THURBER ENGINEERING LTD.

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT
CLASS EA STUDY FOR KIRBY ROAD WIDENING
FROM JANE STREET TO DUFFERIN STREET
CITY OF VAUGHAN, ONTARIO

Report

to

HDR

Date: June 6, 2022
File: 26130

THURBER

TABLE OF CONTENTS

APPENDICES

THURBER

1. INTRODUCTION

This report presents the factual findings obtained from a preliminary geotechnical and pavement investigation conducted in support of the Municipal Class Environmental Assessment (EA) Study for Kirby Road from Jane Street to Dufferin Street in the City of Vaughan, Ontario.

Current plans call for the reconstruction of the roadway from two to four lanes between Jane Street and Dufferin Street, grade separation at the Barrie GO Rail line crossing west of Keele Street and elimination of the jog at Jane Street. It is understood that the rail grade separation may comprise an overpass or underpass structure to convey Kirby Road across the railway.

The purpose of the investigation was to explore the subsurface conditions within the project limits and based on the data obtained, to provide borehole logs, borehole location plans, a written description of the subsurface conditions, and preliminary geotechnical comments and recommendations regarding pavement design and/or rehabilitation, bridge and culvert foundations, high fill embankments, deep cuts, excavation and dewatering.

A limited analytical testing program was completed concurrently on selected soil samples to evaluate the environmental quality and provide preliminary management options for excess excavated soils that may be generated during the proposed construction works. The scope of the analytical testing program was established prior to the filing of Ontario Regulation (O.Reg.) 406/19, On-Site and Excess Soil Management, by the Ontario Ministry of Environment, Conservation and Parks (MECP). As a result, additional sample collection and analyses will be required to meet this new regulation.

A hydrogeological assessment was completed concurrently for this project. The results of hydrogeological assessment are reported under separate cover and should be read in conjunction with this report.

Thurber Engineering Ltd. (Thurber) carried out the investigation as a sub-consultant to HDR who are conducting the EA Study for the City of Vaughan.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. BACKGROUND INFORMATION

2.1 Site Description

The study area extends along Kirby Road from Dufferin Street to approximately 100 meters west of Jane Street in the City of Vaughan. The total length of the study corridor is approximately 4.1 km.

Kirby Road is an east-west arterial road with a posted speed limit of 60 km/h. The roadway presently has a two-lane rural cross section with gravel shoulders between Jane Street and Dufferin Street. Kirby Road crosses the Barrie GO Rail line at a level crossing approximately 300 m west of the Keele Street intersection. The study corridor generally consists of agricultural land with rural residential and farm structures. Housing subdivisions are present south of Kirby Road between Dufferin Street and Keele Street. The zone extending north of Kirby Road between Keele Street and the GO Rail line is developed for commercial and industrial use.

Kirby Road crosses a headwater stream of the West Don River approximately 0.7 km east of Jane Street and a small wet area is present on the north side of Kirby Road approximately 650 m east of Keele Street. The east end of the study corridor enters the environmentally sensitive Oak Ridges Moraine region.

The site topography is generally flat to undulating west of Keele Street and rolling east of Keele Street. Ground surface elevations from Jane to Keele Street range from near elevation 271 to 277, rising from the GO Rail crossing at elevation 291, crossing Keele Street at elevations 298 to 308 and cresting at Ravineview Drive at elevation 311. The ground surface elevation drops from elevation 311 at Ravineview Drive to elevation 283 near Foot Hills Road before rising again towards Dufferin Street near elevation 296. Typical photographs from the corridor are provided in Appendix A.

2.2 Existing Pavement Conditions

A visual examination of the roadway surface was carried out in July 2020 to obtain a general overview of the existing pavement conditions. In general, the existing roadway pavement is in good condition to the west of Keele Street and in fair condition to the east.

The section between Keele and Jane Street exhibits few, very slight transverse cracks and few to frequent slight to severe edge cracking. Locally, severe wheel track rutting and cracking was observed from Jane Street to approximately 150 m east of Jane Street.

