

Canadian Geotechnical Society, 1992. *Canadian Foundation Engineering Manual*, 3rd Edition. The Canadian Geotechnical Society c/o BiTech Publisher Ltd, British Columbia.

Canadian Highway Bridge Design Code (CHBDC) S6-14, CSA Group, December 2014. and *Commentary on CSA, S6.14, Canadian Highway Bridge Design Code, S6. 1-14.* December 2014.

Ontario Regulation 213/91, *Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects*, April 11, 2012.

Ministry of the Environment, April 15, 2011. *Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act*, PIBS # 7382e01.

Ministry of Transportation Ontario, *Adaption and Verification of AASHTO Pavement Design Guide for Ontario Conditions (MI-183*), 2008.

Ministry of Transportation Ontario. *Pavement Design and Rehabilitation Manual (SDO 90-01)*, 1990.

Ministry of Transportation Ontario, *Manual for Condition Rating of Flexible Pavements - Distress Manifestations (SP-024)*, August 1989.

Ontario Provincial Standard Specifications (OPSS)

OPSS.MUNI 206	Construction Specification For Grading.
OPSS.MUNI 212	Construction Specification For Earth Borrow.
OPSS 310	Construction Specification for Hot Mix Asphalt.
OPSS.MUNI 501	Construction Specification For Compacting.
OPSS.MUNI 539	Construction Specification For Temporary Protection Systems.
OPSS 803	Construction Specification For Sodding.
OPSS.MUNI 804	Construction Specification For Seed and Cover.
OPSS 805	Construction Specification For Temporary Erosion And Sediment Control Measures.
OPSS 902	Construction Specification For Excavating and Backfilling – Structures.
OPSS 1001	Material Specification for Aggregates - General
OPSS.MUNI 1010	Material Specification For Aggregates – Base, Subbase, Select Subgrade and Backfill Material.
OPSS.MUNI 1101	Material Specification for Performance Graded Asphalt Cement.
OPSS 1150	Material Specification for Hot Mix Asphalt.
OPSS.MUNI 1205	Material Specification For Clay Seal

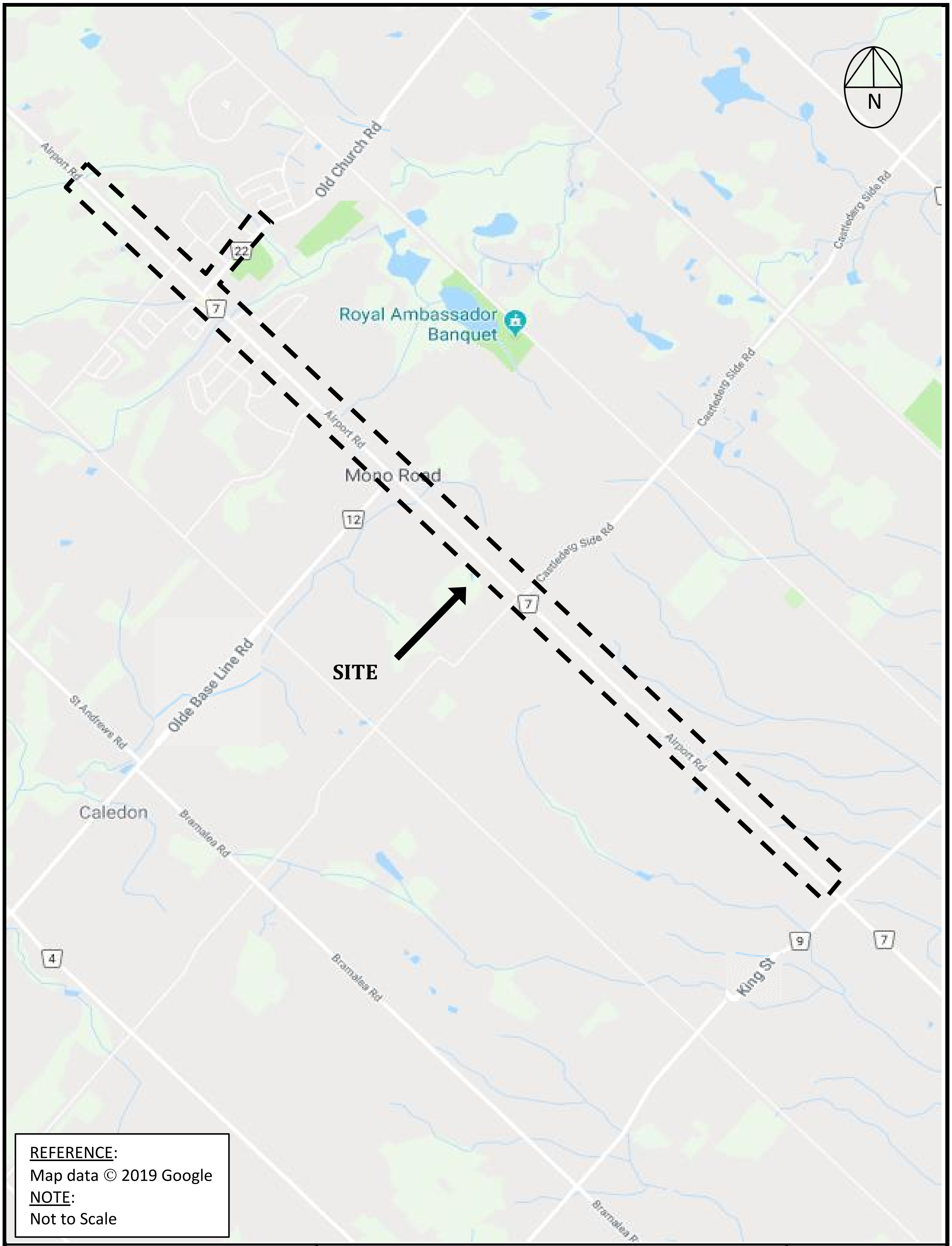
Ontario Provincial Standard Drawings (OPSD)

OPSD 200.010	Earth/Shale Grading, Undivided Rural
OPSD 208.010	Benching Of Earth Slopes.
OPSD 802.010	Flexible Pipe, Embedment and Backfill, Earth Excavation
OPSD 3090.101	Foundation, Frost Penetration Depths For Southern Ontario
OPSD 3101.150	Walls Abutment Backfill, Minimum Granular Requirement

Region of Peel Standard Drawings

STD.DWG 5-2-15A	Region of Peel French Drain Trench Detail.
STD.DWG 5-2-15B	Region of Peel French Drain Trench with Subdrain Trench Details.

FIGURES



REFERENCE:
Map data © 2019 Google
NOTE:
Not to Scale

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Title:
SITE LOCATION PLAN
Airport Road Improvements

File No.: 1-17-0714

Figure: 1

SITE PHOTOGRAPHS	FIGURE 2

Photo 1: Airport Road at Sta. 9+900, Looking South at South Project Limit

Photo 2: Airport Road at Sta. 9+900, Looking North

Project No. :	1-17-0714	Terraprobe Inc.	Prepared by :	SD
Date :	July, 2019		Checked by :	RA

SITE PHOTOGRAPHS | **FIGURE 3**

Photo 3: Airport Road at Sta. 11+100, Looking South

Photo 4: Airport Road at Sta. 11+100, Looking North

Project No. : 1-17-0714
Date : July, 2019

Terraprobe Inc.

Prepared by : SD
Checked by : RA

SITE PHOTOGRAPHS

FIGURE 4

Photo 5: Airport Road at Sta. 12+900, Looking South

Photo 6: Airport Road at Sta. 12+900, Looking North

Project No. : 1-17-0714

Date : July, 2019

Terraprobe Inc.

Prepared by : SD

Checked by : RA

SITE PHOTOGRAPHS

FIGURE 5

Photo 7: Airport Road at Sta. 13+880, Looking South

Photo 8: Airport Road at Sta. 13+880, Looking North

Project No. : 1-17-0714

Date : July, 2019

Terraprobe Inc.

Prepared by : SD

Checked by : RA

SITE PHOTOGRAPHS

FIGURE 6

Photo 9: Airport Road at Sta. 15+200, Looking South

Photo 10: Airport Road at Sta. 15+200, Looking North

Project No. : 1-17-0714

Date : July, 2019

Terraprobe Inc.

Prepared by : SD

Checked by : RA

SITE PHOTOGRAPHS

FIGURE 7

Photo 11: Airport Road at Sta. 15+720, Looking South

Photo 12: Airport Road at Sta. 15+720, Looking North

Project No. : 1-17-0714

Date : July, 2019

Terraprobe Inc.

Prepared by : SD

Checked by : RA

SITE PHOTOGRAPHS	FIGURE 8

Photo 13: Airport Road at Sta. 16+440, Looking South

Photo 14: Airport Road at Sta. 16+440, Looking North

Project No. : 1-17-0714
Date : July, 2019

Terraprobe Inc.

Prepared by : SD
Checked by : RA

SITE PHOTOGRAPHS	FIGURE 9

Photo 15: Airport Road at Sta. 17+150, Looking South

Photo 16: Airport Road at Sta. 17+150, Looking North at North Project Limit

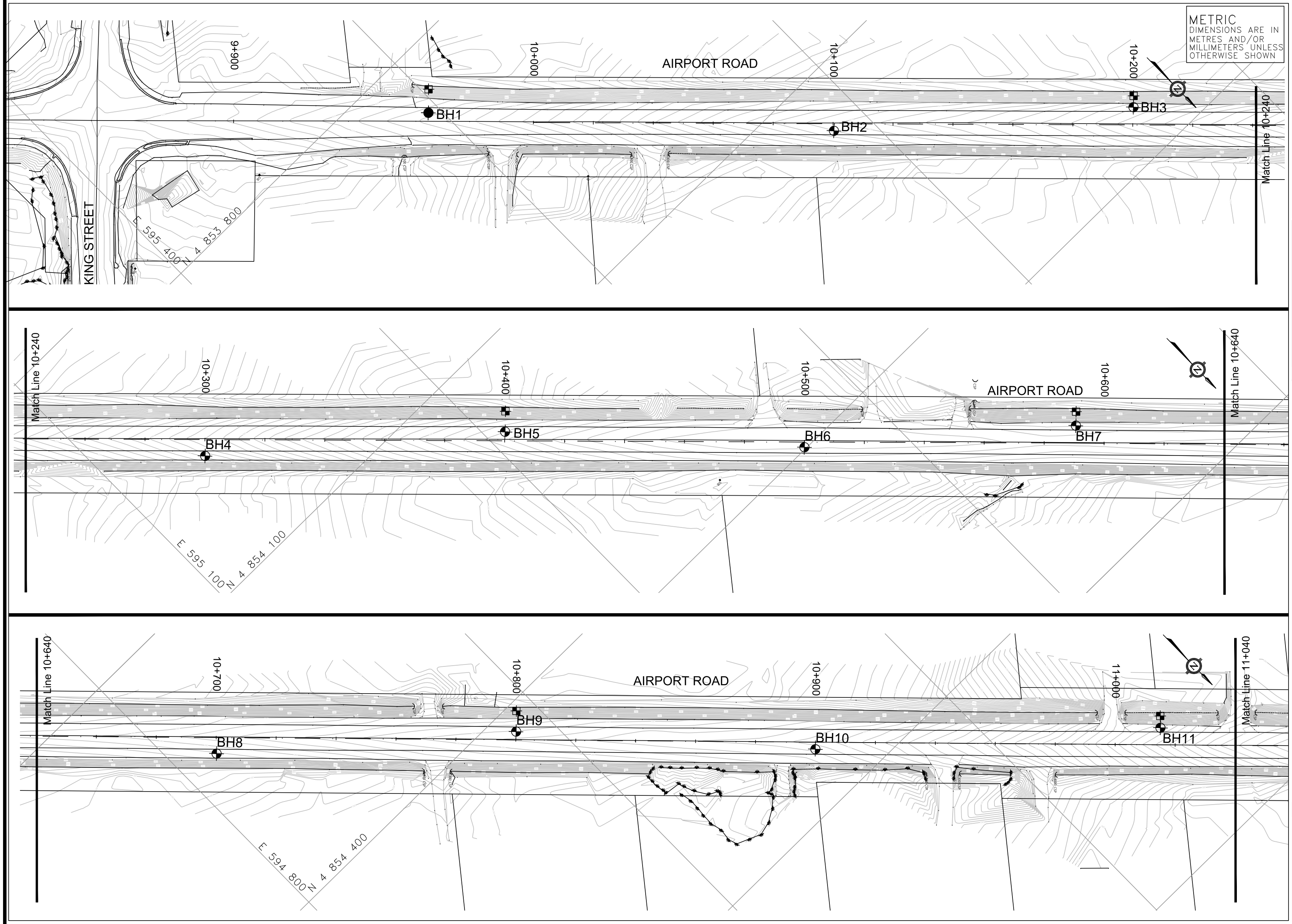
Project No. : 1-17-0714

Date : July, 2019

Terraprobe Inc.

Prepared by : SD

Checked by : RA



METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN

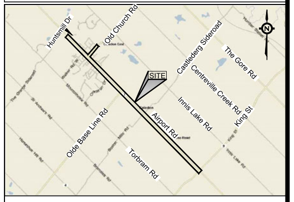
AIRPORT ROAD IMPROVEMENTS

FROM KING STREET TO HUNTSMILL DRIVE,
TOWN OF CALEDON, ONTARIO

BOREHOLE LOCATION PLAN

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



Not to Scale

KEY PLAN

LEGEND

●	Foundation Borehole
⊕	Pavement Borehole
▨	Test Pit

BH No	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE17)	
		NORTHING (m)	EASTING (m)
BH1	275.8	4 853 819.6	595 303.6

SCALE

10 5 0 5 10 15 20m

NOTE

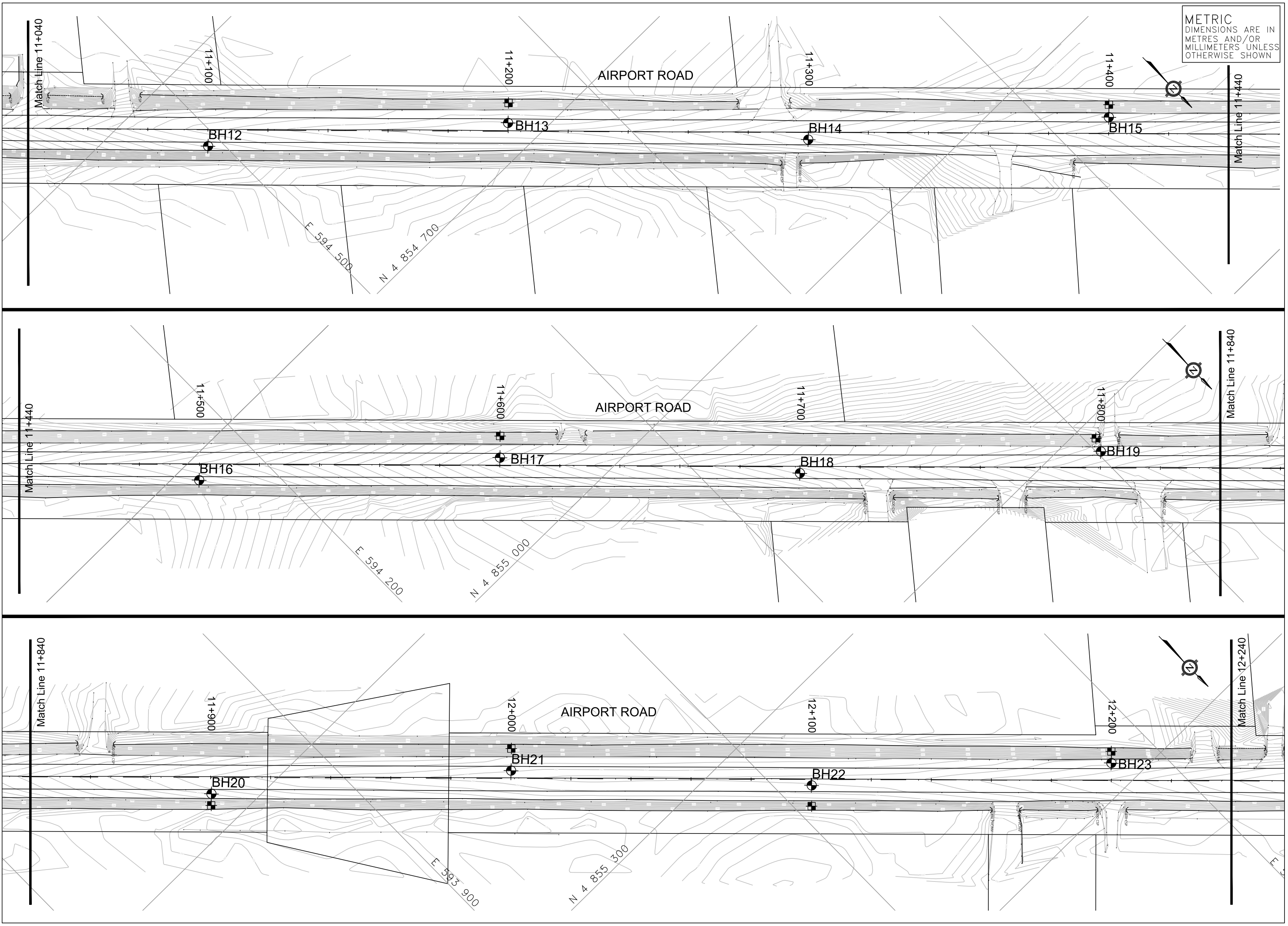
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

Drawing provided in digital format by IBI Group received June 19, 2019.

REVISIONS	DATE	BY	DESCRIPTION

DESIGN RA
PROJECT No. 1-17-0714
DATE July 2019
DRAWN KC
CHK RA
GEOCRES No.: –
FIGURE No. 10



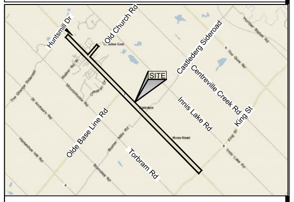
METRIC
DIMENSIONS ARE IN
METRES AND/OR
MILLIMETERS UNLESS
OTHERWISE SHOWN

AIRPORT ROAD IMPROVEMENTS
FROM KING STREET TO HUNTSMILL DRIVE,
TOWN OF CALEDON, ONTARIO

BOREHOLE LOCATION PLAN

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



Not to Scale

KEY PLAN

LEGEND

● Foundation Borehole

◈ Pavement Borehole

▨ Test Pit

BH No	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE17)	
		NORTHING (m)	EASTING (m)

SCALE

10 5 0 5 10 15 20m

NOTE

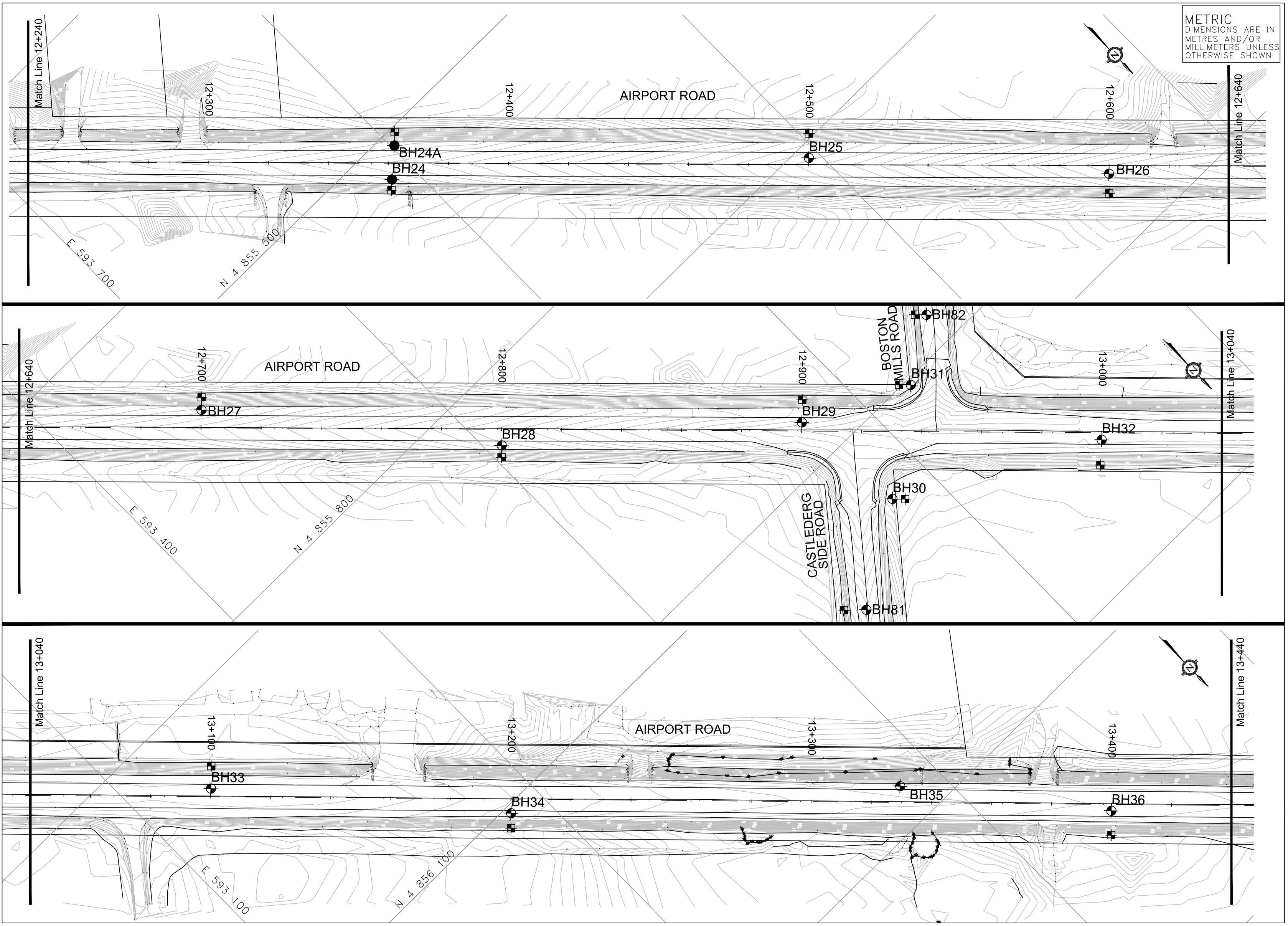
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

Drawing provided in digital format by IBI Group received June 19, 2019.

REVISIONS	DATE	BY	DESCRIPTION

DESIGN RA	PROJECT No. 1-17-0714		DATE July 2019
DRAWN KC	CHK RA	GEOCRES No.: –	FIGURE No. 11

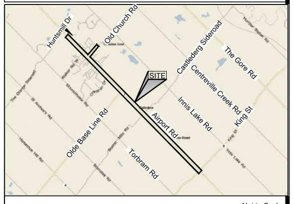


AIRPORT ROAD IMPROVEMENTS
FROM KING STREET TO HUNTSMILL DRIVE,
TOWN OF CALEDON, ONTARIO

BOREHOLE LOCATION PLAN

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



Not to Scale

KEY PLAN

LEGEND

- ● Foundation Borehole
- ⊕ Pavement Borehole
- ▨ Test Pit

BH No	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE17) NORTHING (m)	COORDINATES (UTM, NAD83, ZONE17) EASTING (m)
BH24	294.8	4 855 512.3	593 607.5
BH24A	294.8	4 855 504.8	593 599.0

SCALE

10 5 0 5 10 15 20m

NOTE

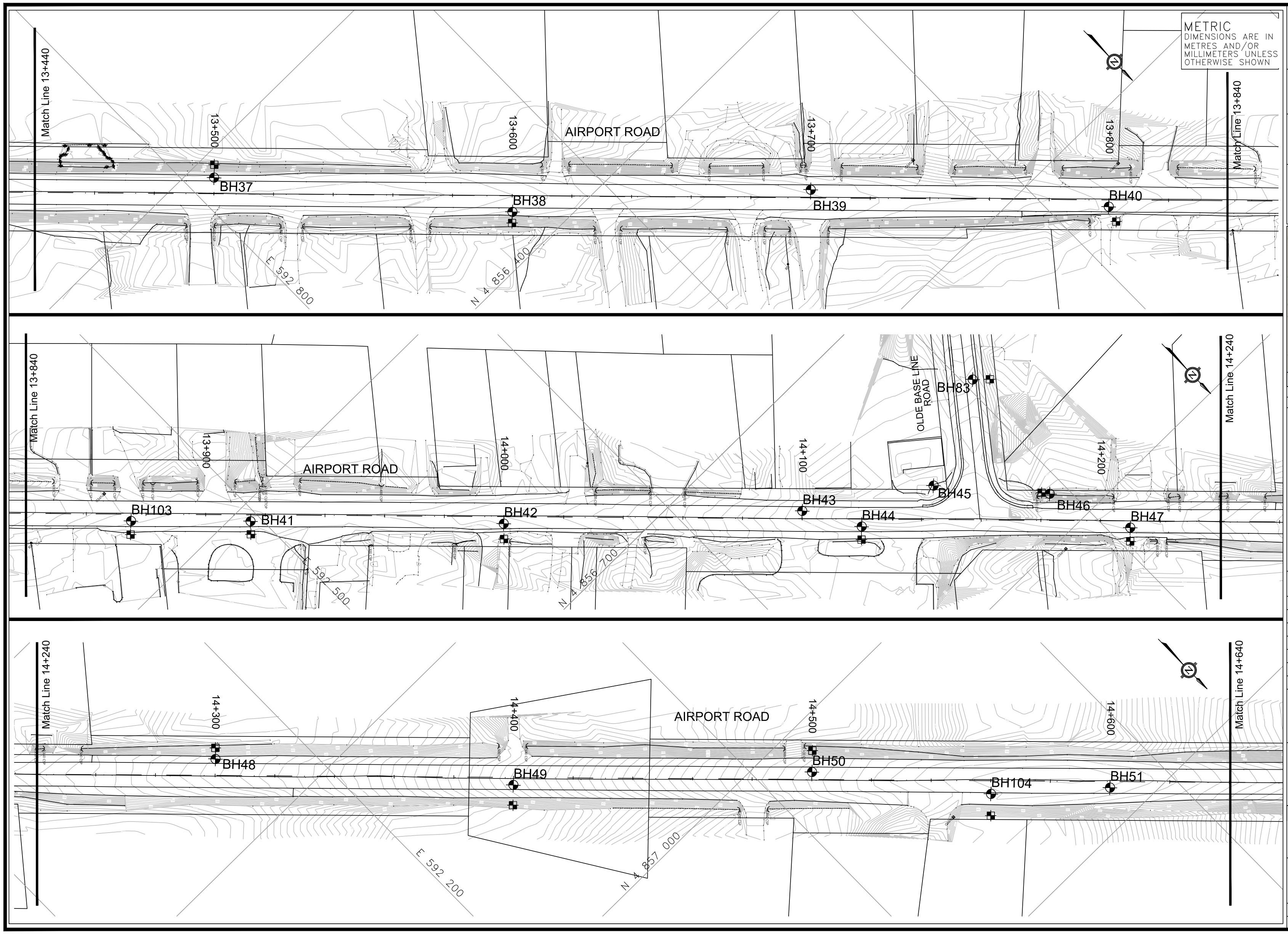
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

Drawing provided in digital format by IBI Group received June 19, 2019.

REVISIONS	DATE	BY	DESCRIPTION

DESIGN RA
PROJECT No. 1-17-0714
DATE July 2019
DRAWN KC
CHK RA
GEOCRES No.: –
FIGURE No. 12

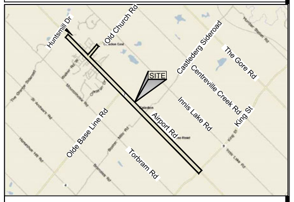


AIRPORT ROAD IMPROVEMENTS
FROM KING STREET TO HUNTSMILL DRIVE,
TOWN OF CALEDON, ONTARIO

BOREHOLE LOCATION PLAN

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



Not to Scale

KEY PLAN

LEGEND

- ● Foundation Borehole
- ⊕ Pavement Borehole
- ▣ Test Pit

BH No	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE17) NORTHING (m)	COORDINATES (UTM, NAD83, ZONE17) EASTING (m)

SCALE

10 5 0 5 10 15 20m

NOTE

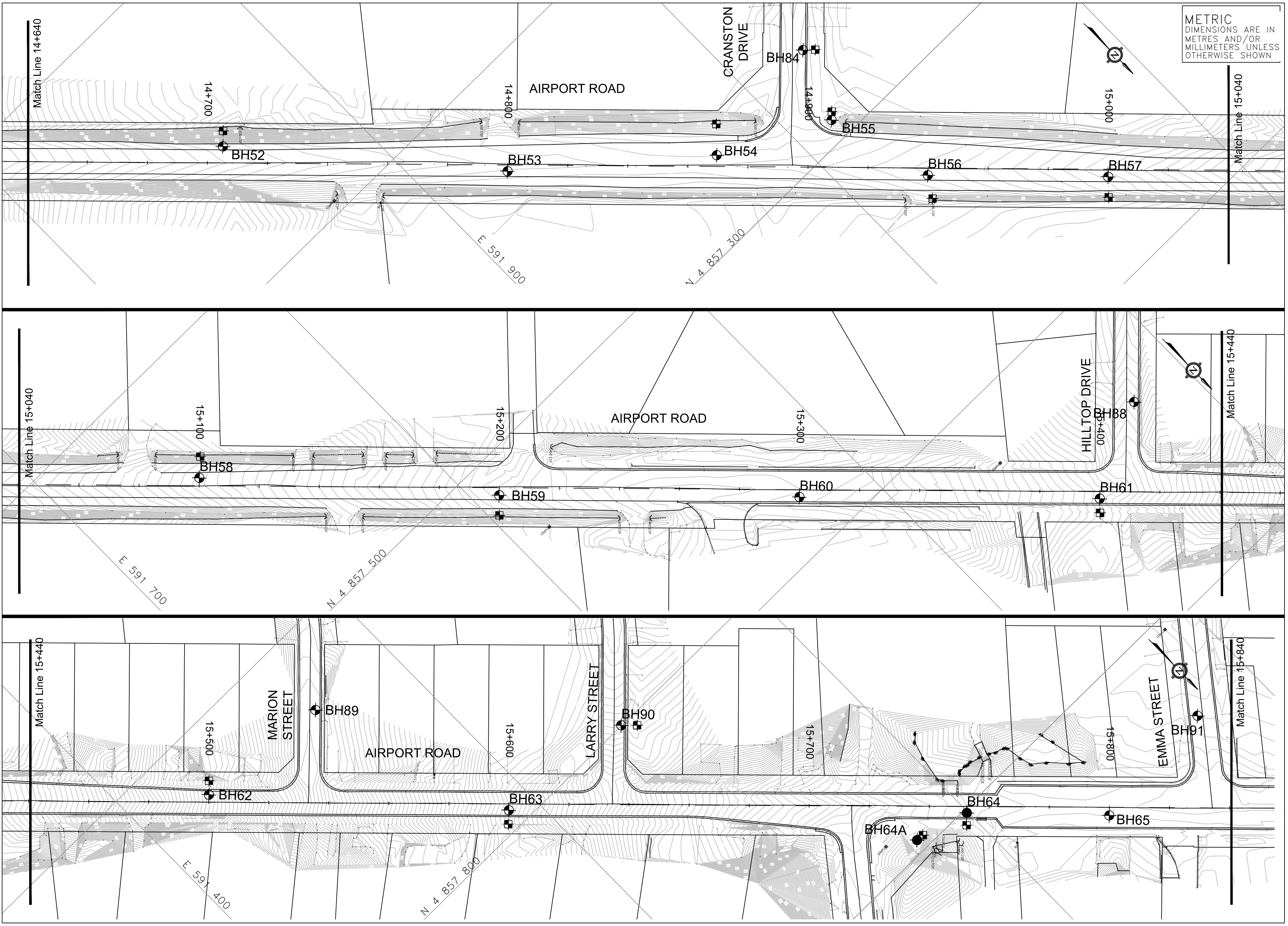
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

Drawing provided in digital format by IBI Group received June 19, 2019.

REVISIONS	DATE	BY	DESCRIPTION

DESIGN RA | PROJECT No. 1-17-0714 | DATE July 2019
DRAWN KC | CHK RA | GEOCRES No.: – | FIGURE No. 13



METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN

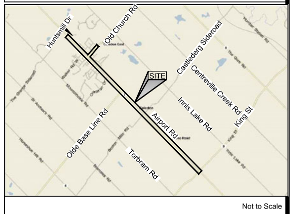
AIRPORT ROAD IMPROVEMENTS

FROM KING STREET TO HUNTSMILL DRIVE,
TOWN OF CALEDON, ONTARIO

BOREHOLE LOCATION PLAN

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



Not to Scale

KEY PLAN

LEGEND

- ⊕ Foundation Borehole
- ⊕ Pavement Borehole
- ▨ Test Pit

BH No	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE17) NORTHING (m)	COORDINATES (UTM, NAD83, ZONE17) EASTING (m)
BH64	288.5	4 857 901.2	591 200.4
BH64A	288.7	4 857 896.1	591 218.6

SCALE

10 5 0 5 10 15 20m

NOTE

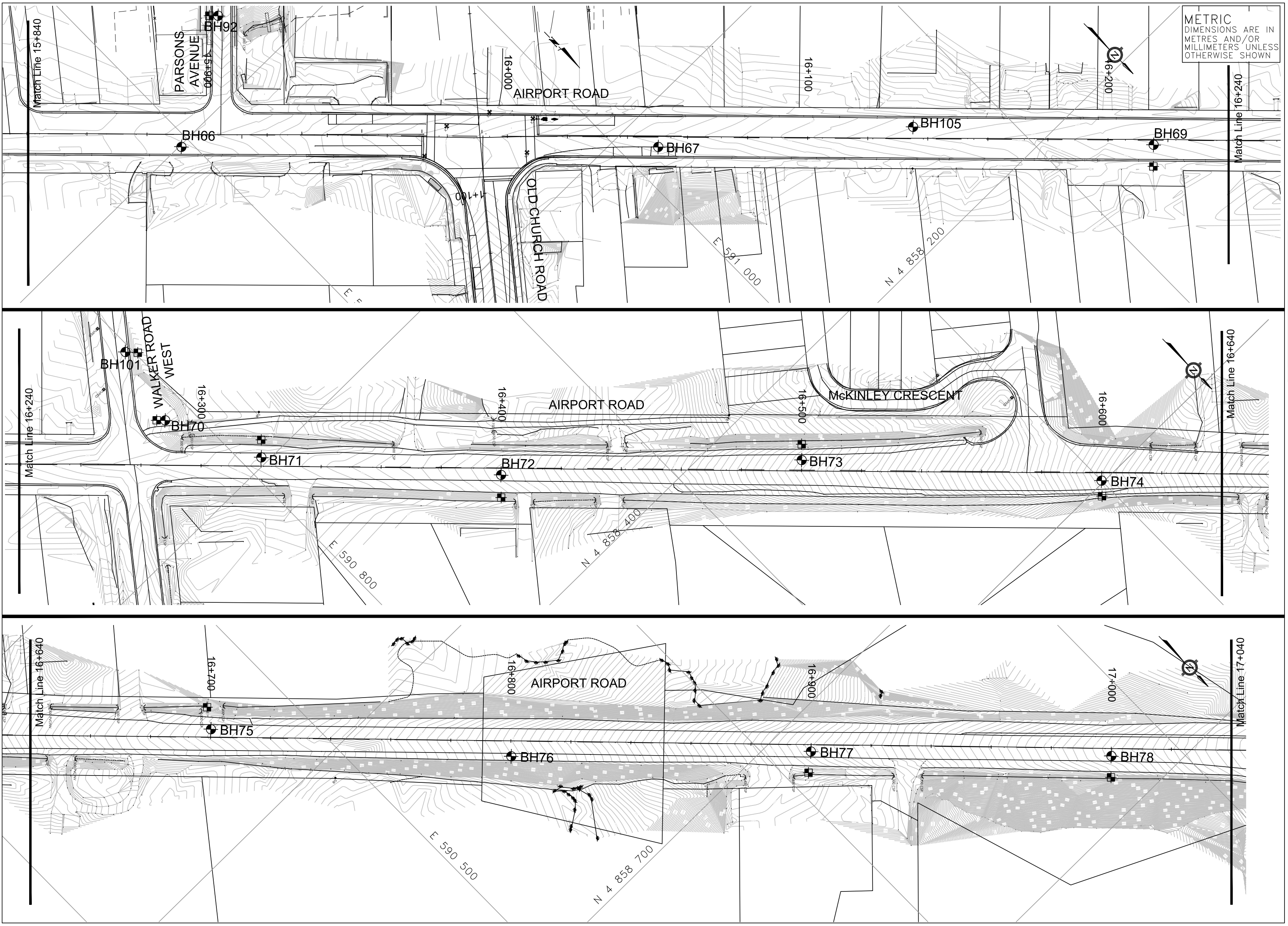
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

Drawing provided in digital format by IBI Group received June 19, 2019.