From Keele Street to Foot Hills Road, moderate centerline cracking was observed with slight to moderate, extensive transverse cracking. Slight longitudinal wheel and edge cracks were evident throughout this zone. Recent resurfacing has been completed in three localized sections over lengths of 5 to 30 m. In general, cracks have been sealed in the section between Keele Street and Dufferin Street.

The section between Foot Hills Road to Dufferin Street exhibits slight to moderate, extensive transverse cracking and slight to moderate, longitudinal wheel and edge cracks. Recent resurfacing was completed over a 30 m section near the intersection with Dufferin Street.

Representative photographs of the existing pavement are provided in Appendix A.

2.3 Geology

Based on the information in *The Physiography of Southern Ontario*[1] by Chapman and Putnam (1984), the site is located within the South Slope and the Oak Ridges Moraine physiographic regions. The South Slope is characterized by low-lying, fine-grained, undulating ground moraine and knolls. The Oak Ridges Moraine is a ridge that extends from the Niagara Escarpment to the Trent River. This unit is a result of the accumulation of material deposited between the opposing Ontario and Northern lobes during the recession of the Wisconsinan glacier. The crest of the ridge rises to approximately 300 meters above sea level and is hilly with knob-and-basin type topography.

Based on *Surficial Geology of Southern Ontario*[2] and *Quaternary Geology Map P2204*[3], the surficial material of the South Slope is composed of clay and silt till where the materials may have been derived from a glaciolacustrine environment or from the shale bedrock. An ice contact slope marks the boundary between the Moraine and the South Slope approximately one kilometer west of Dufferin Street. The surficial deposits within the Oak Ridges Moraine are described as ice-contact deposits, comprising loose sand, gravel, and silt deposited in the ridges. Sand and gravel pits are marked near the site within the Oak Ridges Moraine unit. Pockets of organic material containing peat, muck, and marl are noted within the vicinity of the study area.

---

[1] Chapman, L.J. and Putnam, D.F. 1984. The Physiography of Southern Ontario, Ontario Geological Survey Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

[2] Ontario Geological Survey, 2010: Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV

[3] Sharpe, D. R., 1980: Quaternary Geology of Toronto and Surrounding Area; Ontario Geological Survey Preliminary Map P. 2204, Geological Series. Scale 1:100 000. Compiled 1980

According to *Paleozoic Geology of Southern Ontario*[4], the bedrock underlying the site is comprised of the Georgian Bay and Blue Mountain Formation. Both units are composed of shale and limestone. The bedrock depth is expected to be greater than 100 m below existing ground surface.

3. INVESTIGATION PROCEDURES

3.1 Field Investigation

The field investigation for this project was carried out between July 8 and 15, 2020 and comprised a total of thirteen boreholes (Boreholes 20-01 to 20-13) advanced to depths ranging from 3.7 m to 31.1 m. Borehole details are provided in Table 3.1 and in the Record of Borehole sheets included in Appendix B. The approximate locations of the boreholes are shown on the Borehole Location Plans, Drawings 26130-1 to 26130-6, provided in Appendix C.

Table 3.1 – Borehole Details

Facility/Site Feature	Borehole No.	Ground Elevation (m)	Borehole Termination Depth (m)	Borehole Termination Elevation (m)
West Don River	20-03	272.7	8.2	264.5
Barrie GO Rail Crossing	20-05	291.0	31.1	259.9
	20-06	291.5	9.5	282.0
Wetland	20-09	310.7	6.7	304.0
Embankment Slope	20-12	295.6	11.3	284.3
Pavement Structure, Municipal Services	20-01	271.4	5.2	266.3
	20-02	273.8	3.7	270.1
	20-04	277.4	3.7	273.8
	20-07	298.2	5.2	293.0
	20-08	308.4	3.7	304.7
	20-10	291.7	6.7	285.0
	20-11	282.9	3.7	279.2
	20-13	268.8	3.7	265.2

The borehole locations were established in the field by Thurber using a portable GPS receiver and verified relative to existing site features. The ground surface elevations at the borehole locations were determined using a Trimble R10 GNSS receiver.

[4] Armstrong, D.K. and Dodge, J.E.P., 2007: Paleozoic geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219.