REVISIONS	DATE	BY	DESCRIPTION

DESIGN RA
PROJECT No. 1-17-0714
DATE July 2019
DRAWN KC
CHK RA
GEOCRES No.: –
FIGURE No. 14

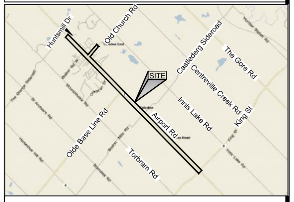


AIRPORT ROAD IMPROVEMENTS
FROM KING STREET TO HUNTSMILL DRIVE,
TOWN OF CALEDON, ONTARIO

BOREHOLE LOCATION PLAN

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



Not to Scale

KEY PLAN

LEGEND

●	Foundation Borehole
⊕	Pavement Borehole
▣	Test Pit

BH No	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE17)	
		NORTHING (m)	EASTING (m)

SCALE

10 5 0 5 10 15 20m

NOTE

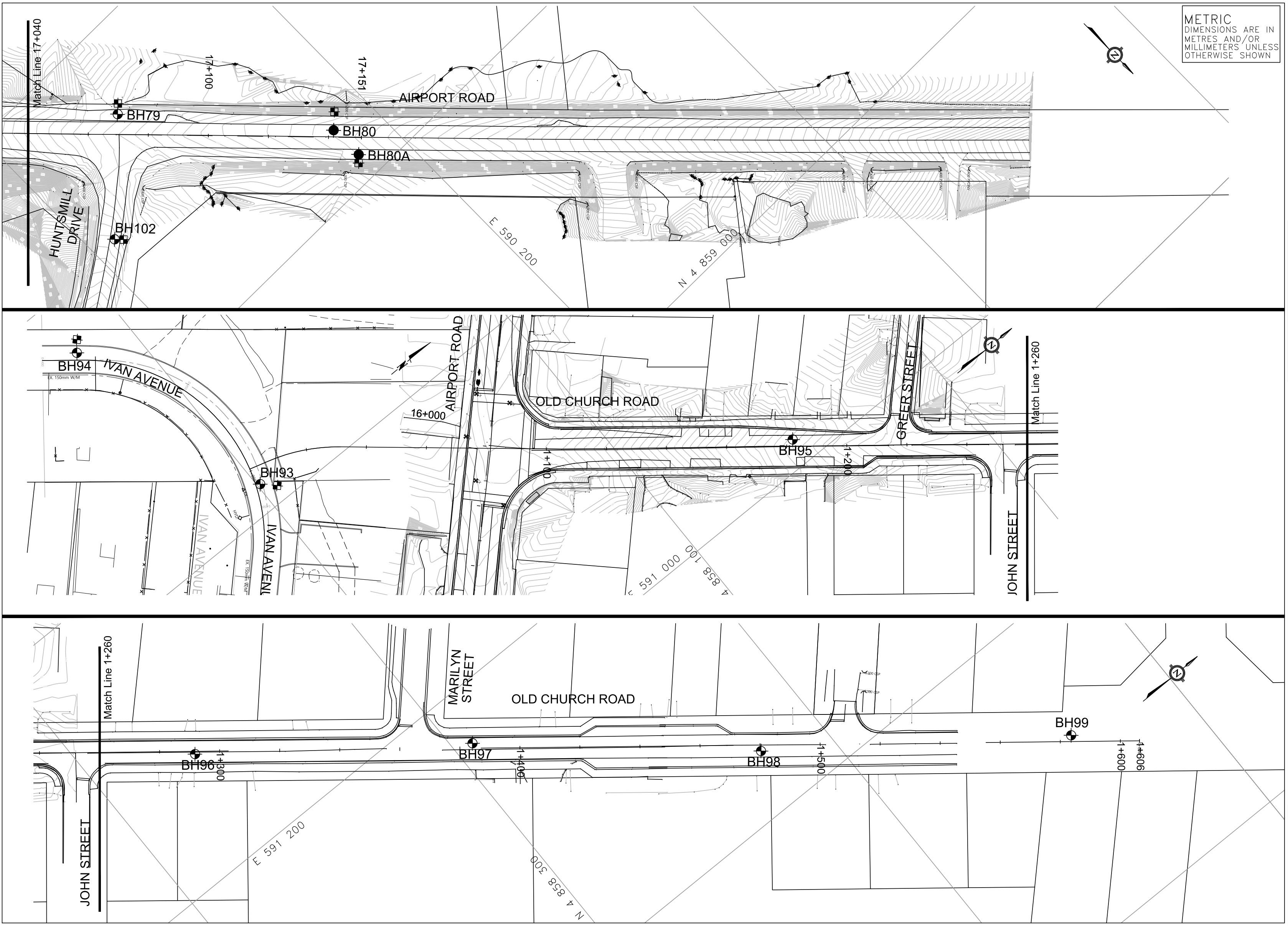
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

Drawing provided in digital format by IBI Group received June 19, 2019.

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN RA	PROJECT No. 1-17-0714		DATE July 2019
DRAWN KC	CHK RA	GEOCRES No.: –	FIGURE No. 15

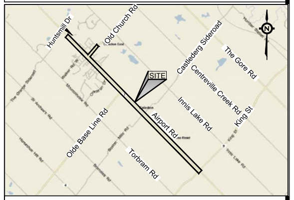


AIRPORT ROAD IMPROVEMENTS
FROM KING STREET TO HUNTSMILL DRIVE,
TOWN OF CALEDON, ONTARIO

BOREHOLE LOCATION PLAN

IBI GROUP
100-175 Galaxy Boulevard
Toronto ON M9W 0C9 Canada
tel 416 679 1930 fax 416 675 4620
ibigroup.com

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



Not to Scale

KEY PLAN

LEGEND

- ● Foundation Borehole
- ◈ Pavement Borehole
- ▩ Test Pit

BH No	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE17)	
		NORTHING (m)	EASTING (m)
BH80	316.6	4 858 879.9	590 214.5
BH80A	316.6	4 858 891.5	590 214.2

SCALE

10 5 0 5 10 15 20m

NOTE

This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

Drawing provided in digital format by IBI Group received Oct. 10, 2019 and June 19, 2019.

REVISIONS	DATE	BY	DESCRIPTION

DESIGN RA		PROJECT No. 1-17-0714	DATE July 2019
DRAWN KC	CHK RA	GEOCRES No.: –	FIGURE No. 16

APPENDIX A

Log of Borehole Sheets

Accep	acceptable
Agg	aggregate
Amor	amorphous
Asph	asphalt
BH	borehole
Bl	blue
Bld (y)	boulder (y)
Blds	boulders
Blk	black
Br	brown
BR	bedrock
BU	break up
CF	channel face
Cl (y)	clay (ey)
Co	coarse
Cob	cobbles
Comp	compact
Conc	concrete
Contam	contaminated
Cord	corduroy
Cr	crushed
D	dense
Decomp	decomposed
Dk	dark
D_R	relative density
E	earth
F	fine
FB	frost boil
FH	frost heave
Fib	fibrous
Fr Wat	free water
Gr (y)	gravel (ly)
Gran	granular
Grn	green

Gry	grey
H	heavy
Hi	highly
HM	hot mix
HP	high plasticity
Ip	plasticity index
L	loose
Liq	liquid
Lo	loam
Lt	light
Matl	material
Max	maximum
MDD	maximum dry density
Med	medium
Mod	moderate
Mott	mottled
MP	medium plasticity
Mrl	marl
Mul	mulch
MWD	maximum wet density
NFP	no further progress
NFP (blds)	no further progress (boulders)
Num	numerous
Ob	overburden
Occ	occasional
Ora	orange
Org	organic
Org M	organic matter
Pavt	pavement
Pedo	pedological
Pen Mac	penetration macadam
Poss	possible
PST	prime and surface treated
Psty	polystyrene

Quant	quantity
Reinf	reinforced
RF	rock fill
RSS	remoulded shear strength
Sa (y)	sand (y)
Sat	saturated
SH	shale
Sh Rk	shot rock
Si (y)	silt (y)
Sl (y)	slight (ly)
SP	slight plasticity
SSM	select subgrade material
St	sensitivity
Stn (y)	stone (y)
Stks	streaks
Surf	surface
Temp	temperature
TH	test hole
TP	test pit
Tps	topsoil
Tr	trace
Unreinf	unreinforced
USS	undisturbed shear strength
Varv	varved
VF	very fine
w	field moisture content
W	with
W_L	liquid limit
Wd (y)	wood (y)
Weath	weathered
Wopt	optimum moisture content
Wp	plastic limit
WT	water table
Yel	yellow

SUSCEPTIBILITY TO FROST HEAVING

HSFH – High
MSFH – Medium
LSFH – Low

ONTARIO PROVINCIAL STANDARD DRAWING

ABBREVIATIONS

GEOTECHNICAL

Nov 2006 | Rev 1

OPSD 100.060

Terraprobe

ABBREVIATIONS AND TERMINOLOGY

SAMPLING METHODS

AS	Auger sample
GS	Grab sample
SS	Split spoon
ST	Shelby tube
WS	Wash sample
RC	Rock core
SC	Soil core

PENETRATION RESISTANCE

Standard Penetration Test (SPT) N-value (penetration resistance) is defined as the number of blows required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.) with a hammer weighing 63.5 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.).

Dynamic Cone Penetration Test (DCPT) resistance is defined as the number of blows required to advance a conical steel point 50 mm (2 in.) base diameter tapered 60° to the apex and attached to 'A' size drill rods for a distance of 0.3 m (12 in.), with a hammer weighing 63.5 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.).

COHESIONLESS SOILS

Relative Density	N-value Blows/0.3m
Very loose	< 5
Loose	5 – 10
Compact	10 – 30
Dense	30 – 50
Very dense	> 50

COHESIVE SOILS

Consistency	N-value Blows/0.3m	Undrained Shear Strength (kPa)
Very soft	< 2	< 12
Soft	2 – 4	12 – 25
Firm	4 – 8	25 – 50
Stiff	8 – 15	50 – 100
Very stiff	15 – 30	100 – 200
Hard	> 30	> 200

MINOR SOIL CONSTITUENTS

Modifier (e.g)	% by weight
trace (trace silt)	< 10
some (some silt)	10 – 20
(ey) or (y) (sandy)	20 – 35
and (sand and silt)	> 35

TESTS AND SYMBOLS

MH	combined sieve and hydrometer analysis
w,	water content
w_L,	liquid limit
w_P,	plastic limit
I_P,	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
G_s	specific gravity
ϕ'	effective angle of internal friction
c'	effective cohesion
c_u	undrained shear strength (ϕ = 0 analysis)

▽	Unstabilized water level
▼	1st water level measurement
▼	2nd water level measurement
▼	Most recent water level measurement
3.0 +	Undrained shear strength from field vane (with sensitivity)
C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
c_v	coefficient of consolidation
m_v	coefficient of compressibility (volume change)
e	void ratio

FIELD MOISTURE DESCRIPTIONS

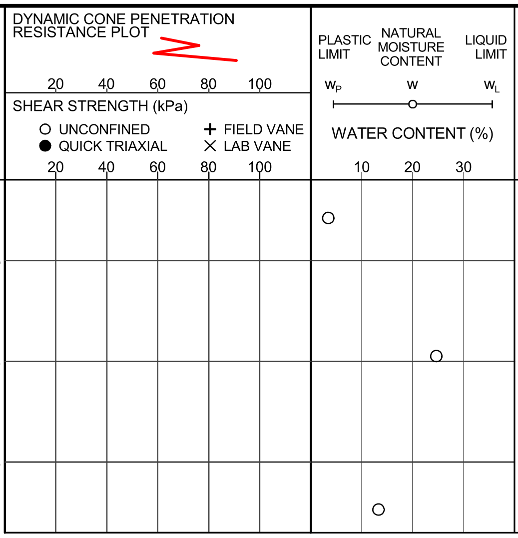
Dry	refers to a soil sample with a moisture content well below optimum ($w < w_{opt}$), absence of moisture, dusty, dry to the touch.
Moist	refers to a soil sample with a moisture content at or near optimum ($w \approx w_{opt}$), no visible pore water.
Wet	refers to a soil sample with a moisture content well above optimum ($w > w_{opt}$), has visible pore water.

LOG OF BOREHOLE 1

Project No. : 1-17-0714
Client : IBI Group
Originated by : SM
Date started : May 16, 2019
Project : Airport Road Improvements
Compiled by : SD
Sheet No. : 1 of 1
Location : Caledon, Ontario
Checked by : RA

Position : E: 595303.6, N: 4853819.6 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Truck-mounted
Drilling Method : Solid stem augers

SOIL PROFILE			SAMPLES									
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
275.8	**GROUND SURFACE**											
	300mm **ASPHALTIC CONCRETE**	■										
275.5 0.3	600mm **FILL**, gravelly sand, some silt, very dense, brown, dry	▩	1	SS	74				28	58	*(14)*	
274.9 0.9	**FILL**, silty clay, trace to some sand, trace gravel, trace organics, firm to stiff, grey, wet	▩	2	SS	14		275					
		▩	3	SS	8		274		0	13	62	25
273.4 2.4	**SILTY CLAY**, trace to some sand, trace gravel, stiff to hard, brown, moist (GLACIAL TILL)	▨	4	SS	14		273					
		▨	5	SS	42							
272.3 3.5												



END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

$+^3, \times^3$: Numbers refer to Sensitivity

$○^{3\%}$ STRAIN AT FAILURE

LOG OF BOREHOLE 24

Project No. : 1-17-0714
Date started : May 16, 2019
Sheet No. : 1 of 1

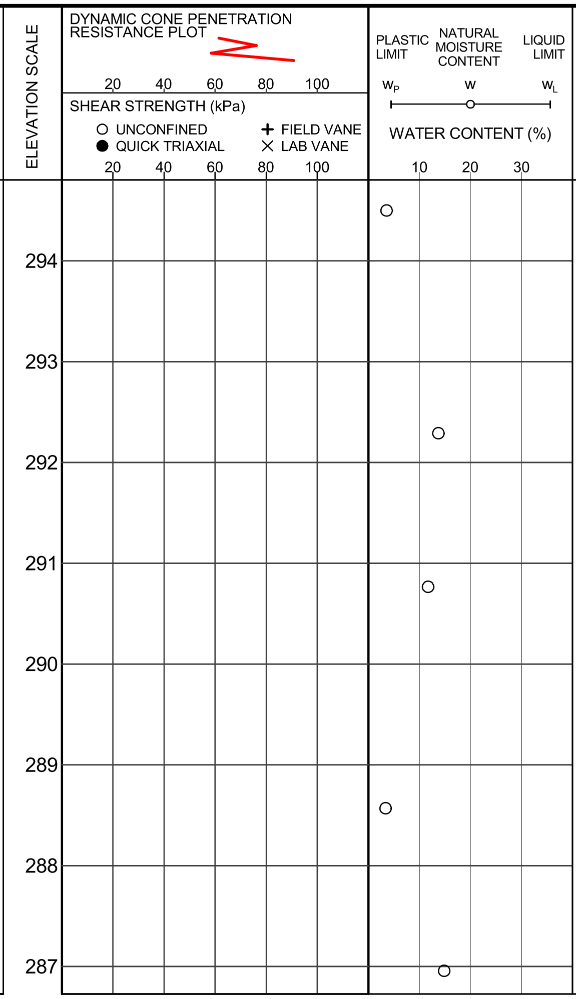
Client : IBI Group
Project : Airport Road Improvements
Location : Caledon, Ontario

Originated by : SM
Compiled by : SD
Checked by : RA

Position : E: 593607.5, N: 4855512.3 (UTM 17T)
Rig type : Truck-mounted
Elevation Datum : Geodetic
Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	NUMBER	TYPE	SPT 'N' VALUE	GR	SA	SI	CL
294.8	**GROUND SURFACE**							
	900mm **FILL**, sand and gravel, some silt, compact, brown, dry	1	SS	26	39	51	*(10)*	
293.9 0.9	**FILL**, silty clay, some sand, trace gravel, trace organics, firm to very stiff, grey, moist	2	SS	6				
		3	SS	16				
293.0 1.8	**SILTY CLAY**, some sand to sandy, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)	4	SS	19	3	32	46	19
		5	SS	53				
291.1 3.7	**SILTY SAND to SANDY SILT**, trace to some gravel, trace clay, dense to very dense, brown, moist to wet	6	SS	38				
		7	SS	52				
		8	SS	100/ 140mm				
		9	SS	50				
286.7 8.1	**END OF BOREHOLE**							

Borehole was dry and open upon completion of drilling.



+3, ×3: Numbers refer to Sensitivity

○3% STRAIN AT FAILURE

Terraprobe

LOG OF BOREHOLE 24A

Project No. : 1-17-0714
Date started : May 16, 2019
Sheet No. : 1 of 1

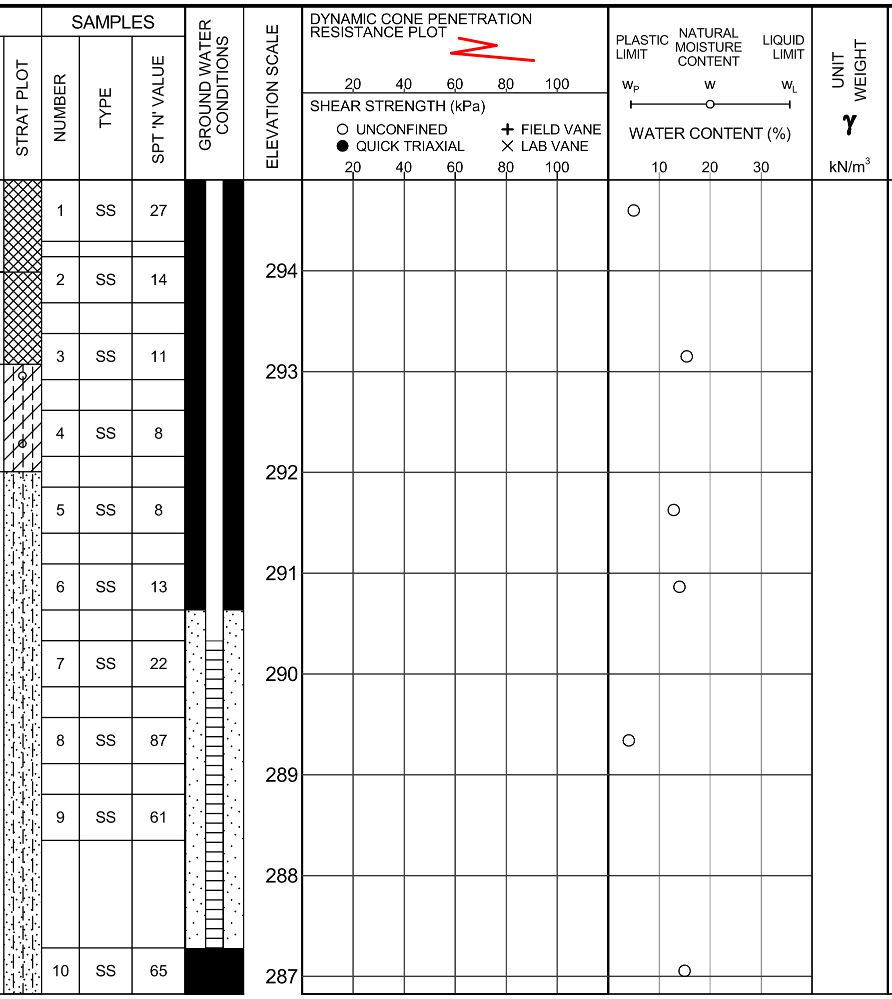
Client : IBI Group
Project : Airport Road Improvements
Location : Caledon, Ontario

Originated by : SM
Compiled by : SD
Checked by : RA

Position : E: 593599.0, N: 4855504.8 (UTM 17T)
Rig type : Truck-mounted

Elevation Datum : Geodetic
Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	NUMBER	TYPE	SPT 'N' VALUE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
294.9	**GROUND SURFACE**				
	900mm **FILL**, gravelly sand, trace to some silt, compact, brown, moist	1	SS	27	
294.0 0.9	**FILL**, silty clay, some sand to sandy, trace gravel, stiff, grey, moist	2	SS	14	
		3	SS	11	
293.1 1.8	**SILTY CLAY**, trace to some sand, trace gravel, firm to stiff, brown, moist (GLACIAL TILL)	4	SS	8	
292.0 2.9	**SILTY SAND to SANDY SILT**, trace to some gravel, trace clay, loose to very dense, brown, moist to wet	5	SS	8	
		6	SS	13	0 32 62 6
		7	SS	22	
		8	SS	87	resistance to augering at 5.6m
		9	SS	61	
		10	SS	65	sampler wet at 7.6m
286.8 8.1					



END OF BOREHOLE

Piezometer installation consists of a 50 mm diameter PVC pipe with a 3.0 m slotted screen.

* Piezometer flush mount casing observed to be destroyed during site visit of June 26, 2019

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 26, 2019	dry	n/a
Jul 10, 2019	dry	n/a

$+^3$, $\times^3$: Numbers refer to Sensitivity   ○ 3% STRAIN AT FAILURE

file: 1-17-0714-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 64

Project No. : 1-17-0714
Date started : May 29, 2019
Sheet No. : 1 of 1

Client : IBI Group
Project : Airport Road Improvements
Location : Caledon, Ontario

Originated by : MA
Compiled by : SD
Checked by : RA

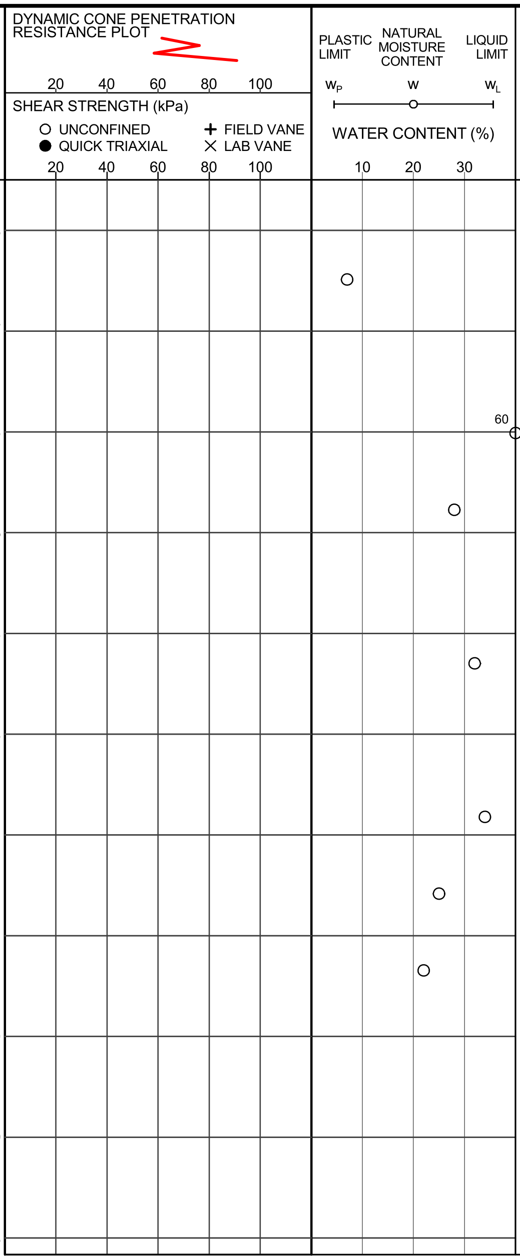
Position : E: 591200.4, N: 4857901.2 (UTM 17T)
Rig type : Truck-mounted
Elevation Datum : Geodetic
Drilling Method : Solid stem augers

SOIL PROFILE

ELEV DEPTH (m)	DESCRIPTION
288.5	**GROUND SURFACE**
288.3 0.2	150mm **ASPHALTIC CONCRETE**
287.8 0.7	550mm **FILL**, sand, some gravel, trace to some silt, dense, brown, dry to moist
286.4 2.1	**FILL**, sand and gravel, trace silt, containing asphaltic concrete, loose to compact, brown, moist to wet
285.6 2.9	**PEAT**, amorphous, black
283.3 5.2	**SILTY SAND**, trace to some gravel, trace clay, trace to some organics, very loose to loose, grey, wet
282.6 5.9	**CLAYEY SILT**, trace to some sand, trace gravel, firm, grey, wet
281.8 6.7	**SAND AND SILT**, trace clay, trace gravel, very loose, grey, wet
277.8 10.7	**CLAYEY SILT**, trace sand, trace gravel, very soft to stiff, grey, wet

SAMPLES

NUMBER	TYPE	SPT 'N' VALUE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	34	
2	SS	22	
			▽ sampler wet at 1.5m
3	SS	6	
4	SS	2	
5	SS	4	8 63 25 4
6	SS	3	
7	SS	5	
8	SS	6	
9	SS	3	1 59 36 4
10	SS	4	0 0 83 17
11	SS	0*	
12	SS	8	



GROUND WATER CONDITIONS

ELEVATION SCALE

UNIT WEIGHT γ kN/m³

END OF BOREHOLE

*Sampler sinking under weight of hammer and/ or rods.

Unstabilized water level measured at 1.4 m below ground surface; borehole caved to 1.8 m below ground surface upon completion of drilling.

file: 1-17-0714-01 bh logs.gpj

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

LOG OF BOREHOLE 64A

Project No. : 1-17-0714
Date started : May 29, 2019
Sheet No. : 1 of 1

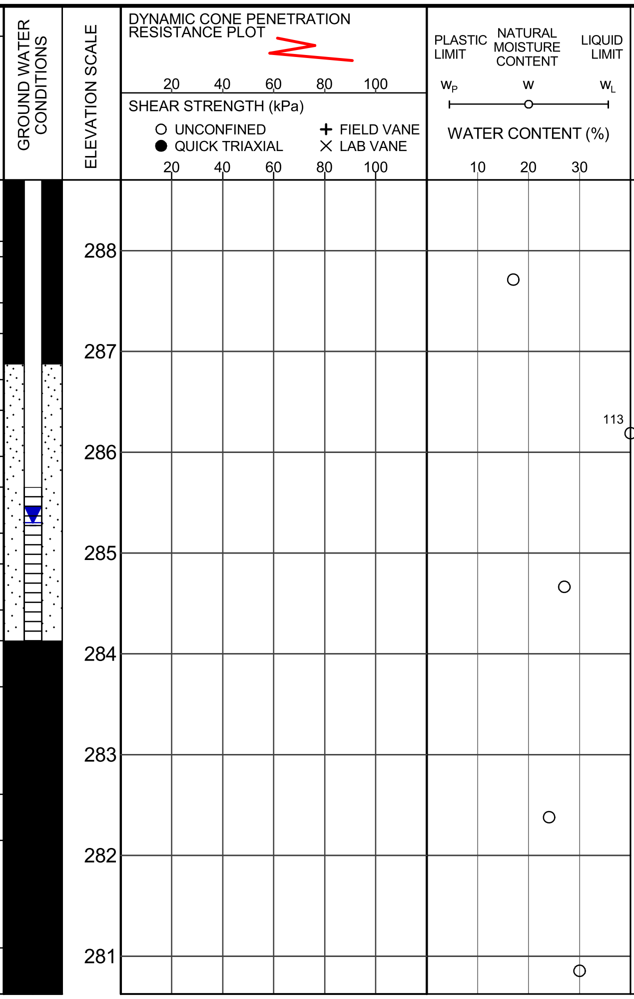
Client : IBI Group
Project : Airport Road Improvements
Location : Caledon, Ontario

Originated by : SM
Compiled by : SD
Checked by : RA

Position : E: 591218.6, N: 4857896.1 (UTM 17T)
Rig type : Geoprobe, truck-mounted
Elevation Datum : Geodetic
Drilling Method : Solid stem / hollow stem augers

ELEV DEPTH (m)	DESCRIPTION
288.7	**GROUND SURFACE**
288.4 0.3	250mm **TOPSOIL**
	FILL, silty sand, trace to some gravel, very loose to compact, brown, moist to wet
286.6 2.1	**PEAT**, amorphous, black
285.0 3.7	**SAND**, some silt, trace clay, trace gravel, very loose to loose, grey, wet
283.8 4.9	**CLAYEY SILT**, trace sand, trace gravel, soft to stiff, grey, wet
280.6 8.1	

NUMBER	TYPE	SPT 'N' VALUE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	10	
2	SS	9	
3	SS	2	
4	SS	5	sampler wet at 2.3m
5	SS	0*	
6	SS	9	1 81 16 2
7	SS	3	
8	SS	11	0 4 86 10
9	SS	3	



UNIT WEIGHT γ kN/m³

END OF BOREHOLE

Unstabilized water level measured at 1.5m below ground surface; wet cave at 7.2 m below ground surface upon completion of drilling.

Piezometer installation consists of a 50 mm diameter PVC pipe with a 1.5 m slotted screen.

*Sampler sinking under weight of hammer and/ or rods.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 26, 2019	3.1	285.6
Jul 10, 2019	3.4	285.3

file: 1-17-0714-01 bh logs.gpj

+ 3 , X 3 : Numbers refer to Sensitivity
O 3% STRAIN AT FAILURE

Terraprobe

LOG OF BOREHOLE 80

Project No. : 1-17-0714
Date started : June 3, 2019
Sheet No. : 1 of 1

Client : IBI Group
Project : Airport Road Improvements
Location : Caledon, Ontario

Originated by : JQ
Compiled by : SD
Checked by : RA

Position : E: 590214.5, N: 4858879.9 (UTM 17T)
Rig type : Track-mounted

Elevation Datum : Geodetic
Drilling Method : Solid stem augers

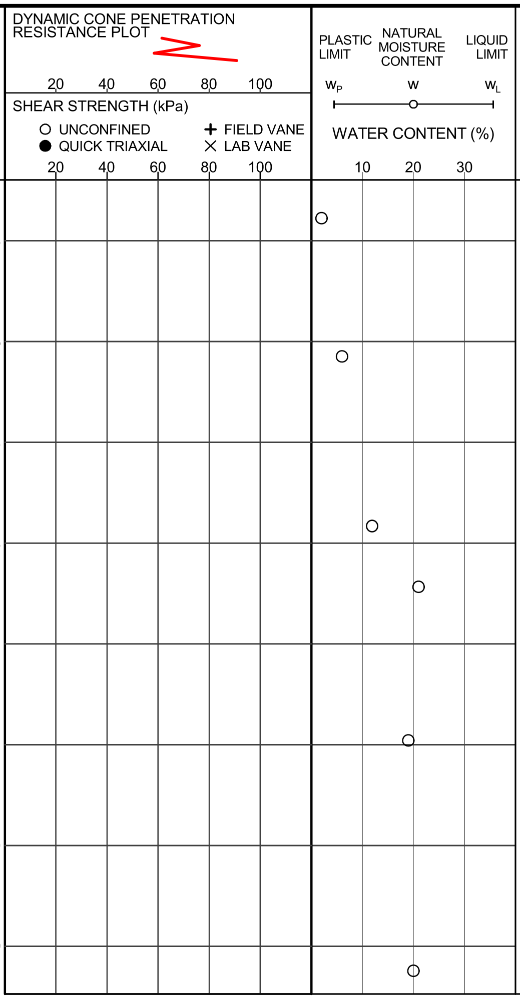
SOIL PROFILE

ELEV DEPTH (m)	DESCRIPTION
316.6	**GROUND SURFACE**
	150mm **ASPHALTIC CONCRETE**
	550mm **FILL**, sand and gravel, trace silt, dense, brown, dry
315.9 0.7	**FILL**, silty sand, trace to some gravel, trace clay, compact to dense, brown, moist
313.7 2.9	**PEAT**, amorphous, black
313.2 3.4	**CLAYEY SILT**, trace sand, very stiff, grey, wet
311.4 5.2	**SILTY SAND to SAND AND SILT**, trace clay, trace gravel, compact to dense, grey, wet
308.5 8.1	**END OF BOREHOLE**

Unstabilized water level measured at 4.0m below ground surface; borehole caved at 5.2 m below ground surface upon completion of drilling.