All borehole locations were cleared of utilities prior to commencement of drilling. The boreholes were repositioned as necessary in consideration of surface features, underground utilities, and restricted site access.

The boreholes were advanced using hollow stem augers and mud rotary/tricone advancement methodologies powered by a track mounted Mobile B57 drill rig supplied and operated by Landshark Drilling Inc. Soil samples were obtained at selected intervals using a 50 mm outside diameter split-spoon sampler driven in conjunction with the Standard Penetration Test (SPT).

The field investigation was carried out under the full-time supervision of Thurber technical staff. All boreholes were logged in the field. Soil samples were identified, placed in labelled containers and transported back to Thurber's laboratory in Oakville for further examination and testing.

Groundwater conditions were observed in the open boreholes throughout the drilling operations. Single monitoring wells were installed in Boreholes 20-01, 20-05, 20-06 and 20-07 and nested wells (shallow (S) and deep (D)) were installed in Boreholes 20-03, 20-09, 20-10 and 20-12 to permit monitoring of the groundwater levels at the site. The monitoring wells consisted of 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. The installation details are summarized in Table 3.2 below.

Table 3.2 – Monitoring Well Details

Borehole/ Monitoring Well (BH/MW) No.	Ground Elevation (m)	Monitoring Well Tip		Slotted Screen Length (m)	Mid-Screen Depth (m)	Mid-Screen Elev. (m)
		Depth (m)	Elevation (m)			
20-01	271.4	4.5	266.9	1.5	3.8	267.6
20-03 (Shallow)	272.7	3.0	269.7	1.5	2.3	270.4
20-03 (Deep)		7.6	265.1	1.5	6.9	265.8
20-05	291.0	29.1	261.9	3.0	27.6	263.4
20-06	291.5	7.0	284.5	1.5	6.0	285.5
20-07	298.2	4.2	294.0	3.0	2.7	295.5
20-09 (Shallow)	310.7	3.0	307.7	1.5	2.3	308.4
20-09 (Deep)		6.0	304.7	1.5	5.3	305.4
20-10 (Shallow)	291.7	2.8	288.9	1.5	2.1	289.6
20-10 (Deep)		5.8	285.9	1.5	5.1	286.6
20-12 (Shallow)	295.6	3.0	292.6	1.5	2.3	293.3
20-12 (Deep)		10.5	285.1	1.5	9.8	284.4

The boreholes in which no monitoring wells were installed were backfilled in general accordance with Ontario Regulation 903.

THURBER

3.2 Laboratory Testing

3.2.1 Geotechnical

Geotechnical laboratory testing was carried out at Thurber's laboratory. All recovered soil samples were subjected to visual identification and to natural moisture content determination. Selected samples were also subjected to grain size distribution analysis (hydrometer and/or sieve) and Atterberg Limits testing, where appropriate. Laboratory testing results are summarized on the Record of Borehole sheets included in Appendix B and are presented on the figures included in Appendix D.

3.2.2 Geoenvironmental

For preliminary evaluation of the environmental quality of the on-site soils, representative samples recovered from select boreholes were submitted to SGS for analysis of one or more of metals and inorganic parameters, petroleum hydrocarbons (PHC) Fractions F1 to F4, including benzene, ethylbenzene, toluene and xylenes (BTEX) and/or polycyclic aromatic hydrocarbons (PAHs) in accordance with O. Reg. 153/04.

4. DESCRIPTION OF SUBSURFACE CONDITIONS

A generalized description of the subsurface conditions encountered in the boreholes is given in the following sections. Detailed descriptions of the soil conditions at the specific locations drilled are presented on the Record of Borehole sheets in Appendix B and take precedence over the generalized description. It should be recognized and expected that soil conditions will vary between and beyond borehole locations.

The subsurface stratigraphy encountered in the boreholes generally comprises a surficial pavement structure, fill and localized organic deposits underlain by a complex interbedding of native deposits consisting of silty clay till, silt and sand till and clayey silt with interspersed layers of sand to silt. Further descriptions of the individual strata are presented below.