SAMPLES

NUMBER	TYPE	SPT 'N' VALUE	GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
1	SS	49				
2	SS	45				
3	SS	14				
4	SS	11				
5	SS	12				
6	SS	19	0	1	83	16
7	SS	17				
8	SS	18				
9	SS	36				
10	SS	28				



UNIT WEIGHT γ kN/m³

GROUND WATER CONDITIONS

REMARKS & GRAIN SIZE DISTRIBUTION (%)

+³, ×³: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

file: 1-17-0714-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 80A

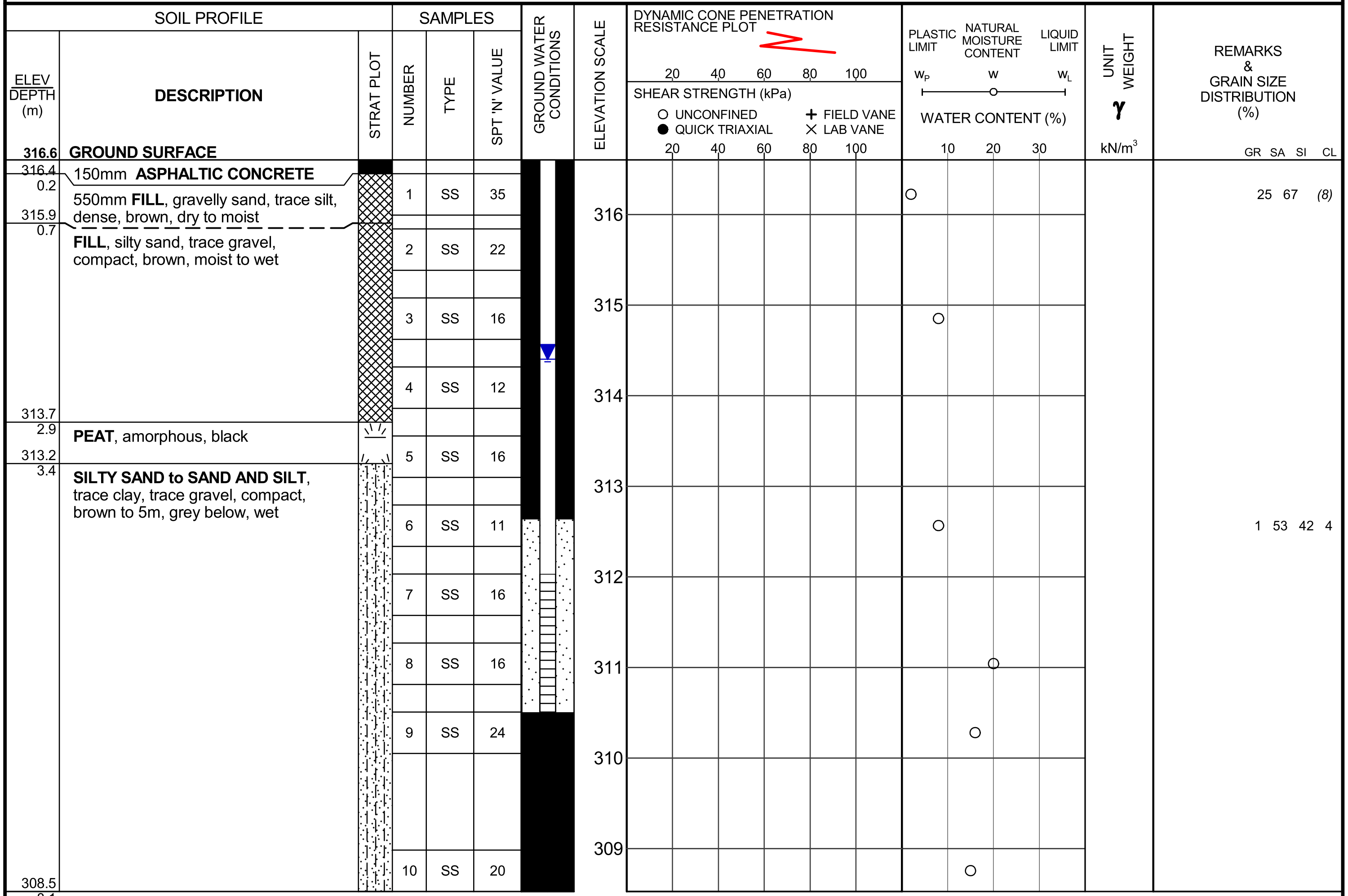
Project No. : 1-17-0714
Date started : June 3, 2019
Sheet No. : 1 of 1

Client : IBI Group
Project : Airport Road Improvements
Location : Caledon, Ontario

Originated by : JQ
Compiled by : SD
Checked by : RA

Position : E: 590214.2, N: 4858891.5 (UTM 17T)
Rig type : Track-mounted

Elevation Datum : Geodetic
Drilling Method : Solid stem augers



ELEV DEPTH (m)	DESCRIPTION
316.6	**GROUND SURFACE**
316.4 0.2	150mm **ASPHALTIC CONCRETE**
315.9 0.7	550mm **FILL**, gravelly sand, trace silt, dense, brown, dry to moist
313.7 2.9	**FILL**, silty sand, trace gravel, compact, brown, moist to wet
313.2 3.4	**PEAT**, amorphous, black
308.5 8.1	**SILTY SAND to SAND AND SILT**, trace clay, trace gravel, compact, brown to 5m, grey below, wet

SAMPLES NUMBER	TYPE	SPT 'N' VALUE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	35	25 67 *(8)*
2	SS	22	
3	SS	16	
4	SS	12	
5	SS	16	
6	SS	11	1 53 42 4
7	SS	16	
8	SS	16	
9	SS	24	
10	SS	20	

UNIT WEIGHT γ kN/m³

END OF BOREHOLE

Piezometer installation consists of a 50 mm diameter PVC pipe with a 1.5 m slotted screen.

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jun 26, 2019	2.0	314.6
Jul 11, 2019	2.2	314.4

file: 1-17-0714-01 bh logs.gpj

$+^3, \times^3$: Numbers refer to Sensitivity   ○ 3% STRAIN AT FAILURE

PAVEMENT BOREHOLE LOGS

Airport Road, from Station 9+965 to Station 17+150

10+100	**NBL (BH2)**
0 - 240	Asph
240 - 1.20	Br Gran, Tr to Some Si, Dry
1.20 - 1.50	Br Cl(y) Si, Sa(y), Tr Gr, Moist

10+200	**SBSH (BH3)**
0 - 740	Br Gran, Tr to Some Si, Dry to Moist
740 - 900	Gry Si(y) Cl, Sa(y), Moist
900 - 1.50	Gry Si(y) Sa, Some Cl, Moist

10+300	**NBSH (BH4)**
0 - 670	Br Gran, Tr to Some Si, Dry to Moist
670 - 1.20	Br Sa and Gr, Some Si, Moist
1.20 - 1.50	Gry Cl(y) Si , and Sa, Tr Gr, Moist

10+400	**SBL (BH5)**
0 - 270	Asph
270 - 1.20	Br Gran, Tr to Some Si, Dry to Moist
1.20 - 1.5	Gry Cl(y) Si , and Sa, Tr Gr, Moist

10+500	**NBL (BH6)**
0 - 200	Asph
200 - 540	Br Gran, Tr to Some Si, Dry
540 - 1.05	Br Sa and Gr, Some Silt, Moist
1.05 - 1.35	Br Si(y) Sa, Tr Cl, Moist
1.35 - 1.50	Br Cl(y) Si, Sa(y), Tr Gr, Moist

*Sample Depth = 200 - 540
Passing 26.5 mm = 100%
19 mm = 98%
13.2 mm = 92%
9.5 mm = 86%
4.75 mm = 65%
1.18 mm = 29%
300 µm = 8%
75 µm = 2%
w = 1%
Not Accep Gran A
Accep Gran B, Type I

10+590	**SBSH (BH7)**
0 - 700	Br Gran, Tr to Some Si, Dry to Moist
700 - 1.5	Gry Si(y) Cl to Cl(y) Si, Tr to Some Sa, Moist

10+700	**NBSH (BH8)**
0 - 550	Br Gran, Tr to Some Si, Dry*
550 - 810	Br Si(y) Sa, Tr Cl, Tr Gr, Moist**
810 - 1.50	Gry Si(y) Cl To Cl(y) Si, Some Sa to Sa(y), Moist

*Sample Depth = 0 - 550
Passing 26.5 mm = 99%
19 mm = 98%
13.2 mm = 89%
9.5 mm = 84%
4.75 mm = 69%
1.18 mm = 49%
300 µm = 31%
75 µm = 18%
w = 4%
Not Accep Gran A
Not Accep Gran B, Type I

**Sample Depth = 550 - 810
Passing 4.75 mm = 93%
2.00 mm = 88%
425 µm = 70%
75 µm = 33%
5 µm = 10%
2 µm = 7%
w = 9%
Frost Susc. = LSFH
K factor = 0.18

10+800	**SBL (BH9)**
0 - 250	Asph
250 - 420	Br Gran, Tr to Some Si, Dry
420 - 1.20	Br Si(y) Sa, Tr Gr, Moist
1.20 - 1.50	Gry Si(y) Cl, Tr to Some Sa, Moist

10+900	**NBL (BH10)**
0 - 200	Asph
200 - 590	Br Gran, Tr to Some Si, Dry to Moist
590 - 900	Br Sa and Gr, Some Si, Dry to Moist
900 - 1.20	Br Sa, Some Si to Si(y), Tr Gr, Dry to Moist
1.20 - 1.50	Br Cl(y) Si, and Sand, Tr Gr, Moist

11+015	**SBSH (BH11)**
0 - 600	Br Gran, Tr to Some Si, Dry to Moist
600 - 1.20	Br Sa, Some Si to Si(y), Tr Gr, Moist
1.20 - 1.50	Gry Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist

11+100	**NBSH (BH12)**
0 - 590	Br Gran, Some Si, Dry to Moist*
590 - 1.05	Br Sa, Some Si to Si(y), Tr Gr, Moist
1.05 - 1.50	Gry Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist

PAVEMENT BOREHOLE LOGS

Airport Road, from Station 9+965 to Station 17+150

*Sample Depth = 0 - 590
Passing 26.5 mm = 100%
19 mm = 99%
13.2 mm = 92%
9.5 mm = 78%
4.75 mm = 55%
1.18 mm = 35%
300 µm = 20%
75 µm = 12%
w = 8%
Marginally Accep Gran A
Marginally Accep Gran B, Type I

11+200 SBL (BH13)
0 - 250 Ashp
250 - 950 Br Gran, Tr to Some Si, Dry to Moist
950 - 1.50 Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

11+300 NBL (BH14)
0 - 220 Asph
220 - 530 Br Gran, Tr to Some Si, Dry
530 - 900 Br Sa, Some Sl to Si(y), Tr Gr, Moist
900 - 1.50 Gry Cl(y) Si, Some Sa to Sa(y), Moist

11+400 SBSH (BH15)
0 - 600 Br Gran, Tr to Some Si, Dry to Moist
600 - 1.50 Gry Si(y) Cl, Tr to Some Sa, Moist

11+500 NBSH (BH16)
0 - 710 Br Gran, Tr to Some Si, Dry to Moist
710 - 1.05 Br Sa and Gr, Tr Si, Dry to Moist
1.05 - 1.50 Gry Cl(y) Si, Some Sa to Sa(y), Tr Gr, Moist

11+600 SBL (BH17)
0 - 220 Asph
220 - 810 Br Gran, Some Si, Dry*
810 - 1.50 Gry Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

*Sample Depth = 220 - 810
Passing 26.5 mm = 94%
19 mm = 93%
13.2 mm = 86%
9.5 mm = 77%
4.75 mm = 58%
1.18 mm = 37%
300 µm = 24%
75 µm = 15%
w = 3%
Not Accep Gran A
Not Accep Gran B, Type I

11+700 NBL **(BH18)**
0 - 220 Asph
220 - 630 Br Gran, Tr to Some Si, Dry to Moist
630 - 1.05 Br Sa and Gr, Tr to Some Si, Dry to Moist
1.05 - 1.50 Br Si(y) Cl, Sa(y), Moist*

*Sample Depth = 1.05 - 1.50
Passing 4.75 mm = 100%
2.00 mm = 100%
425 µm = 96%
75 µm = 79%
5 µm = 46%
2 µm = 34%
w = 19%
Frost Susc. = LSFH
K factor = 33%

11+800 SBSH (BH19)
0 - 230 Br Gran, Tr to Some Si, Dry to Moist
230 - 1.50 Gry Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

11+900 NBSH (BH20)
0 - 780 Br Gran, Tr to Some Si, Moist
780 - 1.50 Br Si(y) Cl,Tr to Some Sa, Tr Gr, Moist

12+000 SBL (BH21)
0 - 210 Asph
210 - 1.05 Br Gran, Tr to Some Si, Dry to Moist
1.05 - 1.50 Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

12+100 NBL (BH22)
0 - 230 Ashp
230 - 850 Br Gran, Some Si, Dry to Moist*
850 - 1.50 Gry Si(y) Cl to Cl(y) Si, Sa(y), Tr Gr, Dry to Moist

*Sample Depth = 230 - 850
Passing 26.5 mm = 94%
19 mm = 89%
13.2 mm = 86%
9.5 mm = 78%
4.75 mm = 64%
1.18 mm = 45%
300 µm = 28%
75 µm = 13%
w = 5%
Not Accep Gran A
Not Accep Gran B, Type I

12+200 SBSH (BH23)
0 - 540 Br Gran, Tr to Some Si, Dry to Moist
540 - 1.50 Gry Gr(y) Sa, Some Si to Si(y), Tr to Some Cl, Moist

PAVEMENT BOREHOLE LOGS

Airport Road, from Station 9+965 to Station 17+150

12+500	**SBL (BH25)**
0 - 240	Asph
240 - 650	Br Gran, Tr to Some Si, Dry to Moist
650 - 1.50	Gry Si(y) Cl, Some Sa, Tr Gr, Moist

12+600	**NBL (BH26)**
0 - 220	Asph
240 - 900	Br Gran,Tr to Some Si. Dry to Moist
900 - 1.50	Br Si(y) Cl, Tr Sa, Tr Gr, Moist

12+700	**SBSH (BH27)**
0 - 530	Br Gran, Tr to Some Si, Dry to Moist
530 - 1.20	Br Gr(y) Sa, Tr Si, Moist
1.20 - 1.50	Gry Si(y) Cl, Some Sa, Tr Gr, Tr Org, Moist

12+800	**NBSH (BH28)**
0 - 800	Br Gran, Tr to Some Si, Dry
800 - 1.50	Gry Si(y) Cl, Tr Gr, Tr to Some Sa, Moist

12+900	**SBL (BH29)**
0 - 240	Asph
240 - 650	Br Gran,Tr to Some Si, Dry to Moist
650 - 1.20	Br Sa, Some Gr, Some Si to Si(y), Moist
1.20 - 1.50	Gry Si(y) Sa, Tr Cl, TR Gr, Dry to Moist

12+930	**NB OFF Rd (BH30)**
0 - 50	Tps
50 - 600	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Tr Org, Moist
600 - 1.80	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

12+930	**SB OFF Rd (BH31)**
0 - 60	Tps
60 - 300	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Tr Org, Moist
300 - 1.80	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

13+000	**NBL (BH32)**
0 - 230	Asph
230 - 900	Br Gran, Some Si, Dry*
900 - 1.50	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

*Sample Depth = 230 - 900
Passing 26.5 mm = 100%
19 mm = 99%
13.2 mm = 92%
9.5 mm = 85%
4.75 mm = 67%
1.18 mm = 42%
300 µm = 24%
75 µm = 13%
w = 4%
Not Accep Gran A
Not Accep Gran B, Type I

13+100	**SBL (BH33)**
0 - 220	Asph
220 - 600	Br Gran, Tr to Some Si, Dry
600 - 1.50	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

13+200	**NBSH (BH34)**
0 - 650	Br Gran, Tr to Some Si, Dry to Moist
650 - 1.05	Br Sa, Some Si to Si(y), Tr Gr, Moist
1.05 - 1.50	Gry Si(y) Cl, Some Sa to Sa(y), Tr Gr, Dry to Moist

13+330	**SBSH (BH35)**
0 - 600	Br Gran,Tr to Some Si, Dry to Moist
600 - 900	Br Sa, Some Si to Si(y), Tr Gr, Moist
900 - 1.50	Gry Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

13+400	**NBL (BH36)**
0 - 220	Asph
220 - 655	Br Gran, Tr to Some Si, Dry to Moist
655 - 1.50	Gry Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist

13+500	**SBSH (BH37)**
0 - 900	Br Gran,Tr to Some Si, Dry to Moist
900 - 1.50	Gry Si(y) Cl, Tr to Soma Sa, Tr Gr, Moist

13+600	**NBSH (BH38)**
0 - 600	Br Gran, Some Si, Dry*
600 - 900	Br Si(y) Sa, Tr Gr, Moist
900 - 1.50	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

*Sample Depth = 0 - 600
Passing 26.5 mm = 100%
19 mm = 98%
13.2 mm = 92%
9.5 mm = 81%
4.75 mm = 63%
1.18 mm = 40%
300 µm = 22%
75 µm = 13%
w = 3%
Not Accep Gran A
Not Accep Gran B, Type I

13+700	**SBL (BH39)**
0 - 230	Asph
230 - 900	Br Gran, Tr to Some Si, Dry to Moist
900 - 1.50	Gry Si(y) Cl, Tr to Some Sa, Tr Gr, Dry to Moist

13+800	**NBL (BH40)**
0 - 220	Asph
220 - 800	Br Gran, Tr to Some Si, Dry
800 - 1.10	Br Gr(y) Sa, Tr Si, Dry
1.10 - 1.50	Gry Si(y) Cl, Tr to Some Sa,Tr Gr, Tr Org, Moist

PAVEMENT BOREHOLE LOGS

Airport Road, from Station 9+965 to Station 17+150

13+875 NBL (BH103)

0 - 240	Asph
240 - 650	Br Gran, Tr to Some Si, Dry
650 - 1.0	Gry Si(y) Sa, Tr Gr, Dry
1.0 - 1.50	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

13+915 NBL (BH41)

0 - 245	Asph
245 - 900	Br Gran, Tr to Some Si, Dry
900 - 1.50	Gry Si(y) Cl, Tr to Some Sa, Dry

14+000 NBL (BH42)

0 - 230	Asph
230 - 800	Br Gran, Tr to Some Si, Moist
800 - 1.0	Gry Si(y) Cl, Tr to Some Sa, Tr Gr, Dry
1.0 - 1.50	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Dry

14+100 SBL (BH43)

0 - 240	Asph
240 - 700	Br Gran, Some Si, Dry*
700 - 1.50	Br Si(y) Cl, Some Sa to Sa(y), Moist

*Sample Depth = 240 - 700
Passing 26.5 mm = 100%
19 mm = 100%
13.2 mm = 98%
9.5 mm = 90%
4.75 mm = 70%
1.18 mm = 44%
300 µm = 24%
75 µm = 13%
w = 3%
Not Accep Gran A
Not Accep Gran B, Type I

14+120 NBL (BH44)

0 - 250	Asph
250 - 700	Br Gran, Tr to Some Si, Dry
700 - 900	Gry Sa, Some Gr, Tr Si, Dry
900 - 1.50	Br Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist

14+140 SB OFF Rd (BH45)

0 - 50	Asph
50 - 800	Gry Si(y) Cl, Tr to Some Sa, Tr Org, Moist
800 - 1.20	Gry Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist
1.20 - 1.80	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Dry to Moist

14+180 SB OFF Rd (BH46)

0 - 80	Top Soil
80 - 600	Gry Si(y) Cl, Tr to Some Sa, Moist to Wet
900 - 1.20	Br Si(y) Cl, Tr to Some Sa, Some Gr, Moist
1.20 - 1.80	Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

14+210 NBL (BH47)

0 - 230	Asph
230 - 900	Br Gran, Tr to Some Si, Dry
900 - 1.50	Gry Si(y) Cl, Sa(y), Moist*

*Sample Depth = 900 - 1.50
Passing 4.75 mm = 100%
2.00 mm = 100%
425 µm = 94%
75 µm = 70%
5 µm = 26%
2 µm = 19%
w = 24%
Frost Susc. = MSFH
K factor = 0.44

14+300 SBSH (BH48)

0 - 600	Br Gran, Tr to Some Si, Dry to Moist
600 - 1.50	Gry Si(y) Cl, Some Sa to Sa(y), Moist

14+400 NBL (BH49)

0 - 250	Asph
250 - 1.40	Br Gran, Tr to Some Si, Dry
1.40 - 1.50	Br Sa, Some Si to Si(y), Tr Gr, Moist

14+500 SBL (BH50)

0 - 250	Asph
250 - 800	Br Gran, Tr to Some Si, Dry
800 - 1.20	Gry Sa, Tr Si, Some Gr, Moist
1.20 - 1.50	Gry Si(y) Cl, and Sa, Tr Gr, Moist

14+560 NBSH (BH104)

0 - 220	Asph
220 - 420	Br Gran, Tr to Some Si, Dry to Moist
420 - 1.50	Br Si(y) Sa, Tr Cl, Moist

14+600 NBL (BH51)

0 - 250	Asph
250 - 900	Br Gran, Tr to Some Si, Dry to Moist
900 - 1.50	Br Si(y) Cl, Sa(y), Tr Gr, Moist

14+705 SBSH (BH52)

0 - 1.20	Br Gran, Some Si, Moist*
1.20 - 1.50	Gry Si(y) Sa, Tr Cl, Tr Gr, Moist

*Sample Depth = 0 - 1.20
Passing 26.5 mm = 93%
19 mm = 93%
13.2 mm = 85%
9.5 mm = 75%
4.75 mm = 59%
1.18 mm = 43%
300 µm = 27%
75 µm = 16%
w = 6%
Not Accep Gran A
Not Accep Gran B, Type I

14+800 NBL (BH53)
0 - 270 Asph
270 - 900 Br Gran, Tr to Some Si, Moist
900 NFP

14+870 SBL (BH54)
0 - 220 Asph
220 - 1.20 Br Gran, Tr to Some Si, Dry
1.20 - 1.50 Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

14+910 SB OFF Rd (BH55)
0 - 100 Tps
100 - 600 Br Si(y) Cl, Some Sa to Sa(y), Tr Gr, Dry
600 - 1.20 Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist
1.20 - 1.80 Br Si(y) Cl, Tr to Some Sa, Tr Gr, Wet

14+940 NBL (BH56)
0 - 260 Asph
260 - 800 Br Gran, Tr to Some Si, Dry to Moist
800 - 1.20 Gry Si(y) Cl, and Sa, Tr Gr, Moist
1.20 - 1.50 Br Si(y) Cl, Some Sa to Sa(y), Moist

15+000 NBL (BH57)
0 - 240 Asph
240 - 1.25 Br Gran, Tr to Some Si, Dry
1.25 - 1.50 Gry Sa and Si, Tr Cl, Tr Gr, Moist*

*Sample Depth = 1.25 - 1.50
Passing 4.75 mm = 99%
2.00 mm = 98%
425 µm = 87%
75 µm = 50%
5 µm = 12%
2 µm = 8%
w = 10%
Frost Susc. = LSFH
K factor = 0.35

15+100 SBL (BH58)
0 - 250 Asph
250 - 1.30 Br Gran, Tr to Some Si, Dry
1.30 - 1.50 Gry Sa and Si, Tr Cl, Tr Gr, Moist

15+200 NBL (BH59)
0 - 260 Asph
260 - 900 Br Gran, Some Si, Dry*
900 - 1.50 Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

*Sample Depth = 260 - 900
Passing 26.5 mm = 100%
19 mm = 97%
13.2 mm = 90%
9.5 mm = 83%
4.75 mm = 68%
1.18 mm = 43%
300 µm = 25%
75 µm = 14%
w = 3%
Not Accep Gran A
Not Accep Gran B, Type I

15+300 NBL (BH60)
0 - 220 Asph
220 - 1.30 Br Gran, Tr to Some Si, Dry
1.30 - 1.50 Br Si(y) Cl, Tr to Some Sa, Tr Gr, Moist

15+400 NBL (BH61)
0 - 180 Asph
180 - 1.40 Br Gran, Tr to Some Si, Dry
1.40 - 1.50 Br Si(y) Sa to Sa and Si, Tr Cl, Tr Gr, Dry to Moist

15+500 SBL (BH62)
0 - 170 Asph
170 - 1.10 Br Gran, Tr to Some Si, Dry to Moist
1.10 - 1.50 Gry Sa and Si, Tr Cl, Tr Gr, Moist

15+600 NBL (BH63)
0 - 140 Asph
140 - 1.30 Br Gran, Tr to Some Si, Dry*
1.30 - 1.50 Br Sa, Some Si to Si(y), Tr Cl, Dry to Moist

*Sample Depth = 140 - 1.30
Passing 26.5 mm = 100%
19 mm = 92%
13.2 mm = 83%
9.5 mm = 71%
4.75 mm = 58%
1.18 mm = 41%
300 µm = 22%
75 µm = 10%
w = 2%
Marginally Accep Gran A
Marginally Accep Gran B, Type I

15+800 NBL (BH65)
0 - 140 Asph
140 - 900 Br Gran, Tr to Some Si, Dry to Moist

15+890 NBL (BH66)
0 - 170 Asph
170 - 1.40 Br Gran, Tr to Some Si, Dry to Moist
1.40 - 1.50 Br Si(y) Sa, Tr Cl, Tr Gr, Wet

16+050 NBL (BH67)
0 - 140 Asph
140 - 1.50 Br Gran, Tr to Some Si, Dry

16+135 SBL (BH105)
0 - 120 Asph
120 - 900 Br Gran, Tr to Some Si, Dry to Moist
900 - 1.50 Br Si(y) Sa, Tr Cl, Tr Gr, Moist

16+215 NBL (BH69)
0 - 130 Asph
130 - 1.30 Br Gran, Tr to Some Si, Dry
1.30 - 1.50 Br Gr(y) Sa, Tr to Some Si, Dry to Moist

16+290 SB OFF Rd (BH70)
0 - 100 Tps
100 - 600 Br Si(y) Sa, Tr Cl, Tr Gr, Moist
600 - 1.20 Br Sa, Some Si to Si(y), Tr Gr, Tr Org, Dry to Moist
1.20 - 1.80 Br Sa, Some Si to Si(y), Tr Gr, Moist

16+320 SBL (BH71)
0 - 210 Asph
210 - 1.00 Br Gran, Tr Si, Dry*
1.00 - 1.50 Br Sa, Some Si to Si(y), Tr to Some Gr, Moist to Wet

*Sample Depth = 210 - 1.00
Passing 26.5 mm = 100%
19 mm = 94%
13.2 mm = 87%
9.5 mm = 75%
4.75 mm = 59%
1.18 mm = 40%
300 µm = 19%
75 µm = 7%
w = 3%
Marginally Accep Gran A
Accep Gran B, Type I

16+400 NBL (BH72)
0 - 270 Asph
270 - 1.20 Br Gran, Tr to Some Si, Dry
1.20 - 1.50 Br Sa, Some Si to Si(y), Some Gr, Moist to Wet

16+500 SBL (BH73)
0 - 240 Asph
240 - 1.0 Br Gran, Tr to Some Si, Dry to Moist
1.0 - 1.50 Br Gr(y) Sa, Some Si, Tr Cl, Tr Gr, Moist*

*Sample Depth = 1.00 - 1.50
Passing 4.75 mm = 77%
2.00 mm = 64%
425 µm = 40%
75 µm = 13%
5 µm = 5%
2 µm = 3%
w = 7%
Frost Susc. = LSFH
K factor = 0.05

16+600 NBL (BH74)
0 - 190 Asph
190 - 850 Br Gran, Tr Si, Dry*
850 - 1.50 Br Si, Tr Cl, Tr Sa, Wet**

*Sample Depth = 190 - 850
Passing 26.5 mm = 100%
19 mm = 96%
13.2 mm = 86%
9.5 mm = 75%
4.75 mm = 56%
1.18 mm = 37%
300 µm = 14%
75 µm = 4%
w = 2%
Marginally Accep Gran A
Accep Gran B, Type I

**Sample Depth = 850 - 1.50
Passing 4.75 mm = 100%
2.00 mm = 100%
425 µm = 99%
75 µm = 95%
5 µm = 17%
2 µm = 9%
w = 19%
Frost Susc. = HSFH
K factor = 0.60

16+700 SBL (BH75)
0 - 300 Asph
300 - 700 Br Gran, Tr to Some Si, Dry to Moist
700 - 950 Br Sa, Some Si to Si(y), Tr Gr, Moist
950 - 1.50 Br Si, Tr to Some Cl, Tr Sa, Moist to Wet

16+800 NBSH (BH76)
0 - 900 Br Gran, Tr to Some Si, Dry to Moist
900 - 1.50 Br Sa, Some Si to Si(y), Tr Gr, Moist

16+900 NBL (BH77)
0 - 240 Asph
240 - 600 Br Gran, Tr to Some Si, Dry
600 - 1.50 Br Sa, Some Si to Si(y), Tr Gr, Moist

17+000	**NBL**	**(BH78)**
0 - 150	Asph	
150 - 600	Br Gran, Tr to Some Si, Dry	
600 - 1.30	Br Gr,Tr to Some Sa, Dry	
1.30 - 1.50	Gry Si(y) Cl to Cl(y) Si, Tr to Some Sa, Moist	

17+070	**SBSH**	**(BH79)**
0 - 400	Gry Gran, Tr to some Si, Dry to Moist	
400 - 1.20	Gry Cl(y) Si, and Sa,Tr Gr, Moist	
1.20 - 1.50	Br Si(y) Sa, Tr Cl, Tr Gr, Wet	

PAVEMENT BOREHOLE LOGS

Intersecting Roads

Castlederg Side Road

BH81	**EBL**
0 - 110	Asph
110 - 420	Br Gran, Some Si to Si(y), Dry to Moist
420 - 1.5	Br Cl(y) Si, and Sa, Tr Gr, Moist

Boston Mills Road

BH82	**EBL**
0 - 350	Br Gran, Tr to Some Si, Dry
350 - 1.5	Br Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist

Olde Base Line Road

BH83	**WBL**
0 - 140	Asph
140 - 500	Br Gran, Tr to Some Si, Dry
500 - 1.2	Br Si(y) Sa, Some Cl, Tr Gr, Dry to Moist
1.2 - 1.5	Br Si(y) Cl, Some Sa to Sa(y), Dry to Moist

Cranston Drive

BH84	WBL
0 - 150	Asph
150 - 550	Br Gran, Tr to Some Si, Dry to Moist
550 - 1.5	Br Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist

Hilltop Drive

BH88	**WBL**
0 - 140	Asph
140 - 600	Br Gran, Tr to Some Si, Dry to Moist
600 - 1.0	Br Gr(y) Sa, Tr Si, Some Gr to Gr(y), Moist
1.0 - 1.5	Br Si(y) Cl, Some Sa to Sa(y), Tr Gr, Moist

Marion Street

BH89	**EBL**
0 - 120	Asph
120 - 500	Br Gran, Tr to Some Si, Dry to Moist
500 - 1.5	Br Si(y) Sa, Tr Gr, Moist

Larry Street

BH90	**WBL**
0 - 130	Asph
130 - 800	Br Gran, Tr to Some Si, Dry to Moist
800 - 1.5	Br Sa, Tr to Some Si to Si(y), Tr Gr, Moist

Emma Street

BH91	**EBL**
0 - 140	Asph
140 - 500	Br Gran, Tr to Some Si, Dry to Moist
500 - 900	Br Gr, Dry
900 - 1.5	Gry Si(y) Sa, Tr to Some Cl, Tr Gr, Moist

Parsons Avenue

BH92	**EBL**
0 - 130	Asph
130 - 900	Br Gran, Tr to Some Si, Dry to Moist
900 - 1.3	Br Si(y) Sa,Tr Cl, Tr Gr, Moist

Ivan Avenue

BH93	**NBL**
0 - 80	Asph
80 - 400	Br Gran, Tr to Some Si, Dry to Moist
400 - 1.0	Br Sa,Tr to Some Si, Tr Gr, Moist
1.0 - 1.5	Br Si(y) Cl to Cl(y) Si, Some Sa to Sa(y), Moist

BH94	**NBL**
0 - 70	Asph
70 - 900	Br Gran, Tr to Some Si, Dry to Moist
900 - 1.5	Br Sa and Si, Tr to Some Cl, Moist

Old Church Street

BH95	**WBL**
0 - 150	Asph
150 - 670	Br Gran, Tr to Some Si, Dry to Moist
670 - 1.5	Br Sa, Some Si to Si(y), Tr Gr, Moist

BH96	**WBL**
0 - 170	Asph
170 - 760	Br Gran, Tr to Some Si, Dry to Moist
760 - 1.5	Br Sa, Some Si to Si(y), Tr Gr, Moist

BH97	**EBL**
0 - 150	Asph
150 - 810	Br Gran, Tr to Some Si, Dry to Moist
810 - 1.5	Br Sa, Some Si to Si(y), Tr Gr, Moist

BH98	**WBL**
0 - 160	Asph
160 - 790	Br Gran, Tr to Some Si, Dry to Moist
790 - 1.5	Br Sa, Some Si to Si(y), Tr Gr, Moist

BH99	**WBL**
0 - 150	Asph
150 - 690	Br Gran, Tr to Some Si, Dry to Moist
690 - 1.5	Br Sa, Some Si to Si(y), Tr Gr, Moist

Walker Road West

BH101	**WBL**
0 - 125	Asph
125 - 600	Br Gran, Tr to Some Si, Dry to Moist
600 - 1.5	Br Gr(y) Sa, Some Si, Moist

Huntsmill Drive

BH102	**WBL**
0 - 150	Asph
150 - 350	Br Gran, Tr to Some Si, Dry to Moist
350 - 1.5	Br Si(y) Cl, Some Sa to Sa(y), Wet

ASPHALT CORE PHOTOGRAPHS AND DATA

Station 10+200, SBL

Layer No.	Thickness (mm)
1	40
2	120
3	60
Total	220

Station 12+000 SBL

Layer No.	Thickness (mm)
1	50
2	130
3	30
Total	210

Station 13+000, NBL

Layer No.	Thickness (mm)
1	40
2	50
3	70
4	70
Total	230

Project No. : 1-17-0714
Date : July, 2019

Terraprobe Inc.

Prepared by : DP
Checked by : RA

ASPHALT CORE PHOTOGRAPHS AND DATA

Station 13+100 SBL

Layer No.	Thickness (mm)
1	50
2	130
3	40
Total	220

Station 13+875 NBL

Layer No.	Thickness (mm)
1	50
2	110
3	80
Total	240

Station 15+000 NBL

Layer No.	Thickness (mm)
1	70
2	110
3	60
Total	240

Project No. : 1-17-0714
Date : July, 2019

Terraprobe Inc.

Prepared by : DP
Checked by : RA

ASPHALT CORE PHOTOGRAPHS AND DATA

Station 16+135, SBL

Layer No.	Thickness (mm)
1	40
2	80
Total	120

Station 17+000 NBL

Layer No.	Thickness (mm)
1	50
2	40
3	60
Total	150

Project No. : 1-17-0714
Date : July, 2019

Terraprobe Inc.