4.1 Pavement Structure

The pavement structure encountered in the boreholes drilled on Kirby Road (Boreholes 20-01 to 20-04, 20-07 to 20-11 and 20-13) consisted of 100 to 150 mm of asphalt overlying a granular base varying from gravelly sand to sandy gravel. The granular materials extended to depths ranging from 0.6 to 1.2 m, locally 1.5 and 2.0 m in Boreholes 20-02 and 20-03, respectively.

Locally, in Borehole 20-12 advanced on the paved shoulder, the pavement structure comprised 30 mm of asphalt over 660 mm of granular base.

The results of grain size analyses conducted on samples of the granular material are presented on Figure D1 of Appendix D. The results of the grain size distribution analyses are summarized below:

Soil Particle	Percentage (%)
Gravel	29 to 47
Sand	33 to 57
Silt + Clay	14 to 21

None of the samples tested meet the OPSS Granular B Type I or Granular A gradation specifications. The results may be impacted by the effects of compaction, auger sampling procedures, infiltration of fines with road runoff, or deterioration of the granular material over time.

4.2 Fill

A fill layer was encountered at the ground surface in Borehole 20-06 and below the pavement structure in Boreholes 20-09, 20-12 and 20-13.

In Borehole 20-06, the fill layer consisted of clayey silt and was penetrated at a depth of 1.5 m (Elev. 290.1). Occasional organic inclusions were noted within this fill layer. SPT ‘N’ values of 8 and 11 blows per 0.3 m of penetration were recorded in the silt fill layer, indicating a stiff consistency. Moisture contents of 7% and 26% were measured.

In Boreholes 20-09 and 20-13, silty clay fill was encountered below the pavement structure at depths of 0.8 and 0.6 m (Elev. 309.9 and 268.2) and penetrated at 2.2 and 1.5 m (Elev. 308.5 and 267.4). SPT ‘N’ values of 7 to 12 blows per 0.3 m of penetration were recorded, indicating a firm to stiff consistency. Moisture contents ranged between 11% and 14%.

A layer of silt and sand fill was contacted below the pavement structure in Borehole 20-12 at 0.7 m depth (Elev. 294.9) and was contacted to 4.1 m (Elev. 291.5). SPT ‘N’ values recorded in the fill layer varied from 9 to 28 blows per 0.3 m, indicating loose to compact condition. Measured moisture contents varied between 9% and 15%. The results of a grain size distribution analysis carried out on a sample of the silt and sand fill are shown on Figure D2 in Appendix D. The results indicated 1% gravel, 37% sand, 60% silt and 2% clay sized particles.

THURBER

4.3 Organic Deposits

In Boreholes 20-03 and 20-09, a 0.2 to 0.4m thick layer of organic silt was contacted below the fill at depths of 2.0 and 2.2 m (Elev. 270.7 and 308.5). An SPT 'N' value of 4 blows per 0.3 m of penetration was recorded in this layer, indicating a soft consistency. Decayed plant matter and/or peat were noted in this stratum. Moisture contents of 23% and 67% were measured.

A 150 mm thick layer of topsoil was encountered at the ground surface of Borehole 20-05. Locally, in Borehole 20-04, a 300 mm thick layer of buried topsoil was encountered below the fill at a depth of 1.2 m (Elev. 276.2) and penetrated at 1.5 m (Elev. 275.9).

4.4 Silty Clay Till

Silty clay till was encountered below the fill, organic silt and/or silt layers at depths of 0.8 to 3.0 m (Elev. 267.4 to 307.7) in Boreholes 20-01, 20-03, 20-07 to 20-10 and 20-13. The clay till was penetrated at depths of 5.6 and 2.2 m (Elev. 267.1 and 289.5) in Boreholes 20-03 and 20-10, respectively. The clay till was contacted to the termination depths of 3.7 to 5.2 m (Elev. 265.2 to 304.7) in Boreholes 20-01, 20-07 to 20-09 and 20-13. The till was interrupted by a sand layer in Borehole 20-01 and a layer of silt and sand in Borehole 20-07.