Prepared by : DP
Checked by : RA

TOPSOIL THICKNESSES

Airport Road, From Station 9+965 to Station 17+150

Airport Road

Approximate Station No.	Location	Topsoil Thickness (mm)
9+965	West of Centre Line	200
10+200	West of Centre Line	80
10+400	West of Centre Line	85
10+590	West of Centre Line	80
10+800	West of Centre Line	50
11+015	West of Centre Line	50
11+200	West of Centre Line	50
11+400	West of Centre Line	80
11+600	West of Centre Line	50
11+800	West of Centre Line	50
11+900	East of Centre Line	40
12+000	West of Centre Line	50
12+100	East of Centre Line	60
12+200	West of Centre Line	30
12+360	East of Centre Line	200
12+360	West of Centre Line	250
12+500	West of Centre Line	50
12+600	East of Centre Line	50
12+700	West of Centre Line	50
12+800	East of Centre Line	50
12+900	West of Centre Line	80
12+930	East of Centre Line	50
12+930	West of Centre Line	60
13+000	East of Centre Line	100
13+100	West of Centre Line	30
13+200	East of Centre Line	75
13+400	East of Centre Line	50
13+500	West of Centre Line	70
13+600	East of Centre Line	70
13+800	East of Centre Line	50
13+875	East of Centre Line	100
13+915	East of Centre Line	50
14+000	East of Centre Line	50
14+120	East of Centre Line	70
14+180	West of Centre Line	80
14+210	East of Centre Line	70
14+300	West of Centre Line	90
14+400	East of Centre Line	100
14+500	West of Centre Line	70
14+560	East of Centre Line	70
14+705	West of Centre Line	70
14+870	West of Centre Line	60

Airport Road

Approximate Station No.	Location	Topsoil Thickness (mm)
14+910	West of Centre Line	100
14+940	East of Centre Line	50
15+000	East of Centre Line	70
15+100	West of Centre Line	70
15+200	East of Centre Line	100
15+400	East of Centre Line	80
15+500	West of Centre Line	120
15+600	East of Centre Line	75
15+740	East of Centre Line	150
15+755	East of Centre Line	50
16+215	East of Centre Line	80
16+290	West of Centre Line	100
16+320	West of Centre Line	150
16+400	East of Centre Line	85
16+500	West of Centre Line	140
16+600	East of Centre Line	110
16+700	West of Centre Line	130
16+900	East of Centre Line	100
17+000	East of Centre Line	120
17+070	West of Centre Line	50
17+150	East of Centre Line	100
17+150	West of Centre Line	100

Intersecting Roads

Castlederg Side Road

BH No.	Location	Topsoil Thickness (mm)
BH 81	South of Centre Line	80

Bostan Mills Road

BH No.	Location	Topsoil Thickness (mm)
BH 82	South of Centre Line	80

Olde Base Line Road

BH No.	Location	Topsoil Thickness (mm)
BH 83	North of Centre Line	40

Carston Drive

BH No.	Location	Topsoil Thickness (mm)
BH 84	North of Centre Line	80

Larry Street

BH No.	Location	Topsoil Thickness (mm)
BH 90	North of Centre Line	100

Parsons Avenue

BH No.	Location	Topsoil Thickness (mm)
BH 92	South of Centre Line	50

Ivan Avenue

BH No.	Location	Topsoil Thickness (mm)
BH 93	East of Centre Line	200
BH 94	North of Centre Line	150

Walker Road

BH No.	Location	Topsoil Thickness (mm)
BH 101	North of Centre Line	100

Huntsmill Drive

BH No.	Location	Topsoil Thickness (mm)
BH 102	South of Centre Line	100

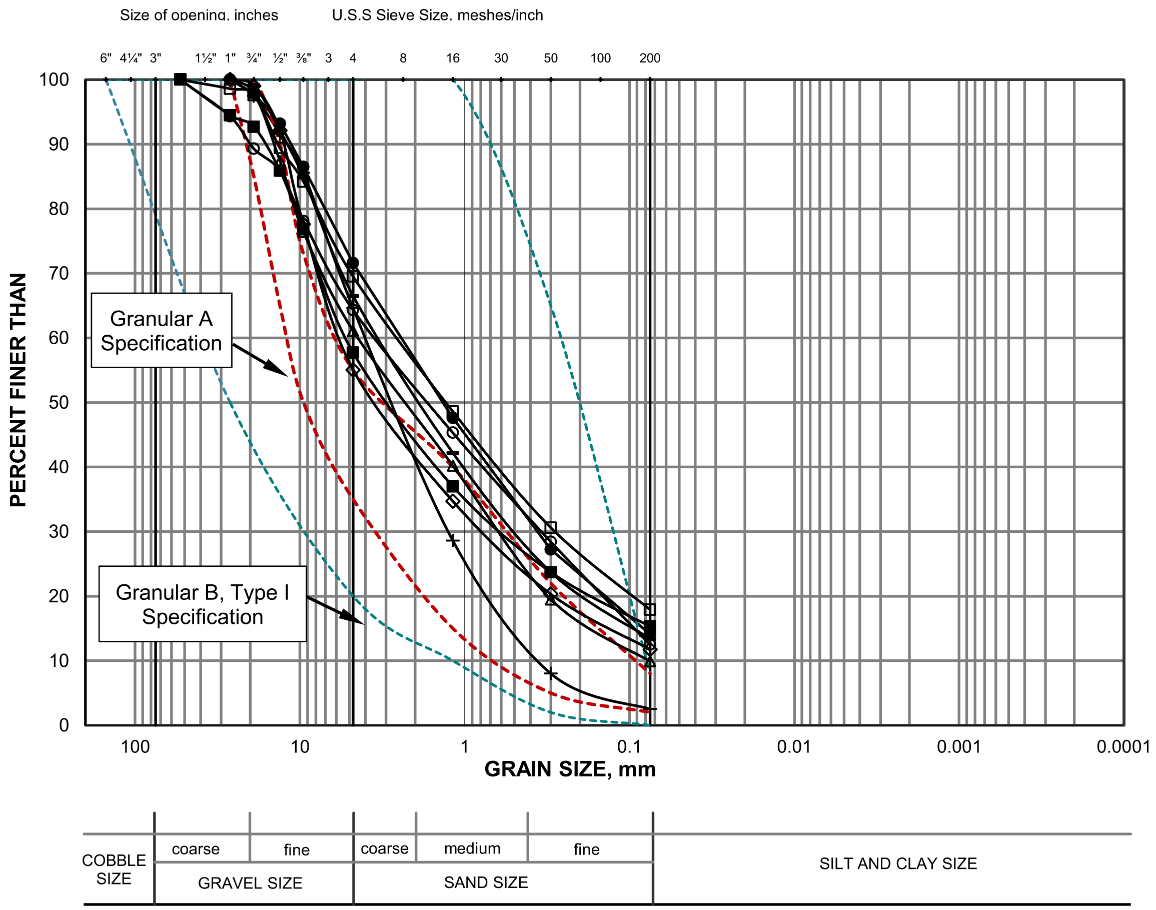
APPENDIX B

Laboratory Test Results

GRAIN SIZE DISTRIBUTION

FIGURE B1

GRANULAR BASE/SUBBASE



LEGEND

SYMBOL	BH No.	STATION	LOCATION	DEPTH (m)
●	BH 1	9+965	SBL	0.30 - 0.90
+	BH 6	10+500	NBL	0.20 - 0.54
□	BH 8	10+700	NBSH	0.00 - 0.55
◇	BH 12	11+100	NBSH	0.00 - 0.59
■	BH 17	11+600	SBL	0.22 - 0.81
○	BH 22	12+100	NBL	0.23 - 0.85
△	BH 24	12+360	SBSH	0.00 - 0.90
−	BH 32	13+000	NBL	0.23 - 0.90

Project No: 1-17-0714
Date: July, 2019

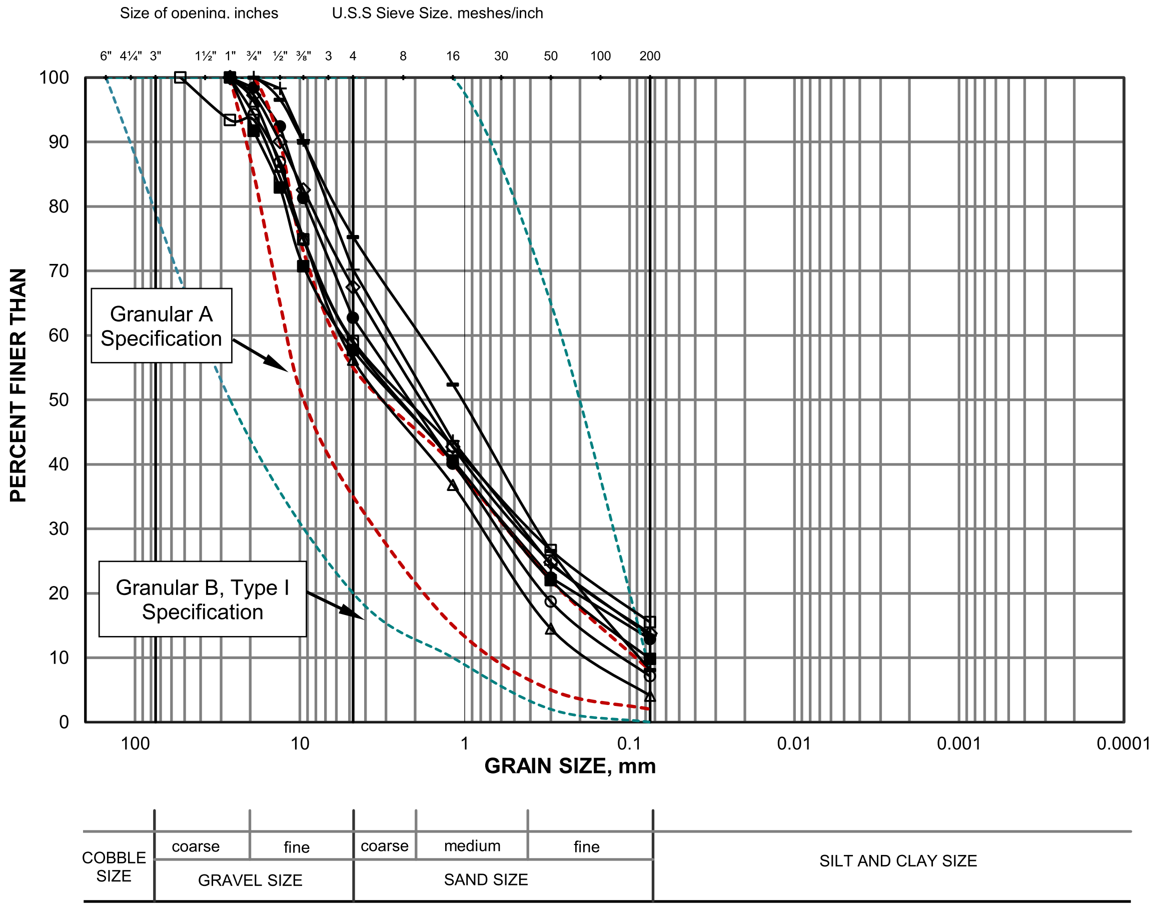
Terraprobe Inc.

Prepared by : MA
Checked by : RA

GRAIN SIZE DISTRIBUTION

FIGURE B2

GRANULAR BASE/SUBBASE



LEGEND

SYMBOL	BH No.	STATION	LOCATION	DEPTH (m)
●	BH 38	13+600	NBSH	0 .00 - 600
+	BH 43	14+100	SBL	0.24 - 0.70
□	BH 52	14+705	SBSH	0.00 - 1.20
◇	BH 59	15+200	NBL	0.26 - 0.90
■	BH 63	15+600	NBL	0.14 - 1.30
○	BH 71	16+320	SBL	0.21 - 1.00
△	BH 74	16+600	NBL	0.19 - 0.85
−	BH 80A	17+145	NBSH	0.15 - 0.70

Project No: 1-17-0714
Date: July, 2019

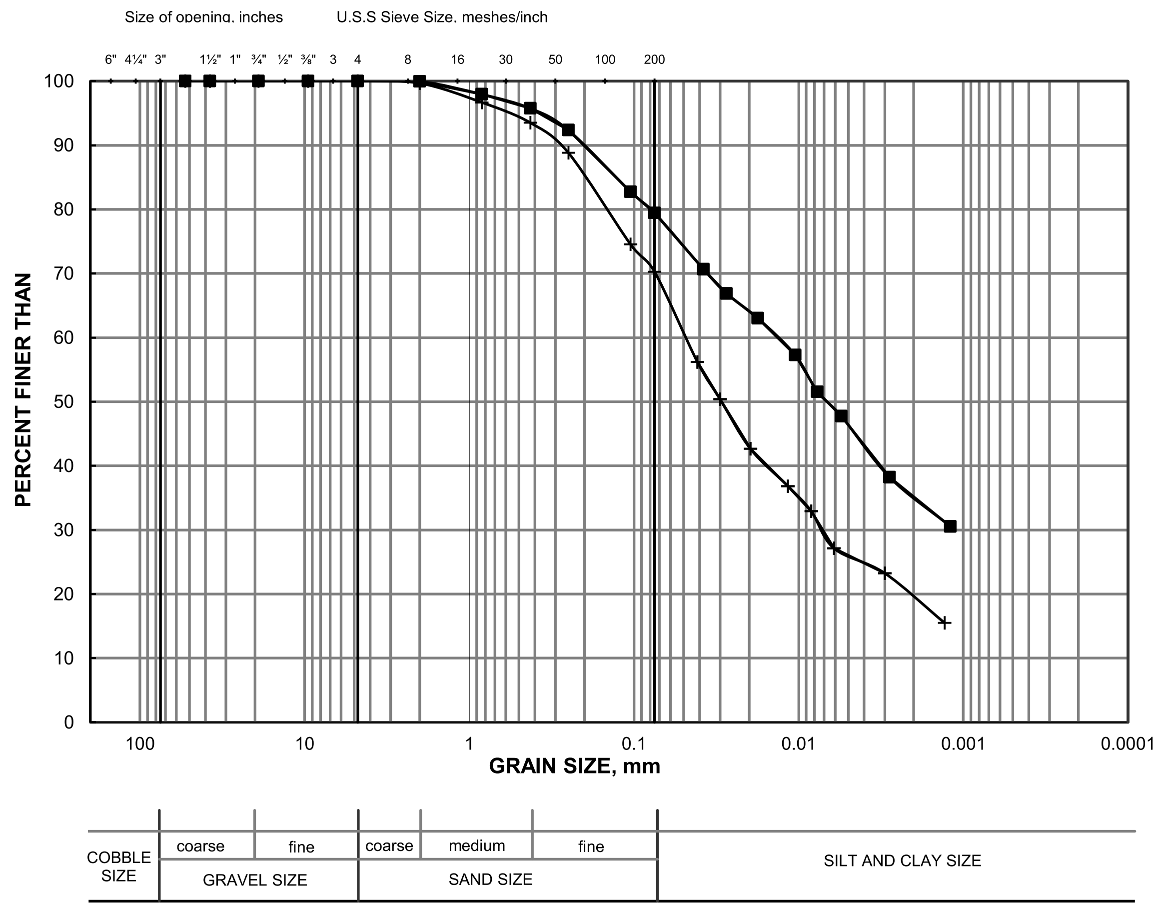
Terraprobe Inc.

Prepared by : MA
Checked by : RA

GRAIN SIZE DISTRIBUTION

FIGURE B3

SUBGRADE (Silty Clay to Clayey Silt)



LEGEND

SYMBOL	BH No.	STATION	LOCATION	DEPTH (m)
■	BH 18	11+700	NBL	1.10 - 1.50
+	BH 47	14+210	NBL	0.90 - 1.50

Project No: 1-17-0714
Date: July, 2019

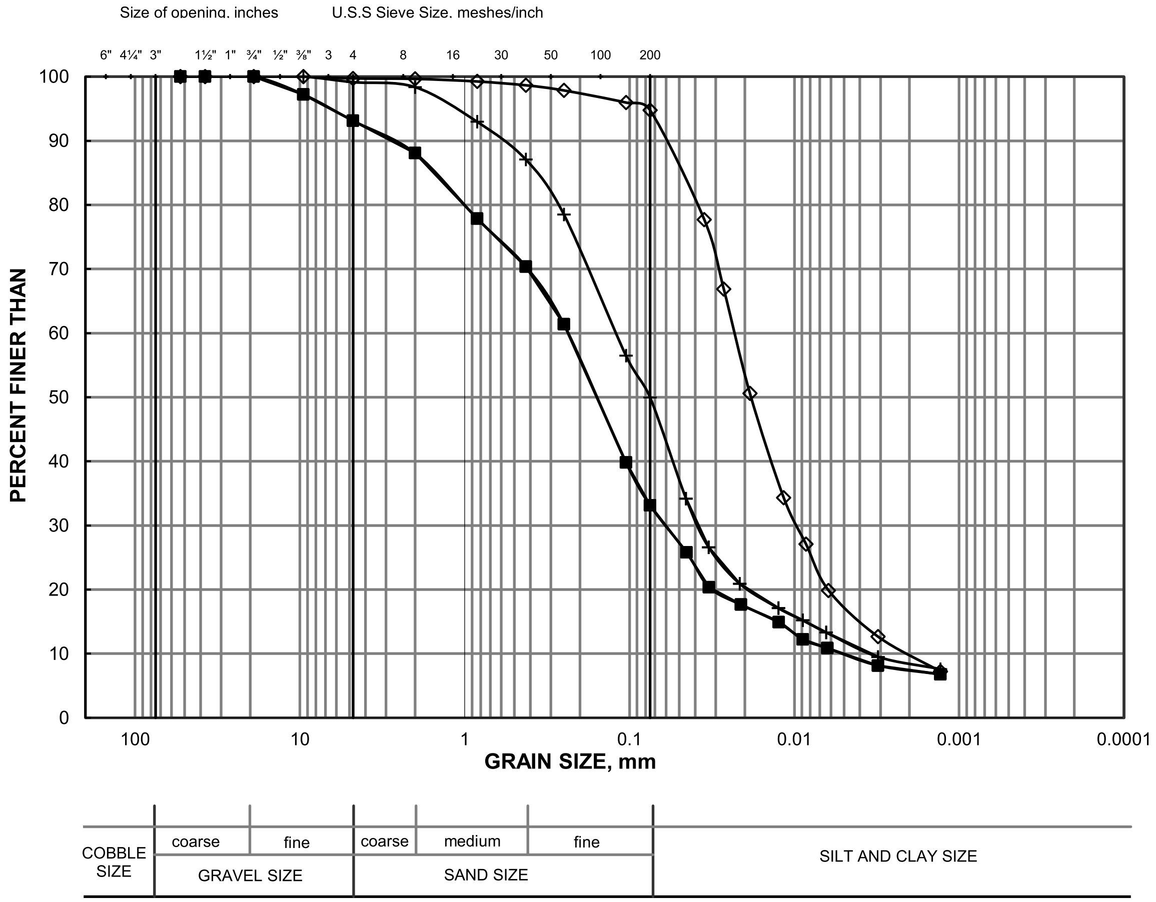
Terraprobe Inc.

Prepared by : SD
Checked by : RA

GRAIN SIZE DISTRIBUTION

FIGURE B4

SUBGRADE (Silty Sand to Silt)



LEGEND

SYMBOL	BH No.	STATION	LOCATION	DEPTH (m)
■	BH 8	10+700	NBSH	0.55 - 0.81
+	BH 57	15+000	NBL	1.25 - 1.50
◇	BH 74	16+600	NBL	0.85 - 1.50

Project No: 1-17-0714
Date: July, 2019

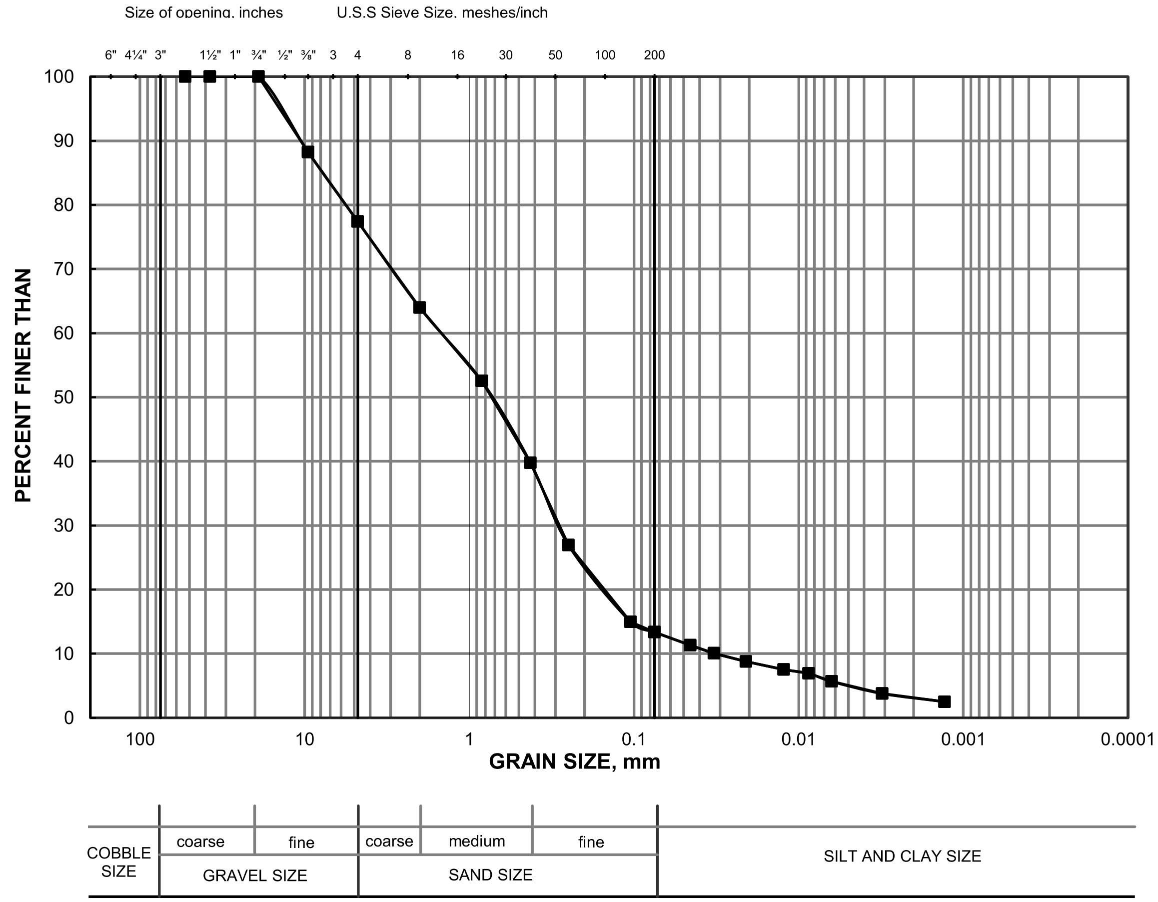
Terraprobe Inc.

Prepared by : SD
Checked by : RA

GRAIN SIZE DISTRIBUTION

FIGURE B5

SUBGRADE (Gravelly Sand to Gravel)



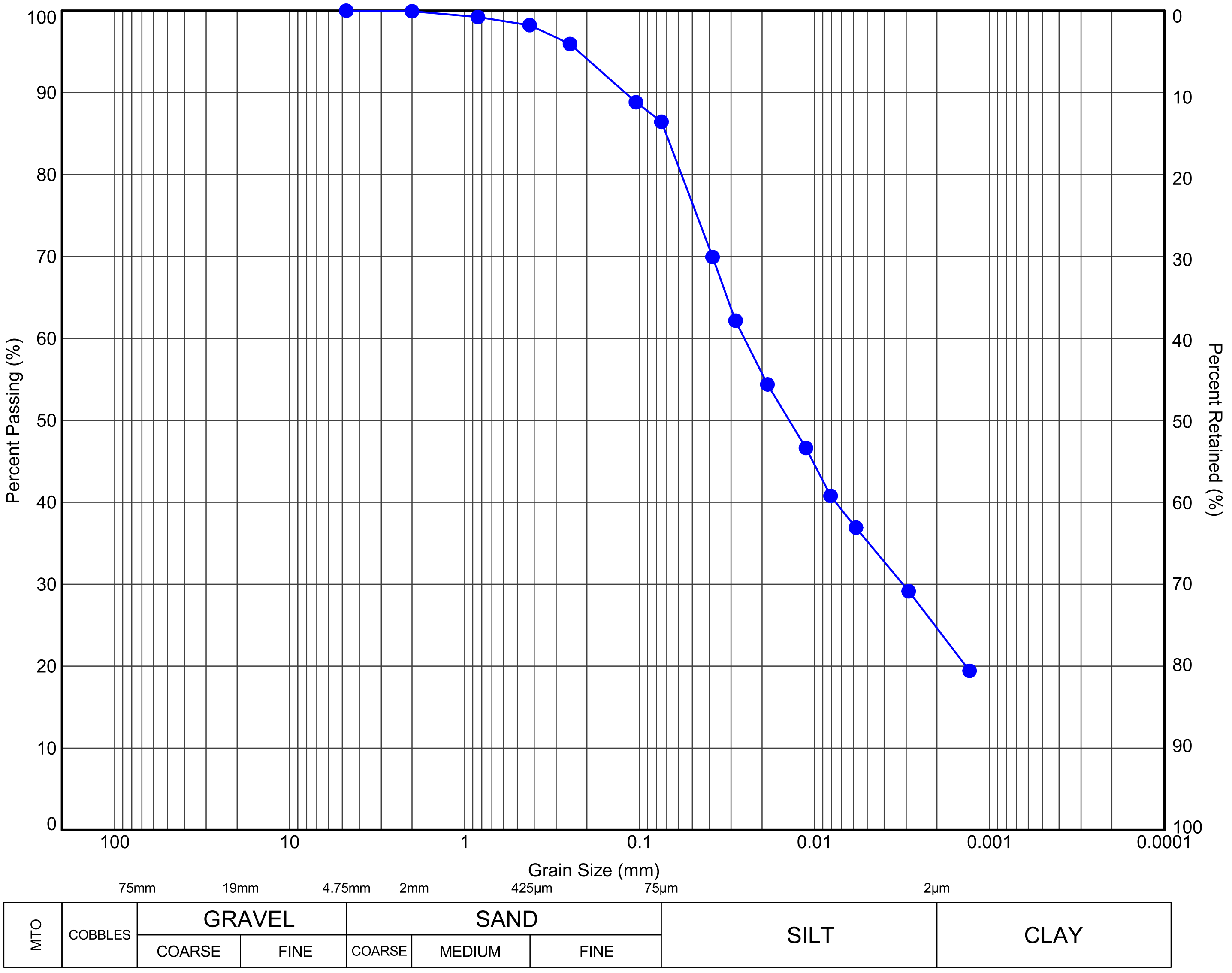
LEGEND

SYMBOL	BH No.	STATION	LOCATION	DEPTH (m)
■	BH 73	16+500	SBL	1.00 - 1.50

Project No: 1-17-0714
Date: July, 2019

Terraprobe Inc.

Prepared by : SD
Checked by : RA



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**1**	SS3	1.8	274.0	0	13	62	25	

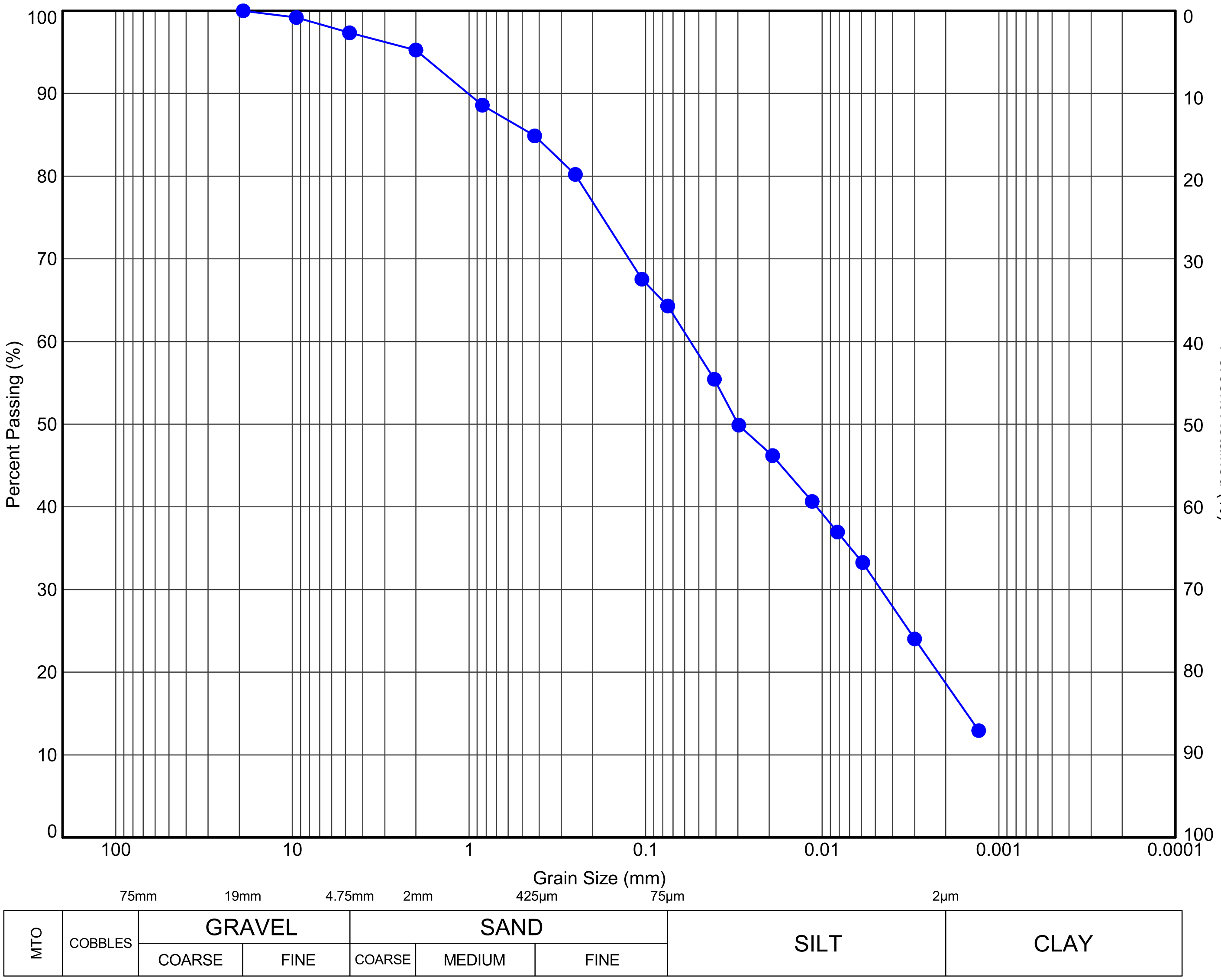
Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
FIGURE B6 - FILL-SILTY CLAY

File No.: **1-17-0714**



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**24**	SS4	2.5	292.3	3	32	46	19	

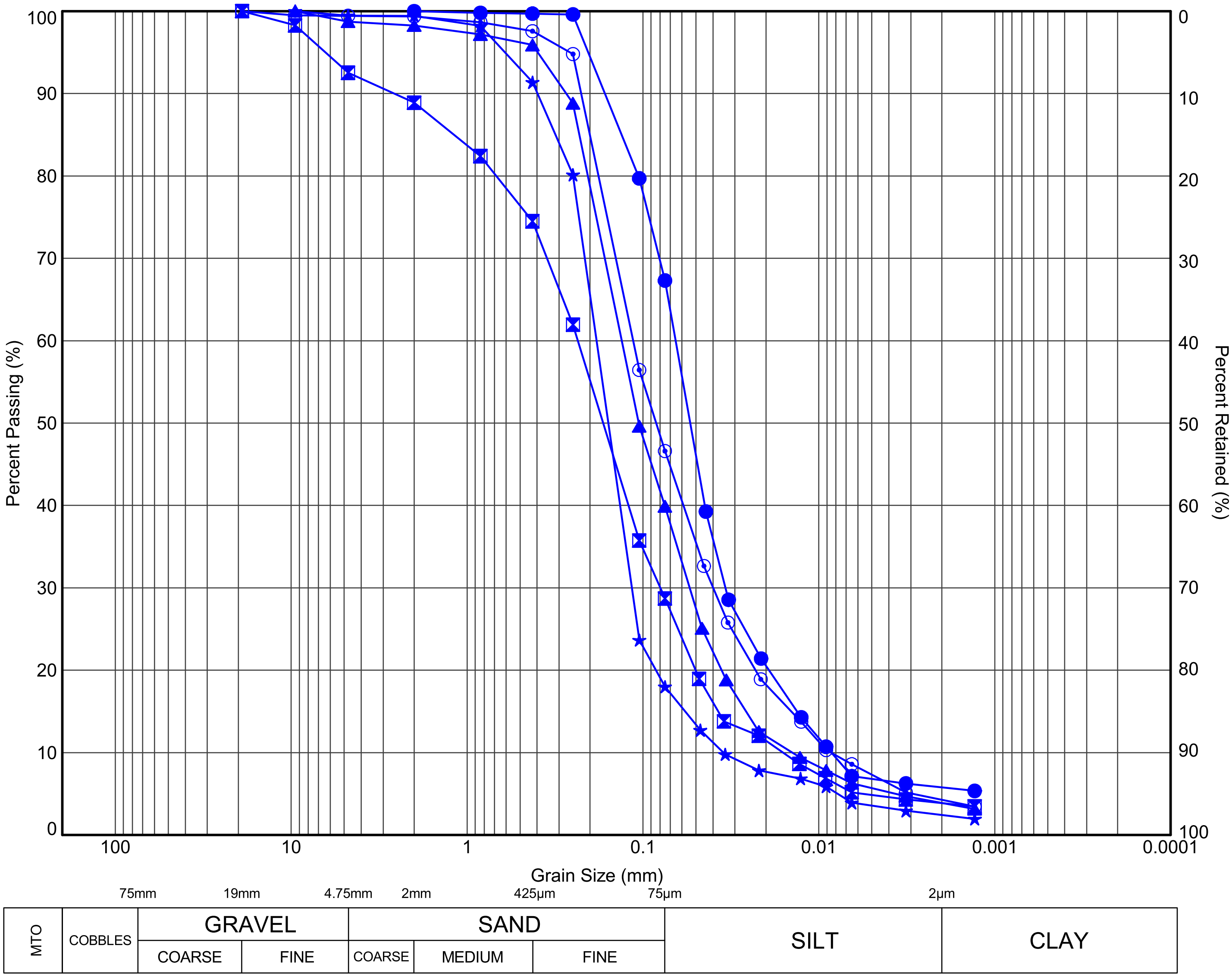
Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
FIGURE B7 - SILTY CLAY (GLACIAL TILL)

File No.: **1-17-0714**



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**24A**	SS6	4.0	290.9	0	32	62	6	
⊠	**64**	SS5	3.3	285.2	8	63	25	4	
▲	**64**	SS9	6.3	282.2	1	59	36	4	
★	**64A**	SS6	4.0	284.7	1	81	16	2	
⊙	**80A**	SS6	4.0	312.6	1	53	42	4	

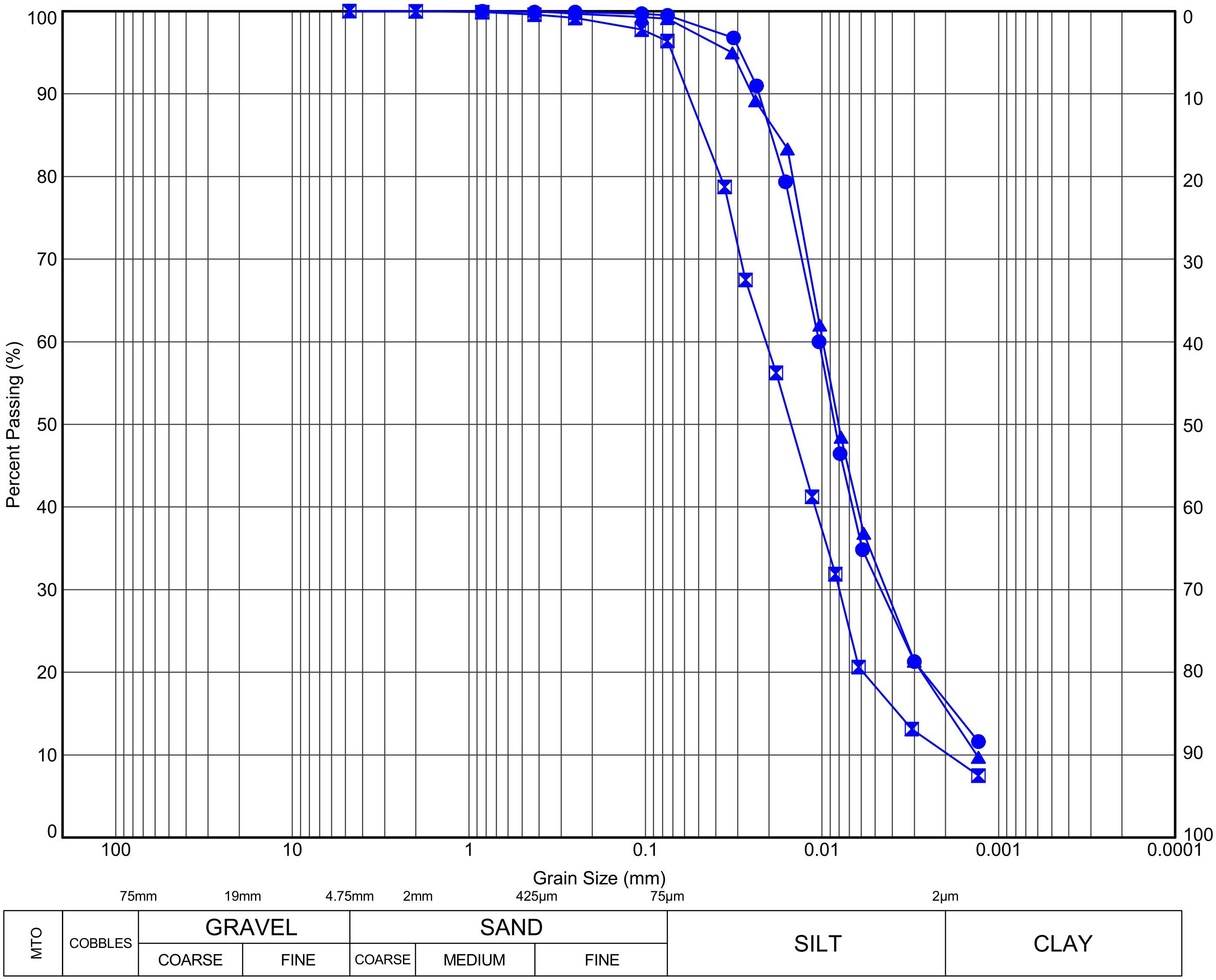
Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
FIGURE B8 - SAND TO SANDY SILT

File No.: **1-17-0714**



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**64**	SS10	7.1	281.4	0	0	83	17	
☒	**64A**	SS8	6.3	282.4	0	4	86	10	
▲	**80**	SS6	4.0	312.6	0	1	83	16	

Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
FIGURE B9 - CLAYEY SILT

File No.: **1-17-0714**

APPENDIX C

Laboratory Test Results
Soil Chemistry

FINAL REPORT

CA15860-MAY19 R

1-17-0714 Airport Rd,

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Terraprobe Inc	Project Specialist	Rob Irwin B.Sc., C.Chem
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane	Address	185 Concession St., Lakefield ON, K0L 2H0
	Brampton, ON		
	L6T 3Y3. Canada		
Contact	Sepideh D_Monfared	Telephone	705-652-2361
Telephone	(905) 796-2650	Facsimile	705-652-6365
Facsimile	(905) 796-2250	Email	rob.irwin@sgs.com
Email	smonfared@terraprobe.ca	SGS Reference	CA15860-MAY19
Project	1-17-0714 Airport Rd,	Received	05/27/2019
Order Number		Approved	05/31/2019
Samples	Soil (3)	Report Number	CA15860-MAY19 R
		Date Reported	05/31/2019

COMMENTS

Temperature of Sample upon Receipt: 9 degrees C

Cooling Agent Present:Yes

Custody Seal Present:No

Chain of Custody Number:007139

Chromium VI Duplicate RPD out side of control limits. Both values were within 5x the reporting limit where a greater uncertainty is expected, data accepted.