Locally, in Boreholes 20-05 and 20-06, the clay till was contacted below the clayey silt and sand layers at depths of 4.1 and 7.2 m (Elev. 286.9 and 284.3). The clay till layer was penetrated at a depth of 8.7 m (Elev. 282.3) in Borehole 20-05 and was contacted to the termination depth of 9.5 m (Elev. 282.0) in Borehole 20-06. A lower clay till layer was contacted at a depth of 13.4 m (Elev. 277.5) in Borehole 20-05 and was penetrated at 16.3 m (Elev. 274.7).

SPT 'N' values recorded in the clay till typically ranged from 6 to 25 blows per 0.3 m of penetration, indicating a firm to very stiff consistency. Higher 'N' values of 34 blows per 0.3 m of penetration to 72 blows for 275 mm of penetration were recorded locally in Boreholes 20-01, 20-03, 20-05 and 20-06, indicating a hard consistency. Measured moisture contents typically ranged from 9 to 15%, locally up to 20%.

The results of grain size distribution analyses carried out on selected samples of the clay till are shown on Figure D3 in Appendix D. The results of the grain size distribution analyses are summarized below:

Soil Particle	Percentage (%)
Gravel	2 to 3
Sand	22 to 36
Silt	45 to 54
Clay	16 to 24

Atterberg limits testing was carried out on selected samples of the clay till. The results indicate that the till samples tested consist of silty clay of low plasticity (CL). The results are plotted on Figure D6 in Appendix D and summarized below.

Liquid Limit	19 to 28
Plastic Limit	11 to 14
Plasticity Index	8 to 14

Till soils frequently contain cobbles and boulders, and these should be anticipated in any construction operations extending into this deposit.

4.5 Silt and Sand Till

A deposit of silt and sand till was encountered below the clay till and fill at depths of 8.7 and 4.1 m (Elev. 282.3 and 291.5) and was contacted to depths of 11.7 and 8.7 m (Elev. 279.3 and 286.9) in Boreholes 20-05 and 20-12, respectively.

SPT ‘N’ values recorded in the silt and sand till deposit ranged from 26 to 101 blows for 0.3 m of penetration, indicating a compact to very dense condition. Measured moisture contents within the silt and sand till varied between 8% and 15%.

Till soils frequently contain cobbles and boulders, and these should be anticipated in any construction operations extending into this deposit.

4.6 Clayey Silt to Silty Clay

Layers of cohesive clayey silt or silty clay were encountered at various depths in Boreholes 20-02 to 20-06, 20-10 and 20-11. In Boreholes 20-02 to 20-04, 20-10 and 20-11, the cohesive layer was encountered at depths of 1.5 to 7.2 m (Elev. 265.6 to 289.5) and was contacted to the termination depths of 3.7 to 8.2 m (Elev. 264.5 to 285.0). In Borehole 20-05, 2.8 and 8.3 m thick layers were contacted at depths of 0.2 and 16.3 m (Elev. 290.8 and 274.7); a lower layer was contacted at a depth of 27.6 m (Elev. 263.4) to the termination depth of 31.1 m (Elev. 259.9). In Borehole 20-06, the cohesive layer was 3.4 m thick and was contacted from 1.5 m (Elev. 290.1) to 4.9 m (Elev. 286.6).

SPT ‘N’ values ranging from 4 to 21 blows per 0.3 m of penetration were recorded in the clayey silt and silty clay, indicating a consistency of soft to very stiff. Locally, in Borehole 20-05, SPT ‘N’ values of 75 and 81 blows per 0.3 m of penetration were recorded at depths of about 17 and 23 m, indicating a hard consistency. The weight of the hammer was used to advance the SPT at a depth of 29 m in Borehole 20-05 for a recorded SPT ‘N” value of 0 blows per 0.3 m of penetration. Moisture contents of 10 to 23% were measured in the cohesive deposits.

The results of a grain size distribution analysis carried out on one sample of clayey silt are shown on Figure D4 in Appendix D. The results indicated 0% gravel, 3% sand, 85% silt and 12% clay sized particles.

Atterberg limits testing carried out on a sample of the clayey silt measured a liquid limit, plastic limit, and plasticity index of 28, 21 and 7, respectively. These results, which are plotted on Figure D7 in Appendix D, indicate that the sample tested consists of clayey silt (CL-ML) to silty clay (CL).

4.7 Sand to Silt

Layers of cohesionless sand, silt, or silt and sand were encountered within or between the till and clayey deposits at variable depths and elevations in all boreholes except Boreholes 20-04, 20-08, 20-10 and 20-13. The thickness of the sand to silt and sand layers typically ranged from 0.7 to 3.0 m. A 0.4 m thick layer of sandy silt with organics was encountered locally below the organic silt layer in Borehole 20-09. Locally in Borehole 20-12, a silt layer was encountered below the silt and sand till at 8.7 m depth (Elev. 286.9) and was contacted to the termination depth of 11.3 m (Elev. 284.3).

SPT ‘N’ values ranging from 3 to 35 blows per 0.3 m of penetration, locally 73 blows per 0.3 m of penetration, were recorded in the sand and silt materials, indicating a variable relative density of very loose to dense, locally very dense. Measured moisture contents ranged from 10 to 26%.

The results of grain size distribution tests carried out on samples of sand, silt and sand, and silt are shown on Figure D5 in Appendix D and summarized below:

Soil Particle	Sand to Silty Sand	Silt and Sand	Silt
	Percentage (%)		
Gravel	0 to 6	0	0
Sand	73 to 92	39 to 55	3
Silt	8 to 27	43 to 55	92
Clay		2 to 6	5

Atterberg limits testing carried out on a sample of the silt and sand measured a liquid limit, plastic limit, and plasticity index of 17, 13 and 4, respectively. These results, which are plotted on Figure D7 in Appendix D, indicate that the sample tested consists of low to slightly plastic silt (ML)

4.8 Groundwater Levels

Groundwater conditions were observed in the open boreholes throughout the drilling operations. As Borehole 20-05 was completed with mud rotary drilling methodologies, the groundwater conditions were not able to be observed in the open boreholes during drilling operations. Upon completion of augering, the remaining boreholes were open and dry.

The groundwater depths and elevations measured in the monitoring wells installed in the boreholes are summarized in Table 4.1.

Table 4.1 – Summary of Groundwater Level Observations

BH/MW No.	Ground Elev. (m)	Mid-Screen Depth (m)	Mid-Screen Elev. (m)	Ground Water Elevation (metres below ground surface)		
				July 21, 2020	July 28, 2020	Sept. 25, 2020
20-01	271.4	3.8	267.6	268.7 (2.7)	268.8 (2.7)	268.3 (3.1)
20-03 (S)	272.7	2.3	270.4	Dry	Dry	Dry
20-03 (D)		6.9	265.8	268.4 (4.4)	268.4 (4.4)	267.7 (5.0)
20-05	291.0	27.6	263.4	264.3 (26.6)	264.4 (26.6)	264.2 (26.8)
20-06	291.5	6.0	285.5	287.8 (3.7)	287.7 (3.8)	287.5 (4.0)
20-07	298.2	2.7	295.5	295.9 (2.3)	296.0 (2.2)	295.6 (2.6)
20-09 (S)	310.7	2.3	308.4	308.8 (1.9)	309.0 (1.7)	308.8 (1.9)
20-09 (D)		5.3	305.4	308.1 (2.6)	309.1 (1.6)	308.8 (1.9)

BH/MW No.	Ground Elev. (m)	Mid-Screen Depth (m)	Mid-Screen Elev. (m)	Ground Water Elevation (metres below ground surface)		
				July 21, 2020	July 28, 2020	Sept. 25, 2020
20-10 (S)	291.7	2.1	289.6	Dry	Dry	Dry
20-10 (D)		5.1	286.6	Dry	Dry	Dry
20-12 (S)	295.6	2.3	293.3	Dry	Dry	Dry
20-12 (D)		9.8	284.4	285.4 (10.2)	285.5 (10.1)	Dry

Notes:

1. (S) – shallow well
2. (D) – deep well

The above groundwater level measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected. Further, groundwater levels may be higher after prolonged periods of precipitation.