SIGNATORIES

Rob Irwin B.Sc., C.Chem

Association of the Chemical Profession of Ontario
CHARTERED
Robert Irwin
CHEMIST

TABLE OF CONTENTS

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	10
			Sample Name	Station 9+965, SBL, 300mm-900mm	Station 15+200, NBL, 260mm-900mm
			Sample Matrix	Soil	Soil
			Sample Date	16/05/2019	14/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Hydrides					
Antimony	µg/g	0.8	1	< 0.8	< 0.8
Arsenic	µg/g	0.5	11	3.4	3.0
Selenium	µg/g	0.7	1.2	< 0.7	< 0.7

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	10
			Sample Name	Station 9+965, SBL, 300mm-900mm	Station 15+200, NBL, 260mm-900mm
			Sample Matrix	Soil	Soil
			Sample Date	16/05/2019	14/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics					
Moisture Content	%	-		4.7	3.7
Barium	µg/g	0.1	210	39	45
Beryllium	µg/g	0.02	2.5	0.21	0.22
Boron	µg/g	1	36	4	4
Cadmium	µg/g	0.02	1	0.07	0.07
Chromium	µg/g	0.5	67	11	17
Cobalt	µg/g	0.01	19	4.4	5.1
Copper	µg/g	0.1	62	21	20
Lead	µg/g	0.1	45	8.6	8.2
Molybdenum	µg/g	0.1	2	0.7	0.4

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	10
			Sample Name	Station 9+965, SBL, 300mm-900mm	Station 15+200, NBL, 260mm-900mm
			Sample Matrix	Soil	Soil
			Sample Date	16/05/2019	14/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics (continued)					
Nickel	µg/g	0.5	37	13	14
Silver	µg/g	0.05	0.5	< 0.05	< 0.05
Thallium	µg/g	0.02	1	0.12	0.13
Uranium	µg/g	0.002	1.9	0.40	0.40
Vanadium	µg/g	3	86	19	20
Zinc	µg/g	0.7	290	38	37
Water Soluble Boron	µg/g	0.5		< 0.5	< 0.5

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	10
			Sample Name	Station 9+965, SBL, 300mm-900mm	Station 15+200, NBL, 260mm-900mm
			Sample Matrix	Soil	Soil
			Sample Date	16/05/2019	14/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Other (ORP)					
Mercury	µg/g	0.05	0.16	< 0.05	< 0.05
Sodium Adsorption Ratio	---	0.2	1	37.3	106
SAR Calcium	mg/L	0.09		3.2	4.6
SAR Magnesium	mg/L	0.02		1.0	0.62
SAR Sodium	mg/L	0.15		332	726
Conductivity	mS/cm	0.002	0.47	1.7	3.4

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	10
			Sample Name	Station 9+965, SBL, 300mm-900mm	Station 15+200, NBL, 260mm-900mm
			Sample Matrix	Soil	Soil
			Sample Date	16/05/2019	14/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Other (ORP) (continued)					
pH	pH Units	0.05		8.28	8.39
Chromium VI	µg/g	0.2	0.66	< 0.2	< 0.2
Free Cyanide	µg/g	0.05		< 0.05	< 0.05

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1
Station 9+965, SBL, 300mm-900mm				
Conductivity	EPA 6010/SM 2510	µg/g	1.7	0.47
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	37.3	1
Station 15+200, NBL, 260mm-900mm				
Conductivity	EPA 6010/SM 2510	µg/g	3.4	0.47
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	106	1

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0534-MAY19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5078-MAY19	μg/g	0.05	<0.05	ND	20	97	80	120	80	75	125

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A I Internal ref.: ME-CA-[ENV]IC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0536-MAY19	μg/g	0.2	<0.2	62	20	103	80	120	93	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0193-MAY19	µg/g	0.05	<0.05	ND	20	101	80	120	98	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0092-MAY19	mg/L	0.09	<0.09	1	20	101	80	120	103	70	130
SAR Magnesium	ESG0092-MAY19	mg/L	0.02	<0.02	9	20	101	80	120	106	70	130
SAR Sodium	ESG0092-MAY19	mg/L	0.15	<0.15	1	20	99	80	120	101	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0193-MAY19	ug/g	0.05	<0.05	7	20	100	70	130	102	70	130
Arsenic	EMS0193-MAY19	µg/g	0.5	<0.5	2	20	98	70	130	105	70	130
Barium	EMS0193-MAY19	ug/g	0.1	<0.1	2	20	100	70	130	94	70	130
Beryllium	EMS0193-MAY19	µg/g	0.02	<0.02	0	20	100	70	130	100	70	130
Boron	EMS0193-MAY19	µg/g	1	<1	2	20	103	70	130	97	70	130
Cadmium	EMS0193-MAY19	µg/g	0.02	<0.02	1	20	100	70	130	103	70	130
Cobalt	EMS0193-MAY19	µg/g	0.01	<0.01	3	20	101	70	130	107	70	130
Chromium	EMS0193-MAY19	µg/g	0.5	<0.5	3	20	100	70	130	110	70	130
Copper	EMS0193-MAY19	µg/g	0.1	<0.1	2	20	103	70	130	106	70	130
Molybdenum	EMS0193-MAY19	µg/g	0.1	<0.1	0	20	101	70	130	102	70	130
Nickel	EMS0193-MAY19	ug/g	0.5	<0.5	1	20	101	70	130	111	70	130
Lead	EMS0193-MAY19	µg/g	0.1	<0.1	1	20	101	70	130	105	70	130
Antimony	EMS0193-MAY19	µg/g	0.8	<0.8	ND	20	92	70	130	110	70	130
Selenium	EMS0193-MAY19	µg/g	0.7	<0.7	ND	20	101	70	130	102	70	130
Thallium	EMS0193-MAY19	µg/g	0.02	<0.02	4	20	104	70	130	103	70	130
Uranium	EMS0193-MAY19	µg/g	0.002	<0.002	2	20	103	70	130	104	70	130
Vanadium	EMS0193-MAY19	µg/g	3	<3	0	20	103	70	130	107	70	130
Zinc	EMS0193-MAY19	µg/g	0.7	<0.7	1	20	103	70	130	108	70	130

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0113-MAY19	pH Units	0.05		1	20	100	80	120			

Water Soluble Boron

Method: O.Reg. 153/04 I Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0088-MAY19	µg/g	0.5	<0.5	ND	20	100	80	120	106	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA15968-MAY19 R

1-17-0714, Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-17-0714, Airport Rd
Order Number	
Samples	Soil (2)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brad.moore@sgs.com
SGS Reference	CA15968-MAY19
Received	05/28/2019
Approved	06/03/2019
Report Number	CA15968-MAY19 R
Date Reported	06/03/2019

COMMENTS

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:007140

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8	9
Sample Name	Station 12+ 360, NBSH, 0-900mm	Station 12+360, SBSH, 5'-6.1/2'
Sample Matrix	Soil	Soil
Sample Date	16/05/2019	16/05/2019

Parameter	Units	RL	L1	Result	Result
Hydrides					
Antimony	µg/g	0.8	1	< 0.8	< 0.8
Arsenic	µg/g	0.5	11	2.3	5.4
Selenium	µg/g	0.7	1.2	< 0.7	< 0.7

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8	9
Sample Name	Station 12+ 360, NBSH, 0-900mm	Station 12+360, SBSH, 5'-6.1/2'
Sample Matrix	Soil	Soil
Sample Date	16/05/2019	16/05/2019

Parameter	Units	RL	L1	Result	Result
Metals and Inorganics					
Moisture Content	%	-		6.8	19.6
Barium	µg/g	0.1	210	30	90
Beryllium	µg/g	0.02	2.5	0.18	0.82
Boron	µg/g	1	36	4	5
Cadmium	µg/g	0.02	1	0.07	0.15
Chromium	µg/g	0.5	67	8.9	26
Cobalt	µg/g	0.01	19	3.4	13
Copper	µg/g	0.1	62	26	35
Lead	µg/g	0.1	45	11	17
Molybdenum	µg/g	0.1	2	0.4	0.3
Nickel	µg/g	0.5	37	8.1	27
Silver	µg/g	0.05	0.5	< 0.05	< 0.05

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9
			Sample Name	Station 12+ 360, NBSH, 0-900mm	Station 12+360, SBSH, 5'-6.1/2'
			Sample Matrix	Soil	Soil
			Sample Date	16/05/2019	16/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics (continued)					
Thallium	µg/g	0.02	1	0.06	0.18
Uranium	µg/g	0.002	1.9	0.28	0.45
Vanadium	µg/g	3	86	12	36
Zinc	µg/g	0.7	290	43	71
Water Soluble Boron	µg/g	0.5		< 0.5	< 0.5

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9
			Sample Name	Station 12+ 360, NBSH, 0-900mm	Station 12+360, SBSH, 5'-6.1/2'
			Sample Matrix	Soil	Soil
			Sample Date	16/05/2019	16/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Other (ORP)					
Mercury	µg/g	0.05	0.16	< 0.05	0.05
Sodium Adsorption Ratio	---	0.2	1	5.2	4.4
SAR Calcium	mg/L	0.09		15.6	40.0
SAR Magnesium	mg/L	0.02		2.4	45.3
SAR Sodium	mg/L	0.15		104	378
Conductivity	mS/cm	0.002	0.47	0.65	2.09
pH	pH Units	0.05		8.17	7.92
Chromium VI	µg/g	0.2	0.66	< 0.2	0.6
Free Cyanide	µg/g	0.05		< 0.05	< 0.05

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1
Station 12+ 360, NBSH, 0-900mm				
Conductivity	EPA 6010/SM 2510	µg/g	0.65	0.47
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	5.2	1
Station 12+360, SBSH, 5'-6.1/2'				
Conductivity	EPA 6010/SM 2510	µg/g	2.09	0.47
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	4.4	1

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0567-MAY19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5090-MAY19	µg/g	0.05	<0.05	ND	20	100	80	120	99	75	125

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-[ENV]IC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0585-MAY19	µg/g	0.2	<0.2	ND	20	100	80	120	94	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 l Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0202-MAY19	µg/g	0.05	<0.05	ND	20	102	80	120	100	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 l Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0097-MAY19	mg/L	0.09	<0.09	1	20	101	80	120	103	70	130
SAR Magnesium	ESG0097-MAY19	mg/L	0.02	<0.02	1	20	100	80	120	106	70	130
SAR Sodium	ESG0097-MAY19	mg/L	0.15	<0.15	3	20	99	80	120	101	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0202-MAY19	ug/g	0.05	<0.05	ND	20	98	70	130	103	70	130
Arsenic	EMS0202-MAY19	μg/g	0.5	<0.5	7	20	99	70	130	103	70	130
Barium	EMS0202-MAY19	ug/g	0.1	<0.1	7	20	106	70	130	98	70	130
Beryllium	EMS0202-MAY19	μg/g	0.02	<0.02	5	20	104	70	130	106	70	130
Boron	EMS0202-MAY19	μg/g	1	<1	7	20	93	70	130	97	70	130
Cadmium	EMS0202-MAY19	μg/g	0.02	<0.02	14	20	102	70	130	106	70	130
Cobalt	EMS0202-MAY19	μg/g	0.01	<0.01	7	20	101	70	130	111	70	130
Chromium	EMS0202-MAY19	μg/g	0.5	<0.5	7	20	106	70	130	115	70	130
Copper	EMS0202-MAY19	μg/g	0.1	<0.1	7	20	103	70	130	112	70	130
Molybdenum	EMS0202-MAY19	μg/g	0.1	<0.1	11	20	96	70	130	107	70	130
Nickel	EMS0202-MAY19	ug/g	0.5	<0.5	6	20	104	70	130	113	70	130
Lead	EMS0202-MAY19	μg/g	0.1	<0.1	2	20	106	70	130	107	70	130
Antimony	EMS0202-MAY19	μg/g	0.8	<0.8	ND	20	100	70	130	117	70	130
Selenium	EMS0202-MAY19	μg/g	0.7	<0.7	ND	20	104	70	130	104	70	130
Thallium	EMS0202-MAY19	μg/g	0.02	<0.02	13	20	106	70	130	104	70	130
Uranium	EMS0202-MAY19	μg/g	0.002	<0.002	4	20	100	70	130	98	70	130
Vanadium	EMS0202-MAY19	μg/g	3	<3	5	20	102	70	130	109	70	130
Zinc	EMS0202-MAY19	μg/g	0.7	<0.7	ND	20	109	70	130	111	70	130

QC SUMMARY

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0118-MAY19	pH Units	0.05		0	20	100	80	120			

Water Soluble Boron

Method: O.Reg. 153/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0091-MAY19	µg/g	0.5	<0.5	ND	20	105	80	120	111	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14189-JUN19 R

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Terraprobe Inc	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Sepideh D_Monfared	Telephone	705-652-2143
Telephone	(905) 796-2650	Facsimile	705-652-6365
Facsimile	(905) 796-2250	Email	brad.moore@sgs.com
Email	smonfared@terraprobe.ca	SGS Reference	CA14189-JUN19
Project	1-17-0714 Airport Rd	Received	06/05/2019
Order Number		Approved	06/11/2019
Samples	Soil (4)	Report Number	CA14189-JUN19 R
		Date Reported	06/11/2019

COMMENTS

Temperature of Sample upon Receipt: 8 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:003931

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

FINAL REPORT

CA14189-JUN19 R

Client: Terraprobe Inc
Project: 1-17-0714 Airport Rd
Project Manager: Sepideh D_Monfared
Samplers: Maged Abdlrahem

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number				8	9	10	11
Sample Name				Station 15 + 740, NBL, 3`-4`	Station 16 + 600, NBL, 190mm-850mm	Station 17 + 145, SBL, 2.5`-4'	Station 14 + 560, NBSH, 220mm-420mm
Sample Matrix				Soil	Soil	Soil	Soil
Sample Date				29/05/2019	31/05/2019	03/06/2019	03/06/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Hydrides							
Antimony	µg/g	0.8	1	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	11	2.5	2.4	2.1	3.0
Selenium	µg/g	0.7	1.2	< 0.7	< 0.7	< 0.7	< 0.7

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number				8	9	10	11
Sample Name				Station 15 + 740, NBL, 3`-4`	Station 16 + 600, NBL, 190mm-850mm	Station 17 + 145, SBL, 2.5`-4'	Station 14 + 560, NBSH, 220mm-420mm
Sample Matrix				Soil	Soil	Soil	Soil
Sample Date				29/05/2019	31/05/2019	03/06/2019	03/06/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics							
Moisture Content	%	-		9.6	4.1	11.7	4.6
Barium	µg/g	0.1	210	30	29	20	39
Beryllium	µg/g	0.02	2.5	0.15	0.14	0.12	0.23
Boron	µg/g	1	36	3	3	3	5
Cadmium	µg/g	0.02	1	0.09	0.10	0.03	0.09
Chromium	µg/g	0.5	67	8.4	9.7	7.8	20
Cobalt	µg/g	0.01	19	3.3	3.7	3.0	5.2
Copper	µg/g	0.1	62	16	20	10	19
Lead	µg/g	0.1	45	22	59	3.3	14
Molybdenum	µg/g	0.1	2	0.5	0.6	0.4	0.3

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	Station 15 + 740, NBL, 3`-4`	Station 16 + 600, NBL, 190mm-850mm	Station 17 + 145, SBL, 2.5`-4'	Station 14 + 560, NBSH, 220mm-420mm
			Sample Matrix	Soil	Soil	Soil	Soil
			Sample Date	29/05/2019	31/05/2019	03/06/2019	03/06/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)							
Nickel	µg/g	0.5	37	7.2	8.5	6.3	12
Silver	µg/g	0.05	0.5	< 0.05	< 0.05	< 0.05	< 0.05
Thallium	µg/g	0.02	1	0.07	0.08	0.06	0.11
Uranium	µg/g	0.002	1.9	0.31	0.26	0.39	0.40
Vanadium	µg/g	3	86	14	18	13	17
Zinc	µg/g	0.7	290	27	33	16	40
Water Soluble Boron	µg/g	0.5		< 0.5	< 0.5	< 0.5	< 0.5

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	Station 15 + 740, NBL, 3`-4`	Station 16 + 600, NBL, 190mm-850mm	Station 17 + 145, SBL, 2.5`-4'	Station 14 + 560, NBSH, 220mm-420mm
			Sample Matrix	Soil	Soil	Soil	Soil
			Sample Date	29/05/2019	31/05/2019	03/06/2019	03/06/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Other (ORP)							
Mercury	µg/g	0.05	0.16	< 0.05	< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	---	0.2	1	5.3	7.0	8.6	0.6
SAR Calcium	mg/L	0.09		13.8	6.7	8.4	19.5
SAR Magnesium	mg/L	0.02		3.7	2.4	2.7	1.4
SAR Sodium	mg/L	0.15		87.1	90.4	135	9.6
Conductivity	mS/cm	0.002	0.47	0.53	0.51	0.80	0.12

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9	10	11
			Sample Name	Station 15 + 740, NBL, 3`-4`	Station 16 + 600, NBL, 190mm-850mm	Station 17 + 145, SBL, 2.5`-4'	Station 14 + 560, NBSH, 220mm-420mm
			Sample Matrix	Soil	Soil	Soil	Soil
			Sample Date	29/05/2019	31/05/2019	03/06/2019	03/06/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Other (ORP) (continued)							
pH	pH Units	0.05		8.01	8.28	8.04	8.26
Chromium VI	µg/g	0.2	0.66	**0.8**	< 0.2	< 0.2	< 0.2
Free Cyanide	µg/g	0.05		< 0.05	< 0.05	< 0.05	< 0.05

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1
Station 15 + 740, NBL, 3`-4`				
Conductivity	EPA 6010/SM 2510	µg/g	0.53	0.47
Chromium VI	EPA218.6/EPA3060A	µg/g	0.8	0.66
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	5.3	1
Station 16 + 600, NBL, 190mm-850mm				
Lead	EPA 3050/EPA 200.8	µg/g	59	45
Conductivity	EPA 6010/SM 2510	µg/g	0.51	0.47
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	7.0	1
Station 17 + 145, SBL, 2.5`-4'				
Conductivity	EPA 6010/SM 2510	µg/g	0.80	0.47
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	µg/g	8.6	1

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0123-JUN19	mS/cm	0.002	<0.002	0	10	99	90	110	NA		

Cyanide by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5016-JUN19	µg/g	0.05	<0.05	ND	20	101	80	120	NV	75	125
Free Cyanide	SKA5021-JUN19	µg/g	0.05	<0.05	ND	20	97	80	120	101	75	125

Hexavalent Chromium by IC

Method: EPA218.6/EPA3060A I Internal ref.: ME-CA-[ENV]IC-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	DIO0119-JUN19	µg/g	0.2	<0.2	ND	20	98	80	120	94	75	125

FINAL REPORT

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0032-JUN19	µg/g	0.05	<0.05	ND	20	101	80	120	93	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0021-JUN19	mg/L	0.09	<0.09	4	20	99	80	120	100	70	130
SAR Magnesium	ESG0021-JUN19	mg/L	0.02	<0.02	ND	20	96	80	120	101	70	130
SAR Sodium	ESG0021-JUN19	mg/L	0.15	<0.15	4	20	91	80	120	93	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0032-JUN19	ug/g	0.05	<0.05	ND	20	102	70	130	101	70	130
Arsenic	EMS0032-JUN19	µg/g	0.5	<0.5	7	20	92	70	130	92	70	130
Barium	EMS0032-JUN19	ug/g	0.1	<0.1	10	20	107	70	130	94	70	130
Beryllium	EMS0032-JUN19	µg/g	0.02	<0.02	1	20	100	70	130	95	70	130
Boron	EMS0032-JUN19	µg/g	1	<1	6	20	108	70	130	96	70	130
Cadmium	EMS0032-JUN19	µg/g	0.02	<0.02	4	20	100	70	130	104	70	130
Cobalt	EMS0032-JUN19	µg/g	0.01	<0.01	0	20	102	70	130	109	70	130
Chromium	EMS0032-JUN19	µg/g	0.5	<0.5	1	20	101	70	130	108	70	130
Copper	EMS0032-JUN19	µg/g	0.1	<0.1	1	20	104	70	130	104	70	130
Molybdenum	EMS0032-JUN19	µg/g	0.1	<0.1	12	20	95	70	130	106	70	130
Nickel	EMS0032-JUN19	ug/g	0.5	<0.5	7	20	105	70	130	109	70	130
Lead	EMS0032-JUN19	µg/g	0.1	<0.1	2	20	103	70	130	95	70	130
Antimony	EMS0032-JUN19	µg/g	0.8	<0.8	ND	20	108	70	130	97	70	130
Selenium	EMS0032-JUN19	µg/g	0.7	<0.7	ND	20	103	70	130	102	70	130
Thallium	EMS0032-JUN19	µg/g	0.02	<0.02	ND	20	101	70	130	96	70	130
Uranium	EMS0032-JUN19	µg/g	0.002	<0.002	1	20	101	70	130	93	70	130
Vanadium	EMS0032-JUN19	µg/g	3	<3	2	20	103	70	130	107	70	130
Zinc	EMS0032-JUN19	µg/g	0.7	<0.7	3	20	103	70	130	102	70	130

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0026-JUN19	pH Units	0.05		0	20	101	80	120			

Water Soluble Boron

Method: O.Reg. 153/04 I Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0015-JUN19	µg/g	0.5	<0.5	ND	20	103	80	120	101	70	130

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14738-MAY19 R

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Terraprobe Inc	Project Specialist	Rob Irwin B.Sc., C.Chem
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Sepideh D_Monfared	Telephone	705-652-2361
Telephone	(905) 796-2650	Facsimile	705-652-6365
Facsimile	(905) 796-2250	Email	rob.irwin@sgs.com
Email	smonfared@terraprobe.ca	SGS Reference	CA14738-MAY19
Project		Received	05/16/2019
Order Number		Approved	05/23/2019
Samples	Soil (1)	Report Number	CA14738-MAY19 R
		Date Reported	05/23/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES
nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:007131

SIGNATORIES

Rob Irwin B.Sc., C.Chem

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Robert Irwin
CHEMIST

TABLE OF CONTENTS

PACKAGE: **REG153 - BTEX** (SOIL)

Sample Number 8
Sample Name Station 13 + 875, NBL, (650mm-1m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
BTEX				
Benzene	µg/g	0.02	0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	< 0.05
Toluene	µg/g	0.05	0.2	< 0.05
Xylene (total)	µg/g	0.05	0.05	< 0.05
m/p-xylene	µg/g	0.05		< 0.05
o-xylene	µg/g	0.05		< 0.05

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

Sample Number 8
Sample Name Station 13 + 875, NBL, (650mm-1m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Moisture Content	%	-		13.6

PACKAGE: **REG153 - PHCs** (SOIL)

Sample Number 8

Sample Name Station 13 + 875,
NBL,
(650mm-1m)

Sample Matrix Soil

Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
PHCs				
F1 (C6-C10)	µg/g	10	17	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10
F2 (C10-C16)	µg/g	10	10	< 10
F3 (C16-C34)	µg/g	50	240	< 50
F4 (C34-C50)	µg/g	50	120	< 50
Chromatogram returned to baseline at nC50	Yes / No	-		YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

Sample Number 8

Sample Name Station 13 + 875,
NBL,
(650mm-1m)

Sample Matrix Soil

Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
THMs (VOC)				
Bromodichloromethane	µg/g	0.05	0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

Sample Number 8
Sample Name Station 13 + 875, NBL, (650mm-1m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOC Surrogates				
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		101
Surr 4-Bromofluorobenzene	Surr Rec %	-		92
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		83

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 13 + 875, NBL, (650mm-1m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs				
Acetone	µg/g	0.5	0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	< 0.05
Chloroform	µg/g	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number 8

Sample Name Station 13 + 875,
NBL,
(650mm-1m)

Sample Matrix Soil

Sample Date 15/05/2019

Parameter	Units	RL	L1	Result
VOCs (continued)				
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 13 + 875, NBL, (650mm-1m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs (continued)				
Vinyl Chloride	µg/g	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

FINAL REPORT

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0364-MAY19	µg/g	10	<10	ND	30	101	80	120	97	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0376-MAY19	µg/g	10	<10	ND	30	117	80	120	111	60	140
F3 (C16-C34)	GCM0376-MAY19	µg/g	50	<50	ND	30	117	80	120	111	60	140
F4 (C34-C50)	GCM0376-MAY19	µg/g	50	<50	ND	30	117	80	120	111	60	140

FINAL REPORT

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	89	50	140
1,1,1-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	79	50	140
1,1,2,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	78	50	140
1,1,2-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	88	50	140
1,1-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
1,1-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	72	60	130	60	50	140
1,2-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	86	50	140
1,2-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	81	50	140
1,2-Dichloropropane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140
1,3-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	83	50	140
1,4-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	84	50	140
Acetone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	96	50	140	90	50	140
Benzene	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	81	60	130	82	50	140
Bromodichloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	86	50	140
Bromoform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	84	50	140
Bromomethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	50	140	56	50	140
Carbon tetrachloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	82	50	140
Chlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	87	50	140
Chloroform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	83	50	140
cis-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	84	60	130	84	50	140
Dibromochloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	92	50	140
Dichlorodifluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	79	50	140	62	50	140
Ethylbenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	85	50	140
Ethylenedibromide	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	92	50	140
n-Hexane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	63	50	140
m/p-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	91	50	140
Methyl ethyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	91	50	140	90	50	140
Methyl isobutyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	89	50	140	93	50	140
Methyl-t-butyl Ether	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	102	60	130	96	50	140
Methylene Chloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	72	50	140
o-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	90	50	140
Styrene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	91	60	130	94	50	140
Tetrachloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	90	50	140
Toluene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	84	50	140
trans-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
trans-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	82	60	130	83	50	140
Trichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	94	50	140
Trichlorofluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	50	140	70	50	140
Vinyl Chloride	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	83	50	140	77	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14740-MAY19 R

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-17-0714 Airport Rd
Order Number	
Samples	Soil (1)

LABORATORY DETAILS

Project Specialist	Rob Irwin B.Sc., C.Chem
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2361
Facsimile	705-652-6365
Email	rob.irwin@sgs.com
SGS Reference	CA14740-MAY19
Received	05/16/2019
Approved	05/23/2019
Report Number	CA14740-MAY19 R
Date Reported	05/23/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.
    nC6 and nC10 response factors within 30% of response factor for toluene: YES
    nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
    C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
    Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:003435

VOC vial tare weight provided by client as vials used were not from SGS.

QC-Batch- GCM0385-MAY19 - PHC F2 (C10-C16) Duplicate RPD is outside control limits. The average of the two duplicates is less than five times the RL, therefore a greater uncertainty is expected.

SIGNATORIES

Rob Irwin B.Sc., C.Chem

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Robert Irwin
CHEMIST

TABLE OF CONTENTS

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8
Sample Name	Station 13+915-NBL (900mm-1.5m)
Sample Matrix	Soil
Sample Date	10/05/2019

Parameter	Units	RL	L1	Result
BTEX				
Benzene	µg/g	0.02	0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	< 0.05
Toluene	µg/g	0.05	0.2	< 0.05
Xylene (total)	µg/g	0.05	0.05	< 0.05
m/p-xylene	µg/g	0.05		< 0.05
o-xylene	µg/g	0.05		< 0.05

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8
Sample Name	Station 13+915-NBL (900mm-1.5m)
Sample Matrix	Soil
Sample Date	10/05/2019

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Moisture Content	%	-		17.6

PACKAGE: **REG153 - PHCs** (SOIL)

Sample Number	8
Sample Name	Station 13+915-NBL (900mm-1.5m)
Sample Matrix	Soil
Sample Date	10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	**Units**	**RL**	**L1**	**Result**
PHCs				
F1 (C6-C10)	µg/g	10	17	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10
F2 (C10-C16)	µg/g	10	10	< 10
F3 (C16-C34)	µg/g	50	240	< 50
F4 (C34-C50)	µg/g	50	120	< 50
Chromatogram returned to baseline at nC50	Yes / No	-		YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

Sample Number	8
Sample Name	Station 13+915-NBL (900mm-1.5m)
Sample Matrix	Soil
Sample Date	10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	**Units**	**RL**	**L1**	**Result**
THMs (VOC)				
Bromodichloromethane	µg/g	0.05	0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

Sample Number 8
Sample Name Station 13+915-NBL (900mm-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOC Surrogates				
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		94
Surr 4-Bromofluorobenzene	Surr Rec %	-		99
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		83

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 13+915-NBL (900mm-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs				
Acetone	µg/g	0.5	0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	< 0.05
Chloroform	µg/g	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 13+915-NBL (900mm-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs (continued)				
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number	8
Sample Name	Station 13+915-NBL (900mm-1.5m)
Sample Matrix	Soil
Sample Date	10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs (continued)				
Vinyl Chloride	µg/g	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0364-MAY19	µg/g	10	<10	ND	30	101	80	120	97	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0385-MAY19	µg/g	10	<10	80	30	114	80	120	119	60	140
F3 (C16-C34)	GCM0385-MAY19	µg/g	50	<50	ND	30	114	80	120	119	60	140
F4 (C34-C50)	GCM0385-MAY19	µg/g	50	<50	ND	30	114	80	120	119	60	140

FINAL REPORT

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	89	50	140
1,1,1-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	79	50	140
1,1,2,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	78	50	140
1,1,2-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	88	50	140
1,1-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
1,1-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	72	60	130	60	50	140
1,2-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	86	50	140
1,2-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	81	50	140
1,2-Dichloropropane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140
1,3-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	83	50	140
1,4-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	84	50	140
Acetone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	96	50	140	90	50	140
Benzene	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	81	60	130	82	50	140
Bromodichloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	86	50	140
Bromoform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	84	50	140
Bromomethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	50	140	56	50	140
Carbon tetrachloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	82	50	140
Chlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	87	50	140
Chloroform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	83	50	140
cis-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140

FINAL REPORT

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	84	60	130	84	50	140
Dibromochloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	92	50	140
Dichlorodifluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	79	50	140	62	50	140
Ethylbenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	85	50	140
Ethylenedibromide	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	92	50	140
n-Hexane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	63	50	140
m/p-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	91	50	140
Methyl ethyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	91	50	140	90	50	140
Methyl isobutyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	89	50	140	93	50	140
Methyl-t-butyl Ether	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	102	60	130	96	50	140
Methylene Chloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	72	50	140
o-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	90	50	140
Styrene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	91	60	130	94	50	140
Tetrachloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	90	50	140
Toluene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	84	50	140
trans-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
trans-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	82	60	130	83	50	140
Trichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	94	50	140
Trichlorofluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	50	140	70	50	140
Vinyl Chloride	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	83	50	140	77	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14744-MAY19 R

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS		**LABORATORY DETAILS**	
Client	Terraprobe Inc	Project Specialist	Rob Irwin B.Sc., C.Chem
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Sepideh D_Monfared	Telephone	705-652-2361
Telephone	(905) 796-2650	Facsimile	705-652-6365
Facsimile	(905) 796-2250	Email	rob.irwin@sgs.com
Email	smonfared@terraprobe.ca	SGS Reference	CA14744-MAY19
Project	1-17-0714 Airport Rd	Received	05/16/2019
Order Number		Approved	05/23/2019
Samples	Soil (1)	Report Number	CA14744-MAY19 R
		Date Reported	05/23/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.
- nC6 and nC10 response factors within 30% of response factor for toluene: YES
- nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
- C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
- Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:003433

VOC vial tare weight provided by client as vials used were not from SGS.

SIGNATORIES

Rob Irwin B.Sc., C.Chem

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Robert Irwin
CHEMIST

TABLE OF CONTENTS

Client: Terraprobe Inc
Project: 1-17-0714 Airport Rd
Project Manager: Sepideh D_Monfared
Samplers: Majed A

PACKAGE: **REG153 - BTEX** (SOIL)

Sample Number 8
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
BTEX				
Benzene	µg/g	0.02	0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	< 0.05
Toluene	µg/g	0.05	0.2	< 0.05
Xylene (total)	µg/g	0.05	0.05	< 0.05
m/p-xylene	µg/g	0.05		< 0.05
o-xylene	µg/g	0.05		< 0.05

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

Sample Number 8
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Moisture Content	%	-		14.4

PACKAGE: **REG153 - PHCs** (SOIL)

Sample Number 8
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
PHCs				
F1 (C6-C10)	µg/g	10	17	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10
F2 (C10-C16)	µg/g	10	10	< 10
F3 (C16-C34)	µg/g	50	240	< 50
F4 (C34-C50)	µg/g	50	120	< 50
Chromatogram returned to baseline at nC50	Yes / No	-		YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

Sample Number 8
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
THMs (VOC)				
Bromodichloromethane	µg/g	0.05	0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

Sample Number 8
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOC Surrogates				
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		98
Surr 4-Bromofluorobenzene	Surr Rec %	-		91
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		84

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs				
Acetone	µg/g	0.5	0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	< 0.05
Chloroform	µg/g	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number 8
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

Parameter	Units	RL	L1	Result
VOCs (continued)				
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8
Sample Name	Station 14+120-NBL-(900m-1.5m)
Sample Matrix	Soil
Sample Date	10/05/2019

Parameter	Units	RL	L1	Result
VOCs (continued)				
Vinyl Chloride	µg/g	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0364-MAY19	µg/g	10	<10	ND	30	101	80	120	97	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0384-MAY19	µg/g	10	<10	ND	30	118	80	120	110	60	140
F3 (C16-C34)	GCM0384-MAY19	µg/g	50	<50	ND	30	118	80	120	110	60	140
F4 (C34-C50)	GCM0384-MAY19	µg/g	50	<50	ND	30	118	80	120	110	60	140

FINAL REPORT

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	89	50	140
1,1,1-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	79	50	140
1,1,2,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	78	50	140
1,1,2-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	88	50	140
1,1-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
1,1-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	72	60	130	60	50	140
1,2-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	86	50	140
1,2-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	81	50	140
1,2-Dichloropropane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140
1,3-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	83	50	140
1,4-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	84	50	140
Acetone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	96	50	140	90	50	140
Benzene	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	81	60	130	82	50	140
Bromodichloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	86	50	140
Bromoform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	84	50	140
Bromomethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	50	140	56	50	140
Carbon tetrachloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	82	50	140
Chlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	87	50	140
Chloroform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	83	50	140
cis-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	84	60	130	84	50	140
Dibromochloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	92	50	140
Dichlorodifluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	79	50	140	62	50	140
Ethylbenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	85	50	140
Ethylenedibromide	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	92	50	140
n-Hexane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	63	50	140
m/p-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	91	50	140
Methyl ethyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	91	50	140	90	50	140
Methyl isobutyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	89	50	140	93	50	140
Methyl-t-butyl Ether	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	102	60	130	96	50	140
Methylene Chloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	72	50	140
o-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	90	50	140
Styrene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	91	60	130	94	50	140
Tetrachloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	90	50	140
Toluene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	84	50	140
trans-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
trans-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	82	60	130	83	50	140
Trichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	94	50	140
Trichlorofluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	50	140	70	50	140
Vinyl Chloride	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	83	50	140	77	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

FINAL REPORT

CA14739-MAY19 R1

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

CA14739-MAY19 R1

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-17-0714 Airport Rd
Order Number	
Samples	Soil (1)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brad.moore@sgs.com
SGS Reference	CA14739-MAY19
Received	05/16/2019
Approved	08/13/2019
Report Number	CA14739-MAY19 R1
Date Reported	08/13/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES
nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: degrees C
Cooling Agent Present:
Custody Seal Present:

Chain of Custody Number:

VOC vial tare weight provided by client as vials used were not from SGS.

VOC RL's were increased due to sample dilution.

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

FINAL REPORT

Client: Terraprobe Inc
Project: 1-17-0714 Airport Rd
Project Manager: Sepideh D_Monfared
Samplers: Majed A

PACKAGE: **REG153 - BTEX** (SOIL)

Sample Number 8
Sample Name Station 14+400, SB, off road, 800mm-1.2m
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
BTEX				
Benzene	µg/g	0.02	0.02	**54.1**
Ethylbenzene	µg/g	0.05	0.05	**112**
Toluene	µg/g	0.05	0.2	**269**
Xylene (total)	µg/g	0.05	0.05	**521**
m/p-xylene	µg/g	0.05		374
o-xylene	µg/g	0.05		148

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

Sample Number 8
Sample Name Station 14+400, SB, off road, 800mm-1.2m
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Moisture Content	%	-		23.2

PACKAGE: **REG153 - PHCs** (SOIL)

Sample Number 8
Sample Name Station 14+400, SB, off road, 800mm-1.2m
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
PHCs				
F1 (C6-C10)	µg/g	10	17	5280
F1-BTEX (C6-C10)	µg/g	10		4320
F2 (C10-C16)	µg/g	10	10	390
F3 (C16-C34)	µg/g	50	240	98
F4 (C34-C50)	µg/g	50	120	55
Chromatogram returned to baseline at nC50	Yes / No	-		YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

Sample Number 8
Sample Name Station 14+400, SB, off road, 800mm-1.2m
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
THMs (VOC)				
Bromodichloromethane	µg/g	0.05	0.05	< 0.5↑
Bromoform	µg/g	0.05	0.05	< 0.5↑
Dibromochloromethane	µg/g	0.05	0.05	< 0.5↑

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

Sample Number 8

Sample Name Station 14+400, SB, off road, 800mm-1.2m

Sample Matrix Soil

Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOC Surrogates				
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		82
Surr 4-Bromofluorobenzene	Surr Rec %	-		94
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		86

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8

Sample Name Station 14+400, SB, off road, 800mm-1.2m

Sample Matrix Soil

Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs				
Acetone	µg/g	0.5	0.5	< 5↑
Bromomethane	µg/g	0.05	0.05	< 1↑
Carbon tetrachloride	µg/g	0.05	0.05	< 0.5↑
Chlorobenzene	µg/g	0.05	0.05	< 0.5↑
Chloroform	µg/g	0.05	0.05	< 0.5↑
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.5↑
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.5↑
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.5↑
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.5↑
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.5↑

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number 8

Sample Name Station 14+400, SB, off road, 800mm-1.2m

Sample Matrix Soil

Sample Date 10/05/2019

Parameter	Units	RL	L1	Result
VOCs (continued)				
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.5↑
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.5↑
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.5↑
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.5↑
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.5↑
cis-1,3-dichloropropene	µg/g	0.03		< 0.3↑
trans-1,3-dichloropropene	µg/g	0.03		< 0.3↑
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.5↑
Ethylenedibromide	µg/g	0.05	0.05	< 0.5↑
n-Hexane	µg/g	0.05	0.05	136
Methyl ethyl ketone	µg/g	0.5	0.5	< 5↑
Methyl isobutyl ketone	µg/g	0.5	0.5	< 5↑
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.5↑
Methylene Chloride	µg/g	0.05	0.05	< 0.5↑
Styrene	µg/g	0.05	0.05	< 0.5↑
Tetrachloroethylene	µg/g	0.05	0.05	< 0.5↑
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.5↑
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.5↑
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.5↑
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.5↑
Trichloroethylene	µg/g	0.05	0.05	< 0.5↑
Trichlorofluoromethane	µg/g	0.05	0.05	< 0.5↑

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 14+400, SB, off road, 800mm-1.2m
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs (continued)				
Vinyl Chloride	µg/g	0.02	0.02	< 0.2↑

FINAL REPORT

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1
Station 14+400, SB, off road, 800mm-1.2m				
F1 (C6 to C10)	CCME Tier 1	µg/g	5280	17
F2 (C10 to C16)	CCME Tier 1	µg/g	390	10
1,1,1,2-Tetrachloroethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,1,1-Trichloroethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,1,2,2-Tetrachloroethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,1,2-Trichloroethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,1-Dichloroethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,1-Dichloroethylene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,2-Dichlorobenzene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,2-Dichloroethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,2-Dichloropropane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,3-Dichlorobenzene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,3-Dichloropropene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
1,4-Dichlorobenzene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Acetone	EPA 5035A/5030B/8260C	µg/g	< 5	0.5
Benzene	EPA 5035A/5030B/8260C	µg/g	54.1	0.02
Bromodichloromethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Bromoform	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Bromomethane	EPA 5035A/5030B/8260C	µg/g	< 1	0.05
Carbon Tetrachloride	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Chlorobenzene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Chloroform	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Dibromochloromethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Dichlorodifluoromethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Dichloroethylene, 1,2-cis-	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Dichloroethylene, 1,2-trans-	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Ethylbenzene	EPA 5035A/5030B/8260C	µg/g	112	0.05
Ethylene dibromide	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Methyl Ethyl Ketone	EPA 5035A/5030B/8260C	µg/g	< 5	0.5
Methyl Isobutyl Ketone	EPA 5035A/5030B/8260C	µg/g	< 5	0.5
Methyl tert-Butyl Ether	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Methylene Chloride	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
n-Hexane	EPA 5035A/5030B/8260C	µg/g	136	0.05
Styrene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Tetrachloroethylene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Toluene	EPA 5035A/5030B/8260C	µg/g	269	0.2
Trichloroethylene	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Trichlorofluoromethane	EPA 5035A/5030B/8260C	µg/g	< 0.5	0.05
Vinyl Chloride	EPA 5035A/5030B/8260C	µg/g	< 0.2	0.02
Xylene Mixture	EPA 5035A/5030B/8260C	µg/g	521	0.05

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0378-MAY19	µg/g	10	<10	ND	30	107	80	120	95	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0376-MAY19	µg/g	10	<10	ND	30	117	80	120	111	60	140
F3 (C16-C34)	GCM0376-MAY19	µg/g	50	<50	ND	30	117	80	120	111	60	140
F4 (C34-C50)	GCM0376-MAY19	µg/g	50	<50	ND	30	117	80	120	111	60	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	117	50	140
1,1,1-Trichloroethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	115	50	140
1,1,2,2-Tetrachloroethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	89	50	140
1,1,2-Trichloroethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	98	50	140
1,1-Dichloroethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	108	50	140
1,1-Dichloroethylene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	73	60	130	104	50	140
1,2-Dichlorobenzene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	111	50	140
1,2-Dichloroethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	101	50	140
1,2-Dichloropropane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	112	50	140
1,3-Dichlorobenzene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	118	50	140
1,4-Dichlorobenzene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	115	50	140
Acetone	GCM0377-MAY19	µg/g	0.5	< 0.5	ND	50	85	50	140	83	50	140
Benzene	GCM0377-MAY19	µg/g	0.02	< 0.02	ND	50	86	60	130	120	50	140
Bromodichloromethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	86	60	130	108	50	140
Bromoform	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	90	50	140
Bromomethane	GCM0377-MAY19	µg/g	0.05	< 1	ND	50	77	50	140	105	50	140
Carbon tetrachloride	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	121	50	140
Chlorobenzene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	120	50	140
Chloroform	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	120	50	140
cis-1,2-Dichloroethylene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	117	50	140

FINAL REPORT

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0377-MAY19	µg/g	0.03	< 0.03	ND	50	86	60	130	102	50	140
Dibromochloromethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	86	60	130	98	50	140
Dichlorodifluoromethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	88	50	140	117	50	140
Ethylbenzene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	90	60	130	127	50	140
Ethylenedibromide	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	86	60	130	95	50	140
n-Hexane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	79	60	130	100	50	140
m/p-xylene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	90	60	130	128	50	140
Methyl ethyl ketone	GCM0377-MAY19	µg/g	0.5	< 0.5	ND	50	85	50	140	80	50	140
Methyl isobutyl ketone	GCM0377-MAY19	µg/g	0.5	< 0.5	ND	50	86	50	140	83	50	140
Methyl-t-butyl Ether	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	91	60	130	100	50	140
Methylene Chloride	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	105	50	140
o-xylene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	90	60	130	127	50	140
Styrene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	91	60	130	123	50	140
Tetrachloroethylene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	123	50	140
Toluene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	121	50	140
trans-1,2-Dichloroethylene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	107	50	140
trans-1,3-dichloropropene	GCM0377-MAY19	µg/g	0.03	< 0.03	ND	50	84	60	130	94	50	140
Trichloroethylene	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	86	60	130	121	50	140
Trichlorofluoromethane	GCM0377-MAY19	µg/g	0.05	< 0.05	ND	50	85	50	140	123	50	140
Vinyl Chloride	GCM0377-MAY19	µg/g	0.02	< 0.02	ND	50	92	50	140	137	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

FINAL REPORT

CA14190-JUN19 R

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-17-0714 Airport Rd
Order Number	
Samples	Soil (2)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brad.moore@sgs.com
SGS Reference	CA14190-JUN19
Received	06/05/2019
Approved	06/11/2019
Report Number	CA14190-JUN19 R
Date Reported	06/11/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.
nC6 and nC10 response factors within 30% of response factor for toluene: YES
nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 8 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:007005

Bromomethane Matrix Spike; Recovery is outside control limits; Results are from a multielement scan where 10% of the analytes may exceed the acceptance criteria by up to 10%.

F1 LCS; Recovery is outside control limits; the overall quality control for this analysis has been assessed and meets method acceptability criteria.

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9
			Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
			Sample Matrix	Soil	Soil
			Sample Date	03/06/2019	31/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
BTEX					
Benzene	µg/g	0.02	0.02	< 0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	< 0.05	< 0.05
Toluene	µg/g	0.05	0.2	< 0.05	< 0.05
Xylene (total)	µg/g	0.05	0.05	< 0.05	< 0.05
m/p-xylene	µg/g	0.05		< 0.05	< 0.05
o-xylene	µg/g	0.05		< 0.05	< 0.05

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9
			Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
			Sample Matrix	Soil	Soil
			Sample Date	03/06/2019	31/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics					
Moisture Content	%	-		10.9	7.8

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9
			Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
			Sample Matrix	Soil	Soil
			Sample Date	03/06/2019	31/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
PHCs					
F1 (C6-C10)	µg/g	10	17	< 10	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10	< 10
F2 (C10-C16)	µg/g	10	10	< 10	< 10
F3 (C16-C34)	µg/g	50	240	< 50	< 50
F4 (C34-C50)	µg/g	50	120	98	< 50
Chromatogram returned to baseline at nC50	Yes / No	-		YES	YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9
			Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
			Sample Matrix	Soil	Soil
			Sample Date	03/06/2019	31/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
THMs (VOC)					
Bromodichloromethane	µg/g	0.05	0.05	< 0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

Sample Number	8	9
Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
Sample Matrix	Soil	Soil
Sample Date	03/06/2019	31/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result	Result
VOC Surrogates					
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		103	100
Surr 4-Bromofluorobenzene	Surr Rec %	-		93	92
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		89	87

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number	8	9
Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
Sample Matrix	Soil	Soil
Sample Date	03/06/2019	31/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result	Result
VOCs					
Acetone	μg/g	0.5	0.5	< 0.5	< 0.5
Bromomethane	μg/g	0.05	0.05	< 0.05	< 0.05
Carbon tetrachloride	μg/g	0.05	0.05	< 0.05	< 0.05
Chlorobenzene	μg/g	0.05	0.05	< 0.05	< 0.05
Chloroform	μg/g	0.05	0.05	< 0.05	< 0.05
1,2-Dichlorobenzene	μg/g	0.05	0.05	< 0.05	< 0.05
1,3-Dichlorobenzene	μg/g	0.05	0.05	< 0.05	< 0.05
1,4-Dichlorobenzene	μg/g	0.05	0.05	< 0.05	< 0.05
Dichlorodifluoromethane	μg/g	0.05	0.05	< 0.05	< 0.05
1,1-Dichloroethane	μg/g	0.05	0.05	< 0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

			Sample Number	8	9
			Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
			Sample Matrix	Soil	Soil
			Sample Date	03/06/2019	31/05/2019
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
VOCs (continued)					
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03	< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03	< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	< 0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.05	< 0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8	9
Sample Name	Station 14 + 569, NBSH, 420mm-1.5m	Station 16 + 900, NBL, 600mm-1.5m
Sample Matrix	Soil	Soil
Sample Date	03/06/2019	31/05/2019

Parameter	Units	RL	L1	Result	Result
VOCs (continued)					
Vinyl Chloride	µg/g	0.02	0.02	< 0.02	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0137-JUN19	µg/g	10	<10	ND	30	128	80	120	101	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0135-JUN19	µg/g	10	<10	ND	30	120	80	120	98	60	140
F3 (C16-C34)	GCM0135-JUN19	µg/g	50	<50	ND	30	120	80	120	98	60	140
F4 (C34-C50)	GCM0135-JUN19	µg/g	50	<50	ND	30	120	80	120	98	60	140

FINAL REPORT

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	93	60	130	95	50	140
1,1,1-Trichloroethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	81	60	130	85	50	140
1,1,2,2-Tetrachloroethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
1,1,2-Trichloroethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	93	60	130	92	50	140
1,1-Dichloroethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	79	60	130	81	50	140
1,1-Dichloroethylene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	71	60	130	73	50	140
1,2-Dichlorobenzene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	94	60	130	95	50	140
1,2-Dichloroethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	88	60	130	89	50	140
1,2-Dichloropropane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	90	60	130	91	50	140
1,3-Dichlorobenzene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	94	60	130	96	50	140
1,4-Dichlorobenzene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	94	60	130	95	50	140
Acetone	GCM0136-JUN19	µg/g	0.5	< 0.5	ND	50	93	50	140	84	50	140
Benzene	GCM0136-JUN19	µg/g	0.02	< 0.02	ND	50	87	60	130	91	50	140
Bromodichloromethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	92	60	130	92	50	140
Bromoform	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	93	60	130	88	50	140
Bromomethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	116	50	140	150	50	140
Carbon tetrachloride	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	84	60	130	88	50	140
Chlorobenzene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	91	60	130	95	50	140
Chloroform	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	89	60	130	92	50	140
cis-1,2-Dichloroethylene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	87	60	130	90	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0136-JUN19	µg/g	0.03	< 0.03	ND	50	91	60	130	84	50	140
Dibromochloromethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	93	60	130	91	50	140
Dichlorodifluoromethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	61	50	140	57	50	140
Ethylbenzene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	91	60	130	95	50	140
Ethylenedibromide	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	93	60	130	92	50	140
n-Hexane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	71	60	130	66	50	140
m/p-xylene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	89	60	130	94	50	140
Methyl ethyl ketone	GCM0136-JUN19	µg/g	0.5	< 0.5	ND	50	97	50	140	83	50	140
Methyl isobutyl ketone	GCM0136-JUN19	µg/g	0.5	< 0.5	ND	50	101	50	140	88	50	140
Methyl-t-butyl Ether	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	96	60	130	88	50	140
Methylene Chloride	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	82	60	130	82	50	140
o-xylene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	91	60	130	96	50	140
Styrene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	92	60	130	95	50	140
Tetrachloroethylene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	88	60	130	91	50	140
Toluene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	90	60	130	94	50	140
trans-1,2-Dichloroethylene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	76	60	130	79	50	140
trans-1,3-dichloropropene	GCM0136-JUN19	µg/g	0.03	< 0.03	ND	50	90	60	130	81	50	140
Trichloroethylene	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	88	60	130	93	50	140
Trichlorofluoromethane	GCM0136-JUN19	µg/g	0.05	< 0.05	ND	50	83	50	140	84	50	140
Vinyl Chloride	GCM0136-JUN19	µg/g	0.02	< 0.02	ND	50	78	50	140	80	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14748-MAY19 R1

1-17-714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS | LABORATORY DETAILS

Client	Terraprobe Inc	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Sepideh D_Monfared	Telephone	705-652-2143
Telephone	(905) 796-2650	Facsimile	705-652-6365
Facsimile	(905) 796-2250	Email	brad.moore@sgs.com
Email	smonfared@terraprobe.ca	SGS Reference	CA14748-MAY19
Project	1-17-714 Airport Rd	Received	05/16/2019
Order Number		Approved	08/13/2019
Samples	Soil (1)	Report Number	CA14748-MAY19 R1
		Date Reported	08/13/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES
nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:003439

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

PACKAGE: **REG153 - BTEX** (SOIL)

Sample Number 8
Sample Name Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix Soil
Sample Date 14/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
BTEX				
Benzene	μg/g	0.02	0.02	< 0.02
Ethylbenzene	μg/g	0.05	0.05	< 0.05
Toluene	μg/g	0.05	0.2	< 0.05
Xylene (total)	μg/g	0.05	0.05	< 0.05
m/p-xylene	μg/g	0.05		< 0.05
o-xylene	μg/g	0.05		< 0.05

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

Sample Number 8
Sample Name Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix Soil
Sample Date 14/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Moisture Content	%	-		14.3

PACKAGE: **REG153 - PHCs** (SOIL)

Sample Number 8
Sample Name Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix Soil
Sample Date 14/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
PHCs				
F1 (C6-C10)	µg/g	10	17	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10
F2 (C10-C16)	µg/g	10	10	< 10
F3 (C16-C34)	µg/g	50	240	< 50
F4 (C34-C50)	µg/g	50	120	< 50
Chromatogram returned to baseline at nC50	Yes / No	-		YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

Sample Number 8
Sample Name Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix Soil
Sample Date 14/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
THMs (VOC)				
Bromodichloromethane	µg/g	0.05	0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

Sample Number 8
Sample Name Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix Soil
Sample Date 14/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOC Surrogates				
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		102
Surr 4-Bromofluorobenzene	Surr Rec %	-		92
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		84

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix Soil
Sample Date 14/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs				
Acetone	µg/g	0.5	0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	< 0.05
Chloroform	µg/g	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number 8
Sample Name Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix Soil
Sample Date 14/05/2019

Parameter	Units	RL	L1	Result
VOCs (continued)				
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	0.07
Trichlorofluoromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8
Sample Name	Station 15+890-NBL-(1.4m-1.5m)
Sample Matrix	Soil
Sample Date	14/05/2019

Parameter	Units	RL	L1	Result
VOCs (continued)				
Vinyl Chloride	μg/g	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1
Station 15+890-NBL-(1.4m-1.5m)				
Trichloroethylene	EPA 5035A/5030B/8260C	µg/g	0.07	0.05

FINAL REPORT

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0364-MAY19	µg/g	10	<10	ND	30	101	80	120	97	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0384-MAY19	µg/g	10	<10	ND	30	118	80	120	110	60	140
F3 (C16-C34)	GCM0384-MAY19	µg/g	50	<50	ND	30	118	80	120	110	60	140
F4 (C34-C50)	GCM0384-MAY19	µg/g	50	<50	ND	30	118	80	120	110	60	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	89	50	140
1,1,1-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	79	50	140
1,1,2,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	78	50	140
1,1,2-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	88	50	140
1,1-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
1,1-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	72	60	130	60	50	140
1,2-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	86	50	140
1,2-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	81	50	140
1,2-Dichloropropane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140
1,3-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	83	50	140
1,4-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	84	50	140
Acetone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	96	50	140	90	50	140
Benzene	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	81	60	130	82	50	140
Bromodichloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	86	50	140
Bromoform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	84	50	140
Bromomethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	50	140	56	50	140
Carbon tetrachloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	82	50	140
Chlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	87	50	140
Chloroform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	83	50	140
cis-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	84	60	130	84	50	140
Dibromochloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	92	50	140
Dichlorodifluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	79	50	140	62	50	140
Ethylbenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	85	50	140
Ethylenedibromide	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	92	50	140
n-Hexane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	63	50	140
m/p-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	91	50	140
Methyl ethyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	91	50	140	90	50	140
Methyl isobutyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	89	50	140	93	50	140
Methyl-t-butyl Ether	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	102	60	130	96	50	140
Methylene Chloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	72	50	140
o-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	90	50	140
Styrene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	91	60	130	94	50	140
Tetrachloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	90	50	140
Toluene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	84	50	140
trans-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
trans-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	82	60	130	83	50	140
Trichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	94	50	140
Trichlorofluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	50	140	70	50	140
Vinyl Chloride	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	83	50	140	77	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14746-MAY19 R

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-17-0714 Airport Rd
Order Number	
Samples	Soil (1)

LABORATORY DETAILS

Project Specialist	Rob Irwin B.Sc., C.Chem
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2361
Facsimile	705-652-6365
Email	rob.irwin@sgs.com
SGS Reference	CA14746-MAY19
Received	05/16/2019
Approved	05/23/2019
Report Number	CA14746-MAY19 R
Date Reported	05/23/2019

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES
nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:No

Chain of Custody Number:007130

Method deviation: VOC and/or F1 sample vials for sample Station 16+135-SBL(900mm-1.5m) contained a ratio of ~1:1 sample wet weight:methanol, whereas the method requires a ratio of 1:2 sample wet weight:methanol.

SIGNATORIES

Rob Irwin B.Sc., C.Chem

Robert Irwin

TABLE OF CONTENTS

PACKAGE: **REG153 - BTEX** (SOIL)

Sample Number 8
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
BTEX				
Benzene	µg/g	0.02	0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	< 0.05
Toluene	µg/g	0.05	0.2	< 0.05
Xylene (total)	µg/g	0.05	0.05	< 0.05
m/p-xylene	µg/g	0.05		< 0.05
o-xylene	µg/g	0.05		< 0.05

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

Sample Number 8
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Moisture Content	%	-		14.7

Client: Terraprobe Inc
Project: 1-17-0714 Airport Rd
Project Manager: Sepideh D_Monfared
Samplers: Maged Abdlrahem

PACKAGE: **REG153 - PHCs** (SOIL)

Sample Number 8
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
PHCs				
F1 (C6-C10)	µg/g	10	17	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10
F2 (C10-C16)	µg/g	10	10	< 10
F3 (C16-C34)	µg/g	50	240	106
F4 (C34-C50)	µg/g	50	120	125
Chromatogram returned to baseline at nC50	Yes / No	-		YES

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

Sample Number 8
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
THMs (VOC)				
Bromodichloromethane	µg/g	0.05	0.05	< 0.05
Bromoform	µg/g	0.05	0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

Sample Number 8
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOC Surrogates				
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		98
Surr 4-Bromofluorobenzene	Surr Rec %	-		92
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		83

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs				
Acetone	µg/g	0.5	0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05
Chlorobenzene	µg/g	0.05	0.05	< 0.05
Chloroform	µg/g	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	< 0.05

FINAL REPORT

CA14746-MAY19 R

Client: Terraprobe Inc
Project: 1-17-0714 Airport Rd
Project Manager: Sepideh D_Monfared
Samplers: Maged Abdlrahem

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Sample Number	8
Sample Name	Station 16+135-SBL(900 mm-1.5m)
Sample Matrix	Soil
Sample Date	15/05/2019

Parameter	**Units**	**RL**	**L1**	**Result**
VOCs (continued)				
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	< 0.05
Styrene	µg/g	0.05	0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOCs** (SOIL)

Sample Number 8
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

Parameter	Units	RL	L1	Result
VOCs (continued)				
Vinyl Chloride	μg/g	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1
Station 16+135-SBL(900mm-1.5m)				
F4 (C34 to C50)	CCME Tier 1	µg/g	125	120

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 l Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0364-MAY19	µg/g	10	<10	ND	30	101	80	120	97	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 l Internal ref.: ME-CA-[ENV]GC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0376-MAY19	µg/g	10	<10	ND	30	117	80	120	111	60	140
F3 (C16-C34)	GCM0376-MAY19	µg/g	50	<50	ND	30	117	80	120	111	60	140
F4 (C34-C50)	GCM0376-MAY19	µg/g	50	<50	ND	30	117	80	120	111	60	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	89	50	140
1,1,1-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	79	50	140
1,1,2,2-Tetrachloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	89	60	130	78	50	140
1,1,2-Trichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	88	50	140
1,1-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
1,1-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	72	60	130	60	50	140
1,2-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	86	50	140
1,2-Dichloroethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	81	50	140
1,2-Dichloropropane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140
1,3-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	83	50	140
1,4-Dichlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	84	50	140
Acetone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	96	50	140	90	50	140
Benzene	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	81	60	130	82	50	140
Bromodichloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	86	50	140
Bromoform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	84	50	140
Bromomethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	50	140	56	50	140
Carbon tetrachloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	82	50	140
Chlorobenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	87	50	140
Chloroform	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	83	50	140
cis-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	84	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	84	60	130	84	50	140
Dibromochloromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	85	60	130	92	50	140
Dichlorodifluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	79	50	140	62	50	140
Ethylbenzene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	85	50	140
Ethylenedibromide	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	87	60	130	92	50	140
n-Hexane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	80	60	130	63	50	140
m/p-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	88	60	130	91	50	140
Methyl ethyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	91	50	140	90	50	140
Methyl isobutyl ketone	GCM0363-MAY19	µg/g	0.5	< 0.5	ND	50	89	50	140	93	50	140
Methyl-t-butyl Ether	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	102	60	130	96	50	140
Methylene Chloride	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	72	50	140
o-xylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	84	60	130	90	50	140
Styrene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	91	60	130	94	50	140
Tetrachloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	60	130	90	50	140
Toluene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	82	60	130	84	50	140
trans-1,2-Dichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	78	60	130	69	50	140
trans-1,3-dichloropropene	GCM0363-MAY19	µg/g	0.03	< 0.03	ND	50	82	60	130	83	50	140
Trichloroethylene	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	81	60	130	94	50	140
Trichlorofluoromethane	GCM0363-MAY19	µg/g	0.05	< 0.05	ND	50	83	50	140	70	50	140
Vinyl Chloride	GCM0363-MAY19	µg/g	0.02	< 0.02	ND	50	83	50	140	77	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14745-MAY19 R

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-17-0714 Airport Rd
Order Number	
Samples	Soil (1)

LABORATORY DETAILS

Project Specialist	Rob Irwin B.Sc., C.Chem
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2361
Facsimile	705-652-6365
Email	rob.irwin@sgs.com
SGS Reference	CA14745-MAY19
Received	05/16/2019
Approved	05/23/2019
Report Number	CA14745-MAY19 R
Date Reported	05/23/2019

COMMENTS

Temperature of Sample upon Receipt: 9 degrees C

Cooling Agent Present:Yes

Custody Seal Present:No

Chain of Custody Number:003433

SIGNATORIES

Rob Irwin B.Sc., C.Chem

Association of the Chemical Profession of Ontario
CHARTERED
Robert Irwin
CHEMIST

TABLE OF CONTENTS

PACKAGE: **REG558 - Acid rock Drainage** (SOIL)

Sample Number 6
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Result
Acid rock Drainage				
Final pH	no unit	0.01		6.01

PACKAGE: **REG558 - Metals and Inorganics** (SOIL)

Sample Number 6
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Result
Metals and Inorganics				
Sample weight	g	0.001		100
Ext Fluid	#1 or #2	0.01		2
^ Ext Volume	mL	0.01		2000
Nitrite (as N)	as N mg/L	0.03		< 0.3↑
Nitrate (as N)	as N mg/L	0.06		< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000	< 0.6↑
Fluoride	mg/L	0.06	150	0.25
Cyanide (total)	mg/L	0.01	20	< 0.01
Mercury	mg/L	0.00001	0.1	0.00001
Arsenic	mg/L	0.01	2.5	< 0.01
Silver	mg/L	0.08	5	< 0.08
Barium	mg/L	0.0009	100	0.342

PACKAGE: **REG558 - Metals and Inorganics** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number 6
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

Parameter	**Units**	**RL**	**L1**	**Result**
Metals and Inorganics (continued)				
Boron	mg/L	0.005	500	0.065
Cadmium	mg/L	0.001	0.5	0.002
Chromium	mg/L	0.001	5	0.005
Lead	mg/L	0.007	5	< 0.007
Selenium	mg/L	0.01	1	< 0.01
Uranium	mg/L	0.1	10	< 0.1

PACKAGE: **REG558 - PCBs** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number 6
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

Parameter	**Units**	**RL**	**L1**	**Result**
PCBs				
Polychlorinated Biphenyls (PCBs) - Total	mg/L	0.001	0.3	< 0.001

PACKAGE: **REG558 - SVOCs - PAHs** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number 6
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

Parameter	**Units**	**RL**	**L1**	**Result**
SVOCs - PAHs				
Benzo(a)pyrene	mg/L	0.001	0.001	< 0.001

PACKAGE: **REG558 - VOCs** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number 6
Sample Name Station 14+120-NBL-(900m-1.5m)
Sample Matrix Soil
Sample Date 10/05/2019

Parameter	**Units**	**RL**	**L1**	**Result**
VOCs				
Methyl ethyl ketone	mg/L	0.8	200	< 0.8
Vinyl Chloride	mg/L	0.008	0.2	< 0.008
Dichloromethane	mg/L	0.02	5	< 0.02
Chloroform	mg/L	0.02	10	< 0.02
Trichloroethylene	mg/L	0.02	5	< 0.02
Tetrachloroethene	mg/L	0.02	3	< 0.02
Monochlorobenzene	mg/L	0.02	8	< 0.02
Carbon tetrachloride	mg/L	0.008	0.5	< 0.008
1,2-Dichlorobenzene	mg/L	0.02	20	< 0.02
1,4-Dichlorobenzene	mg/L	0.02	0.5	< 0.02
1,2-Dichloroethane	mg/L	0.02	0.5	< 0.02
1,1-Dichloroethylene	mg/L	0.02	1.4	< 0.02

FINAL REPORT

CA14745-MAY19 R

Client: Terraprobe Inc

Project: 1-17-0714 Airport Rd

Project Manager: Sepideh D_Monfared

Samplers: Majed A

PACKAGE: **REG558 - VOCs - BTEX** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	Station 14+120-NBL-(900m-1.5m)
Sample Matrix	Soil
Sample Date	10/05/2019

Parameter	Units	RL	L1	Result
VOCs - BTEX				
Benzene	mg/L	0.02	0.5	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 I Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0422-MAY19	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0422-MAY19	mg/L	0.03	<0.03	ND	20	93	80	120	99	75	125
Nitrate (as N)	DIO0422-MAY19	mg/L	0.06	<0.06	ND	20	98	80	120	103	75	125

Cyanide by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0167-MAY19	mg/L	0.01	<0.01	ND	10	93	90	110	77	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0434-MAY19	mg/L	0.06	<0.06	ND	10	98	90	110	NV	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0023-MAY19	mg/L	0.00001	< 0.00001	ND	20	116	80	120	109	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.7 I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	ESG0074-MAY19	mg/L	0.08	< 0.08	ND	20	96	90	110	106	70	130
Arsenic	ESG0074-MAY19	mg/L	0.01	< 0.01	ND	20	93	90	110	NV	70	130
Barium	ESG0074-MAY19	mg/L	0.0009	< 0.0009	1	20	94	90	110	100	70	130
Boron	ESG0074-MAY19	mg/L	0.005	< 0.005	1	20	97	90	110	100	70	130
Cadmium	ESG0074-MAY19	mg/L	0.001	< 0.001	ND	20	94	90	110	92	70	130
Chromium	ESG0074-MAY19	mg/L	0.001	< 0.002	ND	20	95	90	110	93	70	130
Lead	ESG0074-MAY19	mg/L	0.007	< 0.007	ND	20	94	90	110	100	70	130
Selenium	ESG0074-MAY19	mg/L	0.01	< 0.01	ND	20	93	90	110	79	70	130
Uranium	ESG0074-MAY19	mg/L	0.1	< 0.1	ND	20	95	90	110	NV	70	130

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A I Internal ref.: ME-CA-[ENV]GC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0408-MAY19	mg/L	0.001	< 0.001	ND	30	99	60	140	96	60	140