5. ANALYTICAL LABORATORY TESTING RESULTS

Based on the proposed design details and site conditions encountered during the investigation, it is anticipated that the majority of the excavated soils for the proposed construction works will comprise the existing fill materials and native silty clay till. In general, there were no visual and olfactory indications of impact observed in the soil samples recovered from the geotechnical field investigation program.

The sample locations and material types that were selected for analysis are summarized in Table 5.1.

Table 5.1 – Soil Samples Selected for Analytical Testing

Borehole	Sample ID	Depth (m)	Material	Analysis
20-03	20-03 SS4	2.3 – 2.9	Clay Till	Metals & Inorganics
20-05	20-05 SS6	4.6 – 5.2	Clay Till	Metals & Inorganics PAHs
20-06	20-06 SS2	0.8 – 1.4	Silt Fill	Metals & Inorganics PHCs F1 to F4, BTEX, PAHs

Borehole	Sample ID	Depth (m)	Material	Analysis
20-07	20-07 SS3	1.5 – 2.1	Clay Till	Metals & Inorganics PAHs
20-09	20-09 SS7	6.1 – 6.7	Clay Till	Metals & Inorganics
20-12	20-12 SS5	3.0 – 3.6	Silt and Sand Fill	Metals & Inorganics

For preliminary characterization of the on-site soils, the analytical data were compared to the Full Depth Background Table 1 Site Condition Standards for residential/parkland/institutional/industrial/commercial/community (RPI/ICC) property uses provided under O. Reg. 153/04 in the MECP document "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", April 15, 2011 ("2011 MECP Document"). The analytical data was also compared to the MECP Table 2 "Full Depth Generic Site Condition Standards in a Potable Groundwater Condition" for ICC Property Uses, coarse textured soils (MECP Table 2 ICC Standards) to assess the suitability of the on-site reuse of excavated soils within the subject site as part of the proposed construction works.

On December 4, 2019, Ministry of Environment, Conservation and Parks (MECP) filed Ontario Regulation (O. Reg.) 406/19 "On-Site and Excess Soil Management" that is to be phased in over a period extending from January 1, 2021 to January 1, 2026 where the Rules for Soil Management and Excess Soil Quality Standards under this regulation are to be adopted on January 1, 2021. In this regard, the analytical data was also compared to Table 2.1 of the Excess Soil Quality Standards (ESQS) for Residential/Parkland/Institutional and Industrial/Commercial/Community Property Uses, coarse textured soils provided under MECP's Rules for Soil Management and O. Reg. 406/19 for comparison purposes only at this time.

The results of the analytical laboratory testing indicate that the concentrations of the tested parameters met MECP Table 1 and Table 2 Standards and Table 2.1 Excess Soil Quality Standards (ESQS) with the exception of electrical conductivity (EC) and sodium adsorption ratio (SAR).

Laboratory Certificates of Analysis are included in Appendix E. The measured concentrations and corresponding Standards are shown on the certificates of analysis.

6. ENGINEERING DISCUSSION AND RECOMMENDATIONS

This section of the report provides preliminary geotechnical recommendations for design and construction of the roadway improvements and structure foundations. The recommendations are based on the subsurface soil and groundwater conditions encountered during the preliminary investigation. The soil conditions may vary between and beyond the borehole locations. Additional investigation will be required during the detailed design stage to supplement the subsurface information and confirm the preliminary recommendations.

6.1 Pavement Design and Construction

6.1.1 Design Analysis

Kirby Road is an east-west arterial road with a posted speed limit of 60 km/h. The roadway presently has a two-lane rural cross section with gravel shoulders between Jane Street and Dufferin Street. Proposed improvements include widening of the road to a four-lane urban cross-section to handle increasing traffic from ongoing development of the adjacent lands.

The existing and projected traffic volumes along Kirby Road, provided by HDR, are presented in Table 6.1.