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzo(a)pyrene	GCM0406-MAY19	mg/L	0.001	< 0.001	NSS	30	96	50	140	NSS	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C I Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1-Dichloroethylene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	82	60	130	82	50	140
1,2-Dichlorobenzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	101	60	130	100	50	140
1,2-Dichloroethane	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	96	60	130	100	50	140
1,4-Dichlorobenzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	101	60	130	99	50	140
Benzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	96	60	130	98	50	140
Carbon tetrachloride	GCM0400-MAY19	mg/L	0.008	<0.008	ND	30	96	60	130	96	50	140
Chloroform	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	97	60	130	99	50	140
Dichloromethane	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	90	60	130	94	50	140
Methyl ethyl ketone	GCM0400-MAY19	mg/L	0.8	<0.8	ND	30	96	50	140	112	50	140
Monochlorobenzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	99	60	130	98	50	140
Tetrachloroethene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	98	60	130	97	50	140
Trichloroethylene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	98	60	130	99	50	140
Vinyl Chloride	GCM0400-MAY19	mg/L	0.008	<0.008	ND	30	99	50	140	100	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

FINAL REPORT

CA14747-MAY19 R

1-17-0714 Airport Rd

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS | | LABORATORY DETAILS |
|---|---|---|---|
| Client | Terraprobe Inc | Project Specialist | Rob Irwin B.Sc., C.Chem |
| | | Laboratory | SGS Canada Inc. |
| Address | 11 Indell Lane
Brampton, ON
L6T 3Y3. Canada | Address | 185 Concession St., Lakefield ON, K0L 2H0 |
| Contact | Sepideh D_Monfared | Telephone | 705-652-2361 |
| Telephone | (905) 796-2650 | Facsimile | 705-652-6365 |
| Facsimile | (905) 796-2250 | Email | rob.irwin@sgs.com |
| Email | smonfared@terraprobe.ca | SGS Reference | CA14747-MAY19 |
| Project | 1-17-0714 Airport Rd | Received | 05/16/2019 |
| Order Number | | Approved | 05/23/2019 |
| Samples | Soil (1) | Report Number | CA14747-MAY19 R |
| | | Date Reported | 05/23/2019 |

COMMENTS

Temperature of Sample upon Receipt: 9 degrees C

Cooling Agent Present:Yes

Custody Seal Present:No

Chain of Custody Number:007130

SIGNATORIES

Rob Irwin B.Sc., C.Chem

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Robert Irwin
CHEMIST

TABLE OF CONTENTS

PACKAGE: **REG558 - Acid rock Drainage** (SOIL)

Sample Number	6
Sample Name	Station 16+135-SBL(900 mm-1.5m)
Sample Matrix	Soil
Sample Date	15/05/2019

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	**Units**	**RL**	**L1**	**Result**
Acid rock Drainage				
Final pH	no unit	0.01		6.02

PACKAGE: **REG558 - Metals and Inorganics** (SOIL)

Sample Number	6
Sample Name	Station 16+135-SBL(900 mm-1.5m)
Sample Matrix	Soil
Sample Date	15/05/2019

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	**Units**	**RL**	**L1**	**Result**
Metals and Inorganics				
Sample weight	g	0.001		100
Ext Fluid	#1 or #2	0.01		2
^ Ext Volume	mL	0.01		2000
Nitrite (as N)	as N mg/L	0.03		< 0.3↑
Nitrate (as N)	as N mg/L	0.06		< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000	< 0.6↑
Fluoride	mg/L	0.06	150	0.35
Cyanide (total)	mg/L	0.01	20	< 0.01
Mercury	mg/L	0.00001	0.1	0.00001
Arsenic	mg/L	0.01	2.5	< 0.01
Silver	mg/L	0.08	5	< 0.08
Barium	mg/L	0.0009	100	0.282

PACKAGE: **REG558 - Metals and Inorganics** (SOIL)

Sample Number 6
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Result
Metals and Inorganics (continued)				
Boron	mg/L	0.005	500	0.344
Cadmium	mg/L	0.001	0.5	0.001
Chromium	mg/L	0.001	5	0.004
Lead	mg/L	0.007	5	0.010
Selenium	mg/L	0.01	1	< 0.01
Uranium	mg/L	0.1	10	< 0.1

PACKAGE: **REG558 - PCBs** (SOIL)

Sample Number 6
Sample Name Station 16+135-SBL(900 mm-1.5m)
Sample Matrix Soil
Sample Date 15/05/2019

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Result
PCBs				
Polychlorinated Biphenyls (PCBs) - Total	mg/L	0.001	0.3	< 0.001

PACKAGE: **REG558 - SVOCs - PAHs** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	Station 16+135-SBL(900 mm-1.5m)
Sample Matrix	Soil
Sample Date	15/05/2019

Parameter	Units	RL	L1	Result
SVOCs - PAHs				
Benzo(a)pyrene	mg/L	0.001	0.001	< 0.001

PACKAGE: **REG558 - VOCs** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	Station 16+135-SBL(900 mm-1.5m)
Sample Matrix	Soil
Sample Date	15/05/2019

Parameter	Units	RL	L1	Result
VOCs				
Methyl ethyl ketone	mg/L	0.8	200	< 0.8
Vinyl Chloride	mg/L	0.008	0.2	< 0.008
Dichloromethane	mg/L	0.02	5	< 0.02
Chloroform	mg/L	0.02	10	< 0.02
Trichloroethylene	mg/L	0.02	5	< 0.02
Tetrachloroethene	mg/L	0.02	3	< 0.02
Monochlorobenzene	mg/L	0.02	8	< 0.02
Carbon tetrachloride	mg/L	0.008	0.5	< 0.008
1,2-Dichlorobenzene	mg/L	0.02	20	< 0.02
1,4-Dichlorobenzene	mg/L	0.02	0.5	< 0.02
1,2-Dichloroethane	mg/L	0.02	0.5	< 0.02
1,1-Dichloroethylene	mg/L	0.02	1.4	< 0.02

PACKAGE: **REG558 - VOCs - BTEX** (SOIL)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	6
Sample Name	Station 16+135-SBL(900 mm-1.5m)
Sample Matrix	Soil
Sample Date	15/05/2019

Parameter	Units	RL	L1	Result
VOCs - BTEX				
Benzene	mg/L	0.02	0.5	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 I Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nitrate + Nitrite (as N)	DIO0422-MAY19	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0422-MAY19	mg/L	0.03	<0.03	ND	20	93	80	120	99	75	125
Nitrate (as N)	DIO0422-MAY19	mg/L	0.06	<0.06	ND	20	98	80	120	103	75	125

Cyanide by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0167-MAY19	mg/L	0.01	<0.01	ND	10	93	90	110	77	75	125

FINAL REPORT

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0434-MAY19	mg/L	0.06	<0.06	ND	10	98	90	110	NV	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0023-MAY19	mg/L	0.00001	< 0.00001	ND	20	116	80	120	109	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.7 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	ESG0074-MAY19	mg/L	0.08	< 0.08	ND	20	96	90	110	106	70	130
Arsenic	ESG0074-MAY19	mg/L	0.01	< 0.01	ND	20	93	90	110	NV	70	130
Barium	ESG0074-MAY19	mg/L	0.0009	< 0.0009	1	20	94	90	110	100	70	130
Boron	ESG0074-MAY19	mg/L	0.005	< 0.005	1	20	97	90	110	100	70	130
Cadmium	ESG0074-MAY19	mg/L	0.001	< 0.001	ND	20	94	90	110	92	70	130
Chromium	ESG0074-MAY19	mg/L	0.001	< 0.002	ND	20	95	90	110	93	70	130
Lead	ESG0074-MAY19	mg/L	0.007	< 0.007	ND	20	94	90	110	100	70	130
Selenium	ESG0074-MAY19	mg/L	0.01	< 0.01	ND	20	93	90	110	79	70	130
Uranium	ESG0074-MAY19	mg/L	0.1	< 0.1	ND	20	95	90	110	NV	70	130

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-[ENV]GC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0408-MAY19	mg/L	0.001	< 0.001	ND	30	99	60	140	96	60	140

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzo(a)pyrene	GCM0406-MAY19	mg/L	0.001	< 0.001	NSS	30	96	50	140	NSS	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1-Dichloroethylene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	82	60	130	82	50	140
1,2-Dichlorobenzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	101	60	130	100	50	140
1,2-Dichloroethane	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	96	60	130	100	50	140
1,4-Dichlorobenzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	101	60	130	99	50	140
Benzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	96	60	130	98	50	140
Carbon tetrachloride	GCM0400-MAY19	mg/L	0.008	<0.008	ND	30	96	60	130	96	50	140
Chloroform	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	97	60	130	99	50	140
Dichloromethane	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	90	60	130	94	50	140
Methyl ethyl ketone	GCM0400-MAY19	mg/L	0.8	<0.8	ND	30	96	50	140	112	50	140
Monochlorobenzene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	99	60	130	98	50	140
Tetrachloroethene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	98	60	130	97	50	140
Trichloroethylene	GCM0400-MAY19	mg/L	0.02	<0.02	ND	30	98	60	130	99	50	140
Vinyl Chloride	GCM0400-MAY19	mg/L	0.008	<0.008	ND	30	99	50	140	100	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

CERTIFICATE OF ANALYSIS

Company:	SGS Lakefield Research Ltd.	**Report Date:**	25-Nov-19
Contact:	Mr. Brad Moore	**Analysis Date:**	25-Nov-19
Client Address:	185 Concession Street, PO Box 4300, Lakefield, ON	**Received Date:**	20-Nov-19
Client Reference:	CA14742-NOV19 Airport Road	**LEX Project Number:**	08192065
Sampling Date:	31-May-19	**Number of Analyses:**	3

Analysis Requested Bulk Asbestos by PLM

Analysis was performed in accordance with the method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials adopted in Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act Ontario Regulation 278/05. LEX Scientific Inc. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP 101949) by the National Institute of Standards and Technology for analysis of bulk materials for asbestos.

German Leal, B.Sc.
Laboratory Manager

		Fibrous Asbestos Content %		Other Materials Content %	
Client Sample:	14742-NOV19	**Asbestos Detected?**	**No**		
LEX Sample:	01	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Asphalt	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Grey/Black	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Sta. 13 + 100, SBL	**Other Amphiboles:**	None Detected	**Non-Fibrous:**	100
		Comments:	N/A		

Client Sample:	14742-NOV19	**Asbestos Detected?**	**No**		
LEX Sample:	02	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Asphalt	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Grey/Black	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Sta. 16 + 135, SBL	**Other Amphiboles:**	None Detected	**Non-Fibrous:**	100
		Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

		Fibrous Asbestos Content %		**Other Materials Content %**	
Client Sample:	14742-NOV19	**Asbestos Detected?**	**No**		
LEX Sample:	03	**Chrysotile:**	None Detected	**Cellulose:**	None Detected
Layers Analyzed:	Asphalt	**Amosite:**	None Detected	**MMVF:**	None Detected
Colour:	Grey/Black	**Crocidolite:**	None Detected	**Other Fibres:**	None Detected
Description:	Sta. 17 + 000, SBL	**Other Amphiboles:**	None Detected	**Non-Fibrous:**	100
		Comments:	N/A		

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst ________________

APPENDIX D

Falling Weight Deflectometer Testing Results

Falling Weight Deflectometer Testing – Airport Road from King Street to Huntsmill Drive, Caledon, Ontario

Prepared For:

Terraprobe Inc.

Sepideh D-Monfared, MESc., P.Eng.
Project Manager
Terraprobe Inc.
11 Indell Lane, Brampton, ON
L6T 3Y3

Project Number:

ET19-1085A

Prepared By:

Engtec Consulting Inc.
12-100 Hanlan Road
Vaughan, Ontario
L4L 4V8
T: 1.905.856.2988
F: 1.905.856-2989
www.engtec.ca

Date Submitted:
August 13, 2019

Table of Contents

Description **Pages**

Appendices:

Property and Confidentiality

This engineering document is the work and property of Engtec Consulting Inc. (Engtec), and as such is protected under the Copyright Law. It can only be used for the purposes mentioned herein for our client Terraprobe Inc. Any reproduction or adaptation, whether partial or total, is strictly prohibited without having obtained Engtec and its client's prior written authorization.

Test results mentioned herein are only valid for the road referenced in this report. The factual data, interpretations and any recommendations contained in this report pertain to a specific project, as described in the report and are not applicable to any other project or location.

Executive Summary

Engtec Consulting Inc. (Engtec) conducted Falling Weight Deflectometer (FWD) testing on Airport Road from King Street to Huntsmill Drive, Caledon, Ontario. The road has one (1) lane in each travel direction and the approximate length of the road is about 7.1km. This project was undertaken at the request of Ms. Sepideh D-Monfared, Project Manager, Terraprobe Inc.

The non-destructive testing/evaluation on this project consisted of the following elements:

- In-situ FWD testing at approximately 100m intervals on each travel lane, as requested by the Project Manager;
- Recording ambient air and asphalt surface temperatures during the field testing;
- Deflection Normalization to 40kN load and 25°C temperature for deflection basin assessment;
- In-Situ Subgrade Resilient Modulus assessment using back-calculation procedures; and
- Backcalculation of asphalt and granular layer moduli and effective structural number.

1 Introduction

Engtec Consulting Inc. (Engtec) was retained by Terraprobe Inc. to undertake Falling Weight Deflectometer (FWD) testing on Airport Road from King Street to Huntsmill Drive, Caledon, Ontario. The road has one (1) lane in each travel direction and the length is approximately 7.1km. The pavement sections tested and evaluated under this project are listed in Table 1 below. Selected photos for each pavement section are presented in Appendix A.

Table 1: Tested Pavement Sections and Lengths.

Sec. #	Direction	From - To	Station	Length, m
1	NBL	King St. to Castlederg Side Rd.	10+000 to 12+940	2940
2		Castlederg Side Rd. to Olde Base Line	12+940 to 14+160	1220
3		Olde Base Line to Hilltop Dr.	14+160 to 15+410	1250
4		Hilltop Dr. to Old Church Rd.	15+410 to 16+000	590
5		Old Church Rd. to Huntsmill Dr.	16+000 to 17+070	1070
6	SBL	King St. to Castlederg Side Rd.	10+000 to 12+940	2940
7		Castlederg Side Rd. to Olde Base Line	12+940 to 14+160	1220
8		Olde Base Line to Hilltop Dr.	14+160 to 15+410	1250
9		Hilltop Dr. to Old Church Rd.	15+410 to 16+000	590
10		Old Church Rd. to Huntsmill Dr.	16+000 to 17+070	1070

The project employed the use of Engtec's Falling Weight Deflectometer (FWD) to perform field testing at approximately 100m intervals in each travel Lane. For this project, the dynamic load applied using the FWD was kept between 30kN to 85kN (standard for major road pavements) range, as per standard industry practices and MTO protocols outlined in the Publication 053 by Materials and Research Office (MERO-053). The deflection profile recorded by the FWD equipment was then normalized to 40kN at 25°C temperature, as per the industry protocols outlined in the above-mentioned references.

The average pavement structure of the pavement sections was provided by the Terraprobe Inc. to Engtec and was used for detailed data analysis on this project. The data analysis protocol adopted for this project included the backcalculation of the in-situ Subgrade Resilient Modulus (M_R), Granular and Asphalt Layer Moduli. In addition, industry standardized analysis that included Normalized Deflection analysis consisting of determination/assessment of center plate deflection (d_0), deflection ration (d_0/d_{200}) and areas of deflection basin (A) were also determined.

2 Project Methodology

Engtec undertook FWD testing on the subject pavement sections in the night of May 22nd and 23rd, 2019 in order to backcalculate the pavement layer moduli. The objective of this testing was to provide the structural assessment for different pavement layers for each pavement section. Compilation of data collected from the field investigation and the backcalculation results are presented in this report for information purposes.

To achieve this objective, Engtec has performed the following tasks:

1. In-situ FWD testing at approximately 100m intervals on the various lanes;
2. Recording ambient air and asphalt surface temperatures during the field testing;
3. Deflection Normalization to 40kN load and 25°C temperature for deflection basin assessment;
4. In-Situ Subgrade Resilient Modulus assessment using backcalculation procedures; and
5. Backcalculation of Asphalt and Granular Layer Moduli.

3 Evaluated Roadway

A total of one hundred forty-five (145) FWD test points were conducted in the field on the various pavement sections. The pavement sections and the number of FWD tests for each section are summarized in Table 2 below.

Terraprobe conducted a borehole (BH) and corehole (CH) investigation on the roads and provided Engtec with the summary of average pavement layer thicknesses. Table 2 shows the average of the pavement layer thicknesses for each pavement sections. It should be noted that the average pavement layer thicknesses for each pavement section used in the analysis are based upon the borehole and corehole information provided to Engtec. The analysis carried out are based on the assumption that, the existing pavement consists of conventional hot mix asphalt.

Table 2: Number of FWD Tests and Layer Thicknesses from the Boreholes (BH) and Coreholes (CH)

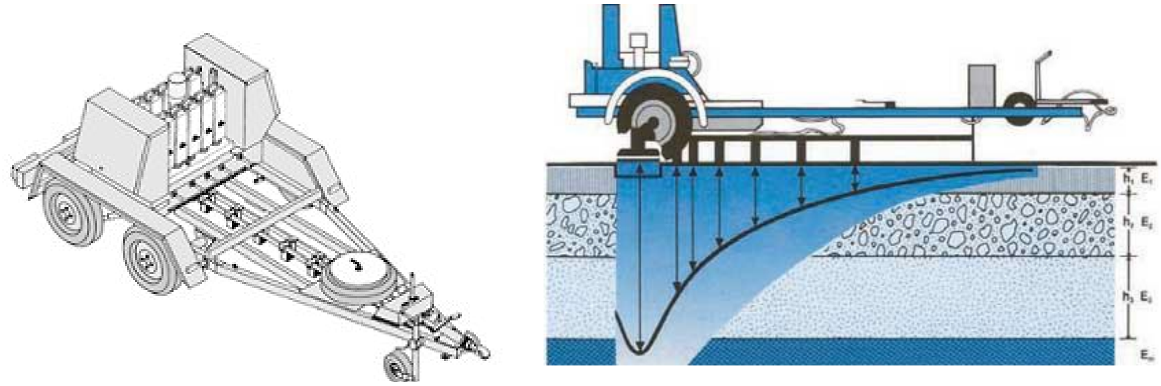
Sec. #	Direction	From - To	No. of FWD Tests	Average Thicknesses, mm		
				AC	Granular	Total
1	NBL	King St. to Castlederg Side Rd.	30	219	530	749
2		Castlederg Side Rd. to Olde Base Line	12	234	539	773
3		Olde Base Line to Hilltop Dr.	13	248	796	1044
4		Hilltop Dr. to Old Church Rd.	5	156	1040	1196
5		Old Church Rd. to Huntsmill Dr.	13	187	822	1009
6	SBL	King St. to Castlederg Side Rd.	29	244	588	832
7		Castlederg Side Rd. to Olde Base Line	13	230	503	733
8		Olde Base Line to Hilltop Dr.	12	240	860	1100
9		Hilltop Dr. to Old Church Rd.	6	158	1018	1176
10		Old Church Rd. to Huntsmill Dr.	12	204	656	860

4 Falling Weight Deflectometer (FWD) Testing and Analysis

A program of FWD load/deflection testing was completed in the night of May 22nd and 23rd, 2019 by Engtec to assess the structural condition of Airport Road from King Street to Huntsmill Drive. The testing device used by Engtec is a Dynatest 8082 Heavy Weight Deflectometer calibrated in May 1st, 2018 by Dynatest North America.

At each test location, six (6) load levels (ranging between 30kN to 85kN), were used to determine the deflection response of the existing pavement structure. For the reader's information, the 40kN load level simulates the wheel load of a standard heavy truck (80kN single axle load). The FWD data was analyzed using the FWD Area computer analysis program for backcalculation of subgrade M_R and deflection normalization works accordingly. The asphalt and granular layers moduli were backcalculated using ELMOD 6 Software developed by Dynatest.

The measured FWD dynamic deflections were normalized to represent the equivalent deflections for a design wheel load of 40kN and asphalt concrete temperature of 25°C. The Strategic Highways Research Program (SHRP) specifies the locations of the sensors, and the minimum number of loading drops that are to be applied to a pavement section, so that the standard deviation and variance in the backcalculated results can be ascertained. The sensor spacing was set as per standard protocols as 0mm, 200mm, 300mm, 450mm, 600mm, 900mm, 1200mm, 1500mm and 1800mm (which are in accordance with the SHRP specifications and MERO-019 requirements) [1,2].



a. **FWD Device** b. **FWD Mechanics**

c - Falling Weight Deflectometer Testing (Load Cells and Geophones)

Figure 1: Falling Weight Deflectometer Device, Mechanics and Testing

The FWD applies an impact load to the pavement surface, and measures the surface deformation (deflection basin), using seven geophones. This data is recorded by the data acquisition system, and then used to backcalculate the material properties of individual layers, if the thicknesses of the pavement layers are known. This process can also be performed vice-versa in order to determine the layer thicknesses, if the material properties are known.

It is also important to determine the surface, sub-surface and ambient air temperatures at the time of the testing, because it is critical to conduct the backcalculation for flexible pavement with hot-mix asphalt surface which has high thermal susceptibility. For the project specified testing plan, the ambient air temperatures and the pavement surface temperatures were detected on site using the thermal gun attached to the data acquisition system. These temperatures are further used to calculate the asphalt layer temperature for any analysis contained in this report.

Once the FWD data for various pavement sections was obtained, a normalized deflection and deflection ratio coupled with the area of deflection basin analysis was performed.

4.1 Normalization of Deflection Data

The data collected from the pavement sections using the FWD is stored in Microsoft® Access and ASCII file format. Normalization of the FWD data to 40kN applied load at 25°C temperature was performed using FWD Area Software to estimate the structural capacity of the existing pavement. The deflection basin profile and individual deflections approximate the existing condition of the pavement that is being tested using the FWD machine. The criteria that are widely used in the industry and employed in this study are as follows:

- d_0: Centre Plate Deflection (primarily measures the subgrade strength and the pavement stiffness);
- d_0/d_{200}: Ratio of Centre Plate Deflection to Sensor Deflection at 200mm from the Centre Plate. The ratio of d_0/d_{200} indicates the strength of the subgrade relative to the overlying pavement structure, as d_0/d_{200} increases, the horizontal tensile forces in the pavement structure layer(s) increases. For given asphalt layer conditions, d_0/d_{200} is a measure of asphalt strain and the potential for material fracture of cracking to occur.
- Normalized Area: Area of the Deflection Basin (overall ability of the pavement to effectively distribute vehicular loading).

The details of this analysis are attached in Appendix B Tables 1-B through 10-B. Summary of the results presented in Appendix B for normalized deflection are shown in Table 3.

4.2 Backcalculation Analysis

Once the deflection profile was obtained for each drop, the backcalculated independent pavement layer moduli were estimated using the ELMOD 6 software developed by Dynatest and accepted in the industry as a standard. The backcalculation under ELMOD 6, was undertaken using the asphalt layer thicknesses. The thicknesses of the pavement were measured from boreholes and coreholes conducted by Terraprobe Inc. Since the asphalt and granular layer thicknesses varied, the backcalculation was conducted based on the average pavement layer thicknesses for each pavement section. Table 4 shows the average backcalculated pavement layer moduli for all pavement sections. Detailed backcalculation for each pavement section are attached in Appendix C, Tables 1-C through 10-C.

The pavement subgrade resilient modulus (M_R) of the existing pavement section was also backcalculated from the FWD deflection data and corrected according to the AASHTO 1993 pavement Design Guide procedure. The AASHTO correction factor used to calculate the resilient Modulus (M_r) is 0.3. The backcalculated average subgrade resilient modulus (M_r) values for all pavement sections are shown in Table 4.

4.3 Effective Structure Number SN_{eff}

The FWD data was used to calculate the Effective Structure Number (SN_{eff}) of the existing pavement structure based on the Effective Modulus (E_p) of all pavement layers above the subgrade layer. Table 3 shows the summary of SN_{eff} for all pavement sections. Detail calculations of the SN_{eff} is presented in Appendix B, Tables 1-B through 10-B.

Table 3: Normalized deflection, deflection basin area, and effective structural number for tested pavement sections

Sec. #	Pavement Section	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
1	King St. to Castlederg Side Rd. (NBL)	0.26	1.27	517	195
2	Castlederg Side Rd. to Olde Base Line (NBL)	0.26	1.27	527	200
3	Olde Base Line to Hilltop Dr. (NBL)	0.24	1.25	551	260
4	Hilltop Dr. to Old Church Rd. (NBL)	0.28	1.15	545	347
5	Old Church Rd. to Huntsmill Dr. (NBL)	0.25	1.23	543	285
6	King St. to Castlederg Side Rd. (SBL)	0.28	1.27	517	203
7	Castlederg Side Rd. to Olde Base Line (SBL)	0.27	1.27	521	188
8	Olde Base Line to Hilltop Dr. (SBL)	0.27	1.26	528	254
9	Hilltop Dr. to Old Church Rd. (SBL)	0.28	1.20	539	332
10	Old Church Rd. to Huntsmill Dr. (SBL)	0.26	1.26	526	258

Table 4: Average Backcalculated Layer Moduli for Tested Pavement Sections.

Sec. #	Pavement Section	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_r), MPa
		Asphalt	Granular	Asphalt	Granular	Subgrade	
1	King St. to Castlederg Side Rd. (NBL)	219	530	3062	304	207	62
2	Castlederg Side Rd. to Olde Base Line (NBL)	234	539	2720	270	182	55
3	Olde Base Line to Hilltop Dr. (NBL)	248	796	3267	237	228	68
4	Hilltop Dr. to Old Church Rd. (NBL)	156	1040	6454	244	233	70
5	Old Church Rd. to Huntsmill Dr. (NBL)	187	822	4817	279	211	63
6	King St. to Castlederg Side Rd. (SBL)	244	588	2353	240	181	54
7	Castlederg Side Rd. to Olde Base Line (SBL)	230	503	2539	269	175	53
8	Olde Base Line to Hilltop Dr. (SBL)	240	860	2666	229	210	63
9	Hilltop Dr. to Old Church Rd. (SBL)	158	1018	7692	235	199	60
10	Old Church Rd. to Huntsmill Dr. (SBL)	204	656	3600	277	206	62

5 Closure

This report summarizes Engtec Consulting Inc. efforts to analyze the FWD data, undertake backcalculation of pavement layer moduli and estimate the Effective Structure number SN_{eff} for Airport Road from King Street to Huntsmill Drive, Caledon, Ontario.

We trust that this report is satisfactory for your purposes. Should you have any questions, please contact the undersigned.

Yours truly,

Hassan, Salama, Ph.D., P. Eng.
Pavement Engineer
Engtec Consulting Inc.

Salman Bhutta, Ph.D., P. Eng.
Principal
Engtec Consulting Inc.

6 References

1. “Manual for FWD Testing in the Long-Term Pavement Performance Program,” SHRP-P-661, PCS Law Engineering and Braun Intertec Pavement, Inc., National Research Council, Washington, DC, 1993.
2. MTO, Pavements and Foundations Section, “Falling Weight Deflectometer (FWD) Testing Guideline,” MERO-019, 2005
3. Anderson, P. D., “Cost-Effective Structural Rehabilitation of Pavements Using NDT Deflection Methods,” 1989.
4. Horak, E. and Emery, S. “Falling Weight Deflectometer Bowl Parameters as Analysis Tool for Pavement Structural Evaluations,” Australian Road Research Board, ARRB, 2016
5. Pierce, L. M., “Development of a Computer Program for the Determination of the Area Value and Subgrade Resilient Modulus Using Dynatest FWD,” Report/Software by Washington State Department of Transportation, May 1999.
6. Zhang, Z., Claros, G., Manuel, L., and Damnjanovic, I.,” Development of Structural Condition Index to Support Pavement Maintenance and Rehabilitation Decisions at Network Level,” Transportation Research Record No. 1827, pp. 10 – 17, 200
7. MTO, “Adaptation and Verification Of AASHTO Pavement Design Guide For Ontario Conditions,” Final Report, March 2008

Appendix A:

Selected photos

Photo 1: Airport Rd. from King St. to Castlederg Side Rd.

Photo 2: Airport Rd. from King St. to Castlederg Side Rd.

Photo 3: Airport Rd. from Castlederg Side Rd. to Olde Base Line Rd.

Photo 4: Airport Rd. from Castlederg Side Rd. to Olde Base Line Rd.

Photo 5: Airport Rd. from Olde Base Line Rd. to Hilltop Dr.

Photo 6: Airport Rd. from Olde Base Line Rd. to Hilltop Dr.

Photo 7: Airport Rd. from Hilltop Dr. to Old Church Rd.

Photo 8: Airport Rd. from Hilltop Dr. to Old Church Rd.

Photo 9: Airport Rd. from Old Church Rd. to Huntsmill Dr.

Photo 10: Airport Rd. from Old Church Rd. to Huntsmill Dr.

Appendix B:

Normalized FWD Deflection Data and Effective Structural Number

Table 1-B: FWD Data Analysis - Airport Road from King St. to Castlederg Side Rd. (NBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
10	0.208	1.28	544	214
10.1	0.225	1.25	539	205
10.2	0.271	1.28	513	183
10.3	0.283	1.33	495	174
10.4	0.249	1.32	503	192
10.5	0.242	1.23	538	211
10.6	0.259	1.26	514	202
10.7	0.265	1.22	531	203
10.8	0.299	1.25	507	186
10.9	0.259	1.29	505	202
11	0.276	1.28	509	192
11.1	0.221	1.25	545	216
11.2	0.225	1.19	564	224
11.3	0.289	1.29	509	190
11.4	0.265	1.26	522	190
11.5	0.232	1.27	518	206
11.6	0.266	1.27	508	184
11.7	0.248	1.26	526	197
11.8	0.304	1.37	470	171
11.9	0.236	1.28	531	207
12	0.239	1.27	532	205
12.1	0.264	1.28	510	189
12.201	0.243	1.33	500	199
12.3	0.207	1.24	551	219
12.4	0.326	1.25	503	167
12.5	0.295	1.27	500	184
12.6	0.288	1.29	498	184
12.7	0.305	1.30	486	175
12.801	0.284	1.28	502	185
12.9	0.232	1.27	531	206
Mean	0.26	1.27	517	195
Standard Deviation	0.03	0.03	21	15
C.O.V (%)	11.78	2.65	4	8
Maximum	0.33	1.37	564	224
Minimum	0.21	1.19	470	167

Notes:
Station 10.00 is 145m North of King St.

Table 2-B: FWD Data Analysis - Airport Road from Castlederg Side Rd. to Olde Base Line (NBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
13	0.251	1.25	535	194
13.1	0.288	1.29	506	187
13.2	0.218	1.28	532	211
13.301	0.236	1.30	519	197
13.4	0.254	1.25	531	199
13.5	0.255	1.26	531	202
13.6	0.258	1.25	528	200
13.7	0.222	1.29	538	207
13.8	0.282	1.23	538	213
13.9	0.233	1.27	541	217
14	0.310	1.26	511	186
14.1	0.298	1.29	511	186
Mean	0.26	1.27	527	200
Standard Deviation	0.03	0.02	12	11
C.O.V (%)	11.59	1.73	2	5
Maximum	0.31	1.30	541	217
Minimum	0.22	1.23	506	186

Notes:
Station 10.00 is 145m North of King St.

Table 3-B: FWD Data Analysis - Airport Road from Olde Base Line to Hilltop Dr. (NBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
14.2	0.404	1.35	464	213
14.3	0.242	1.26	534	260
14.4	0.213	1.30	520	261
14.5	0.259	1.28	513	246
14.6	0.246	1.22	558	247
14.7	0.224	1.28	538	249
14.8	0.189	1.23	573	292
14.9	0.247	1.13	647	262
15	0.206	1.27	545	268
15.1	0.210	1.30	542	258
15.2	0.154	1.16	639	333
15.3	0.280	1.21	535	239
15.4	0.233	1.21	550	255
Mean	0.24	1.25	551	260
Standard Deviation	0.06	0.06	49	28
C.O.V (%)	24.78	4.99	9	11
Maximum	0.40	1.35	647	333
Minimum	0.15	1.13	464	213

Notes:
Station 10.00 is 145m North of King St.

Table 4-B: FWD Data Analysis - Airport Road from Hilltop Dr. to Old Church Rd. (NBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
15.5	0.241	1.07	596	432
15.601	0.272	1.15	537	261
15.702	0.279	1.17	546	397
15.8	0.258	1.17	547	282
15.901	0.328	1.21	497	361
Mean	0.28	1.15	545	347
Standard Deviation	0.03	0.05	35	73
C.O.V (%)	11.88	4.54	6	21
Maximum	0.33	1.21	596	432
Minimum	0.24	1.07	497	261

Notes:
Station 10.00 is 145m North of King St.

Table 5-B: FWD Data Analysis - Airport Road from Old Church Rd. to Huntsmill Dr. (NBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
16.006	0.265	1.22	506	234
16.101	0.361	1.20	509	345
16.2	0.216	1.16	583	257
16.3	0.264	1.25	527	246
16.4	0.208	1.27	552	271
16.5	0.294	1.28	503	229
16.6	0.250	1.16	579	258
16.7	0.189	1.22	575	295
16.8	0.192	1.22	580	289
16.9	0.202	1.28	548	408
17	0.431	1.28	481	191
17.1	0.233	1.22	556	404
17.2	0.191	1.25	564	281
Mean	0.25	1.23	543	285
Standard Deviation	0.07	0.04	34	65
C.O.V (%)	28.63	3.44	6	23
Maximum	0.43	1.28	583	408
Minimum	0.19	1.16	481	191

Notes:
Station 10.00 is 145m North of King St.

Table 6-B: FWD Data Analysis - Airport Road from King St. to Castlederg Side Rd. (SBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
10.05	0.314	1.25	517	192
10.15	0.363	1.26	484	175
10.25	0.289	1.31	495	187
10.35	0.279	1.26	522	200
10.45	0.292	1.27	510	201
10.549	0.236	1.30	513	219
10.65	0.242	1.32	520	224
10.75	0.283	1.26	517	209
10.85	0.263	1.23	531	215
10.95	0.288	1.27	511	197
11.05	0.273	1.27	519	204
11.15	0.290	1.21	526	203
11.25	0.322	1.24	516	189
11.35	0.276	1.29	508	200
11.45	0.247	1.34	510	210
11.55	0.263	1.33	500	197
11.65	0.295	1.24	511	202
11.75	0.286	1.26	517	201
11.85	0.272	1.27	521	204
11.949	0.280	1.31	497	195
12.05	0.256	1.25	522	210
12.15	0.242	1.30	516	208
12.25	0.245	1.26	538	215
12.349	0.243	1.22	549	208
12.45	0.269	1.22	543	204
12.55	0.229	1.21	559	227
12.65	0.311	1.28	499	188
12.75	0.307	1.30	484	184
12.85	0.248	1.28	524	210
Mean	0.28	1.27	517	203
Standard Deviation	0.03	0.03	17	12
C.O.V (%)	10.91	2.65	3	6
Maximum	0.36	1.34	559	227
Minimum	0.23	1.21	484	175

Notes:
Station 10.00 is 145m North of King St.

Table 7-B: FWD Data Analysis - Airport Road from Castlederg Side Rd. to Olde Base Line (SBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
12.95	0.172	1.28	556	230
13.05	0.261	1.27	529	184
13.15	0.271	1.27	529	180
13.25	0.213	1.29	538	203
13.35	0.253	1.29	521	183
13.45	0.261	1.28	518	190
13.55	0.305	1.28	508	174
13.65	0.272	1.25	524	176
13.75	0.289	1.30	498	179
13.85	0.279	1.29	515	185
13.95	0.287	1.27	515	191
14.05	0.389	1.21	513	182
14.149	0.300	1.27	507	188
Mean	0.27	1.27	521	188
Standard Deviation	0.05	0.02	15	15
C.O.V (%)	18.32	1.68	3	8
Maximum	0.39	1.30	556	230
Minimum	0.17	1.21	498	174

Notes:
Station 10.00 is 145m North of King St.

Table 8-B: FWD Data Analysis - Airport Road from Olde Base Line to Hilltop Dr. (SBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
14.249	0.250	1.28	525	255
14.349	0.211	1.30	529	272
14.45	0.258	1.39	491	240
14.55	0.279	1.33	510	235
14.65	0.241	1.39	495	245
14.75	0.215	1.26	541	271
14.85	0.330	1.24	504	230
14.949	0.263	1.23	537	258
15.05	0.259	1.28	517	246
15.15	0.413	1.22	501	219
15.25	0.258	1.13	583	279
15.35	0.215	1.14	601	293
Mean	0.27	1.26	528	254
Standard Deviation	0.06	0.08	34	22
C.O.V (%)	21.30	6.49	6	9
Maximum	0.41	1.39	601	293
Minimum	0.21	1.13	491	219

Notes:
Station 10.00 is 145m North of King St.

Table 9-B: FWD Data Analysis - Airport Road from Hilltop Dr. to Old Church Rd. (SBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
15.449	0.234	1.20	564	414
15.542	0.236	1.22	537	277
15.647	0.220	1.19	565	423
15.74	0.291	1.18	538	265
15.85	0.319	1.17	532	379
15.946	0.363	1.26	496	231
Mean	0.28	1.20	539	332
Standard Deviation	0.06	0.03	25	84
C.O.V (%)	20.50	2.65	5	25
Maximum	0.36	1.26	565	423
Minimum	0.22	1.17	496	231

Notes:
Station 10.00 is 145m North of King St.

Table 10-B: FWD Data Analysis - Airport Road from Old Church Rd. to Huntsmill Dr. (SBL).

Station	d_{0adj} (mm)	d_0/d_{200}	A (mm)	SN_{eff} (mm)
16.05	0.259	1.19	551	375
16.15	0.379	1.27	469	175
16.25	0.300	1.20	524	354
16.35	0.273	1.31	501	207
16.45	0.206	1.29	549	389
16.55	0.305	1.32	481	200
16.65	0.238	1.28	538	234
16.75	0.193	1.24	564	256
16.85	0.245	1.29	530	224
16.95	0.242	1.29	534	237
17.05	0.243	1.26	539	226
17.11	0.269	1.22	537	216
Mean	0.26	1.26	526	258
Standard Deviation	0.05	0.04	29	72
C.O.V (%)	18.78	3.39	5	28
Maximum	0.38	1.32	564	389
Minimum	0.19	1.19	469	175

Notes:
Station 10.00 is 145m North of King St.

Appendix C:

Backcalculated Pavement Layer Moduli

Table 1-C: Backcalculated Layer Moduli - Airport Road from King St. to Castlederg Side Rd. (NBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_r), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
10	219	530	4690	358	224	67
10.1	219	530	3735	334	211	63
10.2	219	530	2858	296	179	54
10.3	219	530	2363	318	186	56
10.4	219	530	2666	330	294	88
10.5	219	530	3417	338	191	57
10.6	219	530	2814	368	175	52
10.7	219	530	3475	245	209	63
10.8	219	530	2639	256	171	51
10.9	219	530	2850	293	300	90
11	219	530	2698	299	191	57
11.1	219	530	4156	310	245	74
11.2	219	530	4814	261	217	65
11.3	219	530	2821	276	161	48
11.4	219	530	3061	275	172	52
11.5	219	530	2981	349	247	74
11.6	219	530	2670	282	211	63
11.7	219	530	3238	303	199	60
11.8	219	530	1893	317	190	57
11.9	219	530	3246	318	244	73
12	219	530	3399	328	200	60
12.1	219	530	2612	307	191	57
12.201	219	530	2589	375	252	76
12.3	219	530	4674	303	264	79
12.4	219	530	2267	231	139	42
12.5	219	530	2440	276	174	52
12.6	219	530	2444	288	187	56
12.7	219	530	2287	256	193	58
12.801	219	530	2418	299	180	54
12.9	219	530	3659	322	213	64
Average			**3062**	**304**	**207**	**62**
Maximum			**4814**	**375**	**300**	**90**
Minimum			**1893**	**231**	**139**	**42**

Notes:

Station 10.00 is 145m North of King St.

Table 2-C: Backcalculated Layer Moduli - Airport Road from Castlederg Side Rd. to Olde Base Line (NBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus ($M_{r)}$, MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
13	234	539	2638	271	191	57
13.1	234	539	2190	253	164	49
13.2	234	539	3041	334	227	68
13.301	234	539	2545	318	207	62
13.4	234	539	2792	263	180	54
13.5	234	539	2855	265	175	52
13.6	234	539	2707	253	172	52
13.7	234	539	2963	334	197	59
13.8	234	539	3071	231	150	45
13.9	234	539	3250	272	233	70
14	234	539	2309	213	143	43
14.1	234	539	2284	233	145	44
Average			**2720**	**270**	**182**	**55**
Maximum			**3250**	**334**	**233**	**70**
Minimum			**2190**	**213**	**143**	**43**

Notes:

Station 10.00 is 145m North of King St.

Table 3-C: Backcalculated Layer Moduli - Airport Road from Olde Base Line to Hilltop Dr. (NBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_r), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
14.2	248	796	1384	185	133	40
14.3	248	796	2806	238	230	69
14.4	248	796	2545	309	330	99
14.5	248	796	2287	243	225	67
14.6	248	796	3033	189	185	56
14.7	248	796	2642	268	238	71
14.8	248	796	3916	292	284	85
14.9	248	796	5477	85	161	48
15	248	796	2979	295	251	75
15.1	248	796	2859	284	242	73
15.2	248	796	7187	276	265	79
15.3	248	796	2427	185	181	54
15.4	248	796	2932	231	235	70
Average			**3267**	**237**	**228**	**68**
Maximum			**7187**	**309**	**330**	**99**
Minimum			**1384**	**85**	**133**	**40**

Notes:

Station 10.00 is 145m North of King St.

Table 4-C: Backcalculated Layer Moduli - Airport Road from Hilltop Dr. to Old Church Rd. (NBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_r), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
15.5	156	1040	10527	182	225	67
15.601	156	1040	5884	241	213	64
15.702	156	1040	8149	214	190	57
15.8	156	1040	8037	238	235	70
15.901	156	1040	3022	241	258	77
16.006	156	1040	3103	349	274	82
Average			**6454**	**244**	**233**	**70**
Maximum			**10527**	**349**	**274**	**82**
Minimum			**3022**	**182**	**190**	**57**

Notes:

Station 10.00 is 145m North of King St.

Table 5-C: Backcalculated Layer Moduli - Airport Road from Old Church Rd. to Huntsmill Dr. (NBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_{r}), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
16.006	187	822	2470	333	280	84
16.101	187	822	3224	165	144	43
16.2	187	822	6330	235	217	65
16.3	187	822	4014	259	192	58
16.4	187	822	5280	341	232	70
16.5	187	822	2936	253	185	56
16.6	187	822	6296	195	167	50
16.7	187	822	6052	385	221	66
16.8	187	822	7793	289	284	85
16.9	187	822	4768	380	237	71
17	187	822	2076	154	112	33
17.1	187	822	5390	295	220	66
17.2	187	822	5988	350	249	75
Average			**4817**	**279**	**211**	**63**
Maximum			**7793**	**385**	**284**	**85**
Minimum			**2076**	**154**	**112**	**33**

Notes:

Station 10.00 is 145m North of King St.

Table 6-C: Backcalculated Layer Moduli - Airport Road from King St. to Castlederg Side Rd. (SBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus ($M_{r),}$ MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
10.05	244	588	2154	190	142	43
10.15	244	588	1664	178	137	41
10.25	244	588	1939	247	180	54
10.35	244	588	2472	216	169	51
10.45	244	588	2221	222	168	50
10.549	244	588	2436	316	258	77
10.65	244	588	2629	318	215	64
10.75	244	588	2491	231	164	49
10.85	244	588	2625	236	195	59
10.95	244	588	2103	236	167	50
11.05	244	588	2399	236	169	51
11.15	244	588	2309	203	169	51
11.25	244	588	2098	180	139	42
11.35	244	588	2097	256	175	53
11.45	244	588	2315	310	206	62
11.55	244	588	2016	285	203	61
11.65	244	588	2154	216	171	51
11.75	244	588	2422	214	175	52
11.85	244	588	2426	228	175	53
11.949	244	588	1992	256	183	55
12.05	244	588	2488	250	201	60
12.15	244	588	2379	296	213	64
12.25	244	588	2789	265	182	55
12.349	244	588	2914	233	178	53
12.45	244	588	2772	205	171	51
12.55	244	588	3552	232	210	63
12.65	244	588	1974	214	160	48
12.75	244	588	1761	235	185	55
12.85	244	588	2640	256	200	60
Average			**2353**	**240**	**181**	**54**
Maximum			**3552**	**318**	**258**	**77**
Minimum			**1664**	**178**	**137**	**41**

Notes:

Station 10.00 is 145m North of King St.

Table 7-C: Backcalculated Layer Moduli - Airport Road from Castlederg Side Rd. to Olde Base Line (SBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_r), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
12.95	230	503	4014	404	327	98
13.05	230	503	2722	263	165	49
13.15	230	503	2490	248	154	46
13.25	230	503	3090	338	220	66
13.35	230	503	2398	281	180	54
13.45	230	503	2477	276	181	54
13.55	230	503	2244	223	137	41
13.65	230	503	2317	253	164	49
13.75	230	503	2033	269	170	51
13.85	230	503	2395	267	154	46
13.95	230	503	2402	267	160	48
14.05	230	503	2243	156	111	33
14.149	230	503	2187	248	158	47
Average			**2539**	**269**	**175**	**53**
Maximum			**4014**	**404**	**327**	**98**
Minimum			**2033**	**156**	**111**	**33**

Notes:

Station 10.00 is 145m North of King St.

Table 8-C: Backcalculated Layer Moduli - Airport Road from Olde Base Line to Hilltop Dr. (SBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_{r}), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
14.249	240	860	2489	243	207	62
14.349	240	860	2837	314	258	78
14.45	240	860	1872	288	253	76
14.55	240	860	2048	226	203	61
14.65	240	860	1983	312	264	79
14.75	240	860	2890	285	242	73
14.85	240	860	1929	173	159	48
14.949	240	860	2743	211	192	58
15.05	240	860	2244	240	222	67
15.15	240	860	1810	114	156	47
15.25	240	860	4123	151	192	58
15.35	240	860	5022	195	177	53
Average			**2666**	**229**	**210**	**63**
Maximum			**5022**	**314**	**264**	**79**
Minimum			**1810**	**114**	**156**	**47**

Notes:

Station 10.00 is 145m North of King St.

Table 9-C: Backcalculated Layer Moduli - Airport Road from Hilltop Dr. to Old Church Rd. (SBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_{r}), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
15.449	158	1018	9887	250	214	64
15.542	158	1018	7060	289	256	77
15.647	158	1018	10603	276	207	62
15.74	158	1018	7195	208	185	55
15.85	158	1018	7059	198	178	53
15.946	158	1018	4351	192	157	47
Average			**7692**	**235**	**199**	**60**
Maximum			**10603**	**289**	**256**	**77**
Minimum			**4351**	**192**	**157**	**47**

Notes:

Station 10.00 is 145m North of King St.

Table 10-C: Backcalculated Layer Moduli - Airport Road from Old Church Rd. to Huntsmill Dr. (SBL).

Station	Layer Thickness, mm		Backcalculated Layer Moduli, MPa			Corrected Subgrade Resilient Modulus (M_r), MPa
	Asphalt	Granular	Asphalt	Granular	Subgrade	
16.05	204	656	4157	219	174	52
16.15	204	656	1861	208	154	46
16.25	204	656	3342	215	183	55
16.35	204	656	2661	303	188	56
16.45	204	656	4438	358	243	73
16.55	204	656	2273	263	225	67
16.65	204	656	4127	282	223	67
16.75	204	656	5076	375	247	74
16.85	204	656	3935	275	199	60
16.95	204	656	3823	303	260	78
17.05	204	656	3798	299	204	61
17.11	204	656	3704	230	172	52
Average			**3600**	**277**	**206**	**62**
Maximum			**5076**	**375**	**260**	**78**
Minimum			**1861**	**208**	**154**	**46**

Notes:

Station 10.00 is 145m North of King St.

Appendix D:

Calibration Certificate – FWD Machine

FWD Calibration

Date of Calibration: 01-May-2018

Calibration Center: TMR
Calibration Center Operator: Laslo Tot
Signature

FWD Owner: Engtec
FWD Manufacturer Dynatest
FWD Model: 8082
FWD Serial Number 8082-128
FWD Operator: Glenn Black

Reference Load Cell: tmr001
Reference Accelerometer: SN 26663
WinFWDCal Software: Version 2.2.12

LOAD CELL CALIBRATION

Serial Number	Initial Gain	Reference Gains 1	2	Average Gain	**Final Gain**
957	0.984	0.991	0.989	0.990	**0.990**

DEFLECTION SENSOR CALIBRATION

Serial Number	Initial Gain	Reference Gains 1	2	Relative Gains 1	2	**Final Gain**
7511	0.997	0.997	0.997	0.994	0.994	0.994
7512	0.997	0.993	0.993	0.989	0.990	0.989
7513	0.997	0.992	0.992	0.991	0.991	0.991
7514	0.993	0.990	0.990	0.990	0.989	0.990
7515	0.997	0.993	0.993	0.992	0.992	0.992
7516	0.995	0.992	0.992	0.992	0.992	0.992
7886	0.994	0.995	0.995	1.000	0.999	0.999
7518	0.998	0.995	0.995	0.997	0.997	0.997
7519	0.992	0.987	0.987	0.992	0.992	0.992

Messages:
Load Cell:
All data checks passed
Sensor Reference Calibration:
Reference Calibrations Accepted.
Reference Trial Acceptance Criteria Met.
Sensor Relative Calibration:
Sensor Calibration Completed!
Final Acceptance Criteria are met for all sensors.

APPENDIX E

Flexible Pavement Condition Evaluation Forms

Ministry of Transportation
Ontario

Flexible Pavement Condition Evaluation Form

Location: Airport Road

From: Station 9+965 **To:** Station 15+210

LHRS ☐☐☐☐☐ begins ☐☐☐☐ offset km **Section Length** 5 2 4 5 m

Survey Date 1 9 year 0 7 month **PCR** 8 0 **RCR** 8 . 0

Contract No. ☐☐ - ☐☐☐ **WP No.** ☐☐☐☐☐☐☐☐☐

District ☐☐ **Highway** ☐☐☐☐

Traffic Direction B — B - both directions; N - northbound; S - southbound; E - eastbound; W - westbound

Facility A — A - all lanes; C - collector; E - express; O - others (additional lanes)

Class A — F - freeway; A - arterial; C - collector; L - local; S - secondary

Ride Condition Rating (at 80 km/hr)

10 Excellent (smooth)
8 Good (comfortable)
6 Fair (uncomfortable)
4 Poor (v. rough/bumpy)
2 Very Poor, (dangerous, at 80 km/hr)
0

				Severity of Distress					Density of Distress Extent of Occurrence %				
				Very Slight	Slight	Moderate	Severe	Very Severe	Few	Intermittent	Frequent	Extensive	Throughout
									<10	10-20	20-50	50-80	80-100
PAVEMENT				1	2	3	4	5	1	2	3	4	5
	Surface Defects	Ravelling & C. Agg. Loss	1		✓								✓
		Flushing	2										
	Surface Deformations	Rippling and Shoving	3										
		Wheel Track Rutting	4										
		Distortion	5										
CRACKING	Longitudinal Wheel Track	Single and Multiple	6		✓						✓		
		Alligator	7										
	Centre Line	Single and Multiple	8			✓					✓		
		Alligator	9		✓						✓		
	Pavement Edge	Single and Multiple	10		✓							✓	
		Alligator	11		✓							✓	
	Transverse	Half, Full and Multiple	12		✓						✓		
		Alligator	13										
	Longitudinal Meander and Midlane		14										
	Random / Map		15										

Distress Comments: (items not covered above)

Shoulders			**Severity of Distress**				**Density of Distress** Extent of Occurrence, %			
Dominant Type		Distress	Right		Left		Right		Left	
			Mod.	Sev.	Mod.	Sev.	10-30	>30	10-30	>30
			1	2	1	2	1	2	1	2
Paved Full		Cracking								
Paved Partial	✓	Pavement Edge/ Curb Separation								
		Distortion								
Surface Treated		Breakup/Separtion								
		Edge Break								
Primed		Breakup/Separtion								
Gravel										

Maintenance Treatment		**EXTENT OF OCCURRENCE, %**				
		<10	10-20	20-50	50-80	>80
		1	2	3	4	5
Pavement	Manual Patching					
	Machine Patching	✓				
	Spray Patching					
	Rout and Seal Cracks				✓	
	Chip Seal					
Shoulders	Manual Patching					
	Machine Patching					
	Rout and Seal Cracks					
	Chip Seal					

Other Comments: (e.g., subsections, additional contracts)

Evaluated by: Rehman Abdul. P.Eng.

Ministry of Transportation
Ontario

Flexible Pavement Condition Evaluation Form

Location: Airport Road

District ☐☐ **Highway** ☐☐☐☐

From: Station 15+210 **To:** Station 16+300

LHRS ☐☐☐☐☐ (begins) ☐☐☐☐ km (offset) **Section Length** 1 0 9 0 m

Traffic Direction B — B - both directions; N - northbound; S - southbound; E - eastbound; W - westbound

Survey Date 1 9 (year) 0 7 (month) **PCR** 7 0 **RCR** 7 . 0

Facility A — A - all lanes; C - collector; E - express; O - others (additional lanes)

Contract No. ☐☐ - ☐☐☐ **WP No.** ☐☐☐☐☐☐☐☐☐

Class A — F - freeway; A - arterial; C - collector; L - local; S - secondary

Ride Condition Rating (at 80 km/hr)
10 Excellent (smooth)
8 Good (comfortable)
6 Fair (uncomfortable)
4 Poor (v. rough/bumpy)
2 Very Poor, (dangerous, at 80 km/hr)
0

			Severity of Distress					Density of Distress Extent of Occurrence %				
			Very Slight	Slight	Moderate	Severe	Very Severe	Few <10	Intermittent 10-20	Frequent 20-50	Extensive 50-80	Throughout 80-100
PAVEMENT			1	2	3	4	5	1	2	3	4	5
Surface Defects	Ravelling & C. Agg. Loss	1		✓							✓	
	Flushing	2										
Surface Deformations	Rippling and Shoving	3										
	Wheel Track Rutting	4			✓					✓		
	Distortion	5			✓				✓			
CRACKING Longitudinal Wheel Track	Single and Multiple	6		✓					✓			
	Alligator	7										
CRACKING Centre Line	Single and Multiple	8		✓					✓			
	Alligator	9										
CRACKING Pavement Edge	Single and Multiple	10										
	Alligator	11										
CRACKING Transverse	Half, Full and Multiple	12		✓						✓		
	Alligator	13										
CRACKING	Longitudinal Meander and Midlane	14										
CRACKING	Random / Map	15		✓					✓			

Distress Comments: (items not covered above)

Shoulders			**Severity of Distress**				**Density of Distress** Extent of Occurrence, %			
Dominant Type		Distress	Right		Left		Right		Left	
			Mod.	Sev.	Mod.	Sev.	10-30	>30	10-30	>30
			1	2	1	2	1	2	1	2
Paved Full		Cracking								
		Pavement Edge/ Curb Separation								
Paved Partial		Distortion								
Surface Treated		Breakup/Separtion								
		Edge Break								
Primed		Breakup/Separtion								
Gravel										

Maintenance Treatment		EXTENT OF OCCURRENCE, %				
		<10	10-20	20-50	50-80	>80
		1	2	3	4	5
Pavement	Manual Patching					
	Machine Patching	✓				
	Spray Patching					
	Rout and Seal Cracks			✓		
	Chip Seal					
Shoulders	Manual Patching					
	Machine Patching					
	Rout and Seal Cracks					
	Chip Seal					

Other Comments: (e.g., subsections, additional contracts)

Evaluated by: Rehman Abdul. P.Eng.

Ministry of Transportation
Ontario

Flexible Pavement Condition Evaluation Form

Location: Airport Road

From: Station 16+300 **To:** Station 17+150

LHRS ☐☐☐☐☐ begins ☐☐☐☐ offset km **Section Length** 8 5 0 m

Survey Date 1 9 year 0 7 month **PCR** 8 0 **RCR** 8 . 0

Contract No. ☐☐ - ☐☐☐ **WP No.** ☐☐☐☐☐☐☐☐☐

District ☐☐ **Highway** ☐☐☐☐

Traffic Direction B — B - both directions; N - northbound; S - southbound; E - eastbound; W - westbound

Facility A — A - all lanes; C - collector; E - express; O - others (additional lanes)

Class A — F - freeway; A - arterial; C - collector; L - local; S - secondary

Ride Condition Rating (at 80 km/hr)

10	Excellent (smooth)
8	Good (comfortable)
6	Fair (uncomfortable)
4	Poor (v. rough/bumpy)
2	Very Poor, (dangerous, at 80 km/hr)
0	

			Severity of Distress					Density of Distress Extent of Occurrence %				
			Very Slight	Slight	Moderate	Severe	Very Severe	Few <10	Intermittent 10-20	Frequent 20-50	Extensive 50-80	Throughout 80-100
PAVEMENT			1	2	3	4	5	1	2	3	4	5
Surface Defects	Ravelling & C. Agg. Loss	1		✓								✓
	Flushing	2										
Surface Deformations	Rippling and Shoving	3										
	Wheel Track Rutting	4										
	Distortion	5										
CRACKING Longitudinal Wheel Track	Single and Multiple	6		✓					✓			
	Alligator	7										
Centre Line	Single and Multiple	8		✓					✓			
	Alligator	9										
Pavement Edge	Single and Multiple	10		✓						✓		
	Alligator	11		✓						✓		
Transverse	Half, Full and Multiple	12		✓						✓		
	Alligator	13										
Longitudinal Meander and Midlane		14										
Random / Map		15										

Shoulders			Severity of Distress				Density of Distress Extent of Occurrence, %			
			Right		Left		Right		Left	
Dominant Type		Distress	Mod. 1	Sev. 2	Mod. 1	Sev. 2	10-30 1	>30 2	10-30 1	>30 2
Paved Full		Cracking								
		Pavement Edge/ Curb Separation								
Paved Partial	✓	Distortion								
Surface Treated		Breakup/Separtion								
		Edge Break								
Primed		Breakup/Separtion								
Gravel										

Maintenance Treatment		EXTENT OF OCCURRENCE, %				
		<10 1	10-20 2	20-50 3	50-80 4	>80 5
Pavement	Manual Patching					
	Machine Patching		✓			
	Spray Patching					
	Rout and Seal Cracks				✓	
	Chip Seal					
Shoulders	Manual Patching					
	Machine Patching					
	Rout and Seal Cracks					
	Chip Seal					

Distress Comments: (items not covered above)

Other Comments: (e.g., subsections, additional contracts)

Evaluated by: Rehman Abdul. P.Eng.

APPENDIX F

Pavement Design Data

File. No. 1-17-0714

Table F1
Airport Road
King Street To Huntsmill Drive (Road Widening)
Town of Caledon
Equivalent Single Axle Load Calculations (AADT DATA)

Description - Airport Road (King Street to Huntsmill Drive-Road Widening)

Traffic Data Year	2017	2019	2021	2041
Design Year			**2021**	
Analysis Period	2	2	20	
1a) Average Annual Daily Traffic (AADT)	9,000	9,307	9,624	13,456
Annual Growth Rate (%)	1.69%	1.69%	1.69%	
1b) Truck fraction of total traffic			8.0%	
Number of lanes in one direction			1	
1c) Directional Factor			0.5	
1d) Lane distribution Factor			1	
Daily Truck Volume			**385**	

Road Classification		**Rural Minor Arterial**
2) Breakdown of Truck Proportions		
	Class 1	45.0%
	Class 2	5.0%
	Class 3	35.0%
	Class 4	15.0%
3) Daily Truck Volumes (4 Classes)		**2021 to 2041**
	Class 1	173
	Class 2	19
	Class 3	135
	Class 4	58
4) Truck Factors (4 Classes)		
	Class 1	0.5
	Class 2	2.3
	Class 3	1.6
	Class 4	5.5
5) Daily ESALs per Truck Class (4 Classes)		
	Class 1	87
	Class 2	44
	Class 3	216
	Class 4	318
6) Total Daily ESALs in Design Lane		**665**
7) Total Base Year ESALs		**2021**
Number of Days of Truck Traffic		300
	Total Base Year ESALs	**199,500**
8) Cumulative ESALs for Design Period		
Design Period		20
Annual Growth Rate (%)		1.69%
Geometric Growth Factor		23.6
		4,708,200
	Cumulative ESALs for the Design Period	**4,708,200**

Note: ESAL Calculations are based on "Procedures for Estimating Traffic Loads for Pavement Design",Hajek, J., 1995, and "Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions" (MI-83), 2008.

Table F2
Airport Road
King Street To Huntsmill Drive (Roundabouts)
Town of Caledon
Equivalent Single Axle Load Calculations (AADT DATA)

Description - Airport Road (King Street to Huntsmill Drive-Roundabouts)					
Traffic Data Year		**2017**	**2019**	**2021**	**2041**
Design Year				**2021**	
Analysis Period		2	2	20	
1a) Average Annual Daily Traffic (AADT)		9,000	9,307	9,624	13,456
Annual Growth Rate (%)		1.69%	1.69%	1.69%	
1b) Truck fraction of total traffic				8.0%	
Number of lanes in one direction				1	
1c) Directional Factor				1	
1d) Lane distribution Factor				1	
	Daily Truck Volume			**770**	
Road Classification				**Rural Minor Arterial**	
2) Breakdown of Truck Proportions					
	Class 1			45.0%	
	Class 2			5.0%	
	Class 3			35.0%	
	Class 4			15.0%	
3) Daily Truck Volumes (4 Classes)				**2021 to 2041**	
	Class 1			347	
	Class 2			39	
	Class 3			270	
	Class 4			116	
4) Truck Factors (4 Classes)					
	Class 1			0.5	
	Class 2			2.3	
	Class 3			1.6	
	Class 4			5.5	
5) Daily ESALs per Truck Class (4 Classes)					
	Class 1			173	
	Class 2			89	
	Class 3			431	
	Class 4			635	
6) Total Daily ESALs in Design Lane				**1329**	
7) Total Base Year ESALs				**2021**	
Number of Days of Truck Traffic				300	
	Total Base Year ESALs			**398,700**	
8) Cumulative ESALs for Design Period					
Design Period				20	
Annual Growth Rate (%)				1.69%	
Geometric Growth Factor				23.6	
				9,409,320	
	Cumulative ESALs for the Design Period			**9,409,320**	

Note: ESAL Calculations are based on "Procedures for Estimating Traffic Loads for Pavement Design",Hajek, J., 1995, and "Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions" (MI-83), 2008.

File. No. 1-17-0714

Table F3
Old Church Road
Airport Road To Marilyn Street
Town of Caledon
Equivalent Single Axle Load Calculations (AADT DATA)

Description - Old Church Road (Sta. 1+100 to Sta. 1+600)

Traffic Data Year		**2017**	**2019**	**2021**	**2041**
Design Year				**2021**	
Analysis Period		2	2	20	
1a) Average Annual Daily Traffic (AADT)		6,000	6,205	6,416	8,971
Annual Growth Rate (%)		1.69%	1.69%	1.69%	
1b) Truck fraction of total traffic				8.0%	
Number of lanes in one direction				1	
1c) Directional Factor				0.5	
1d) Lane distribution Factor				1	
Daily Truck Volume				**257**	
Road Classification				**Rural Minor Arterial**	
2) Breakdown of Truck Proportions					
	Class 1			45.0%	
	Class 2			5.0%	
	Class 3			35.0%	
	Class 4			15.0%	
3) Daily Truck Volumes (4 Classes)				**2021 to 2041**	
	Class 1			116	
	Class 2			13	
	Class 3			90	
	Class 4			39	
4) Truck Factors (4 Classes)					
	Class 1			0.5	
	Class 2			2.3	
	Class 3			1.6	
	Class 4			5.5	
5) Daily ESALs per Truck Class (4 Classes)					
	Class 1			58	
	Class 2			30	
	Class 3			144	
	Class 4			212	
6) Total Daily ESALs in Design Lane				**444**	
7) Total Base Year ESALs				**2021**	
Number of Days of Truck Traffic				300	
Total Base Year ESALs				**133,200**	
8) Cumulative ESALs for Design Period					
Design Period				20	
Annual Growth Rate (%)				1.69%	
Geometric Growth Factor				23.6	
				3,143,520	
Cumulative ESALs for the Design Period				**3,143,520**	

Note: ESAL Calculations are based on "Procedures for Estimating Traffic Loads for Pavement Design",Hajek, J., 1995, and "Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions" (MI-83), 2008.

Table F4
1993 AASHTO FLEXIBLE PAVEMENT DESIGN

File No.:	1-17-0714
Project Name:	Airport Road New Construction (Road Widening)

Design Structural Number for Future Traffic

Design ESALs:	4,708,500
Initial Serviceability:	4.4
Terminal Serviceability:	2.2
Level of Reliability (%):	85
Overall Standard Deviation:	0.44
Subgrade Resilient Modulus (MPa):	30
Design Structural Number:	122

Effective Structural Number of Existing Pavement

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA				
Base Course				
Subbase Course				
Total				

The existing pavement is structurally inadequate.

New Pavement Structural Design

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA	150	0.42	1.0	63
Base Course	150	0.14	1.0	21
Subbase Course	450	0.09	1.0	41
Total	750			125

The designed pavement is structurally adequate.

Table F5

1993 AASHTO FLEXIBLE PAVEMENT DESIGN

File No.: 1-17-0714

Project Name: Airport Road New Construction (Roundabouts)

Design Structural Number for Future Traffic

Design ESALs:	9,409,500
Initial Serviceability:	4.4
Terminal Serviceability:	2.2
Level of Reliability (%):	85
Overall Standard Deviation:	0.44
Subgrade Resilient Modulus (MPa):	30
Design Structural Number:	133

Effective Structural Number of Existing Pavement

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA				
Base Course				
Subbase Course				
Total				

The existing pavement is structurally inadequate.

New Pavement Structural Design

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA	150	0.42	1.0	63
Base Course	150	0.14	1.0	21
Subbase Course	550	0.09	1.0	50
Total	850			134

The designed pavement is structurally adequate.

Table F6

1993 AASHTO FLEXIBLE PAVEMENT DESIGN

File No.: 1-17-0714
Project Name: Airport Road Rehabilitation (Sta. 9+965 to Sta. 15+210)

Design Structural Number for Future Traffic

Design ESALs:	4,708,500
Initial Serviceability:	4.4
Terminal Serviceability:	2.2
Level of Reliability (%):	85
Overall Standard Deviation:	0.44
Subgrade Resilient Modulus (MPa):	50
Design Structural Number:	103

Effective Structural Number of Existing Pavement

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA	235	0.2	1.0	47
Base Course	150	0.12	0.9	16
Subbase Course	375	0.09	0.9	30
Total	760			94

The existing pavement is structurally inadequate.

Mill and HMA Overlay Design

Mill (mm): **50**

HMA Overlay (mm): **50**

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
New HMA	50	0.42	1.0	21
Existing HMA	185	0.2	1.0	37
Base Course	150	0.12	0.9	16
Subbase Course	375	0.09	0.9	30
Total	760			105

The designed pavement is structurally adequate.

Table F7

1993 AASHTO FLEXIBLE PAVEMENT DESIGN

File No.: 1-17-0714

Project Name: Airport Road Rehabilitation (Sta. 15+210 to Sta. 16+300)

Design Structural Number for Future Traffic

Design ESALs:	4,708,500
Initial Serviceability:	4.4
Terminal Serviceability:	2.2
Level of Reliability (%):	85
Overall Standard Deviation:	0.44
Subgrade Resilient Modulus (MPa):	50
Design Structural Number:	103

Effective Structural Number of Existing Pavement

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA	150	0.2	1.0	30
Base Course	150	0.12	0.9	16
Subbase Course	375	0.09	0.9	30
Total	675			77

The existing pavement is structurally inadequate.

Full Depth Asphalt Removal

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
New HMA	150	0.42	1.0	63
Existing Base Course	150	0.12	0.9	16
Existing Subbase Course	375	0.09	0.9	30
Total	675			110

The designed pavement is structurally adequate.

Table F8

1993 AASHTO FLEXIBLE PAVEMENT DESIGN

File No.:	1-17-0714
Project Name:	Airport Road Rehabilitation (Sta. 16+300 to Sta. 17+370)

Design Structural Number for Future Traffic

Design ESALs:	4,708,500
Initial Serviceability:	4.4
Terminal Serviceability:	2.2
Level of Reliability (%):	85
Overall Standard Deviation:	0.44
Subgrade Resilient Modulus (MPa):	50
Design Structural Number:	103

Effective Structural Number of Existing Pavement

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA	195	0.2	1.0	39
Base Course	150	0.12	0.9	16
Subbase Course	375	0.09	0.9	30
Total	720			86

The existing pavement is structurally inadequate.

Full Depth Asphalt Removal

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
New HMA	150	0.42	1.0	63
Existing Base Course	150	0.12	0.9	16
Existing Subbase Course	375	0.09	0.9	30
Total	675			110

The designed pavement is structurally adequate.

Table F9

1993 AASHTO FLEXIBLE PAVEMENT DESIGN

File No.:	1-17-0714
Project Name:	Old Church Road Rehabilitation (Sta. 1+100 to Sta. 1+600)

Design Structural Number for Future Traffic

Design ESALs:	3,143,600
Initial Serviceability:	4.4
Terminal Serviceability:	2.2
Level of Reliability (%):	85
Overall Standard Deviation:	0.44
Subgrade Resilient Modulus (MPa):	35
Design Structural Number:	109

Effective Structural Number of Existing Pavement

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
HMA	155	0.2	1.0	31
Base Course	150	0.12	0.9	16
Subbase Course	380	0.09	0.9	31
Total	685			78

The existing pavement is structurally inadequate.

Full Depth Asphalt Removal

Pavement Components	Thickness (mm)	Structural Coefficient	Drainage Coefficient	Structural Number
New HMA	150	0.42	1.0	63
New Gran A	5	0.14	1.0	1
Existing Base Course	150	0.12	0.9	16
Existing Subbase Course	380	0.09	0.9	31
Total	685			111

The designed pavement is structurally adequate.