Table 6.1 – Kirby Road Traffic Information

Section	Existing ADT (2019)	Future ADT (2026 Year of Construction)	Future ADT (2031 Build-out)	Truck Volume
Highway 400 to Jane Street	5,750	10,978	14,900	10%
Jane Street to Keele Street	6,300	11,242	15,400	10%
Keele Street to Dufferin Street	8,600	13,940	18,200	10%

The traffic data was used to determine the pavement damage caused by the anticipated traffic volumes over the design life of the pavement. Using axle load equivalency factors, different axle loads and axle groups are converted to a standard axle load known as an Equivalent Single Axle Loads (ESALs). The Design ESALs calculation was completed in accordance with the MTO *Procedures for Estimating Traffic Loads for Pavement Designs.* Assuming an average truck factor of 2.2 and a reduced growth rate of 3% after 2031 build-out, the number of ESALs during a 20-year design period was computed to be 11.9 million in the west section (Jane Street to Keele Street) and 14.4 million to the east (Keele Street to Dufferin Street).

The pavement design analysis was carried out using the methodology outlined in the 1993 AASHTO "*Guide for the Design of Pavement Structures*", as modified by the Ministry's "*Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions*", and the MTO "*Pavement Design and Rehabilitation Manual*". The AASHTO procedure determines a required Structural Number that characterizes the structural capacity of the pavement layers for a given set of inputs.

The following design inputs were used in the AASHTO design analysis.

- Design Period = 20 years
- Initial serviceability, (Pi) = 4.5
- Terminal serviceability (Pt) = 2.5
- Reliability level (R) = 90 percent
- Overall standard of deviation (So) = 0.44
- Mean soil resilient modulus (MR) = 30 MPa

The subgrade for the pavement structure is expected to consist primarily of native firm to very stiff silty clay till with localized areas of loose to compact sand or firm to stiff silty clay.

Based on the design input parameters and calculated ESALs, design structural numbers (SN_{Des}) of 146 and 149 mm are required for the west and east sections, respectively. The recommended pavement design thickness, based on the structural requirements, traffic projections, and subgrade conditions, is presented below.

6.1.2 Recommended Pavement Design

In general, the existing roadway pavement is in good condition to the west of Keele Street and in fair condition to the east exhibiting primarily slight transverse, longitudinal and pavement edge cracking. However, areas of moderate to severe wheel track rutting and transverse, longitudinal, and pavement edge cracking are also present.

The pavement structure encountered in the boreholes drilled on the roadway (Boreholes 20-01 to 20-04, 20-07 to 20-11 and 20-13) consisted of 100 to 150 mm of asphalt overlying a granular base varying from gravelly sand to sandy gravel. The granular materials extended to depths ranging from 0.6 to 2.0 m.

The existing pavement structure is not considered to be structurally adequate to carry the 20-year design ESAL's calculated above, and strengthening by such means an overlay would be required. However, the potential would exist for the observed cracks and other localized distresses to reflect up into the new pavement surface, as well as for differential performance between the existing pavement and new pavement in widening areas. Further, incorporation of the existing two-lane rural cross-section into a widened urban section with grade adjustments is unlikely to be practical.

To avoid the development of reflection cracks and provide a uniform pavement performance, it is recommended that the roadway pavement be fully reconstructed as part of the widening project.

Based on the borehole data, the anticipated traffic volumes, and assuming adequate subgrade drainage, the following preliminary pavement design is recommended for widening and reconstruction of Kirby Road:

Component	Thickness
HL1	50 mm
HDBC (2 lifts)	140 mm
OPSS Granular A Base	150 mm
OPSS Granular B Type II Subbase	500 mm

A consistent pavement structure is recommended for the full study area. The pavement design thicknesses should be reviewed during detailed design.

The minimum PGAC grade of virgin asphalt cement in the surface and top binder course should be PG 64-28, and minimum PG 58-28 for the lower binder course. Consideration should be given to further upgrading of the PGAC grade to PG 70-28 if rutting has been experienced in other sections of this roadway due to truck traffic. Aggregates for the asphalt mixes should be in accordance with OPSS.MUNI 1003.

Should the City consider using Superpave asphalt mixes for this project, the recommended HL1 material should be substituted with a Superpave 12.5 FC1 asphalt mix, and the HDBC asphalt material should be replaced with Superpave SP 19. As the 20-year design ESALs for Kirby Road was estimated to be 11.9 to 14.4 million, a Traffic Category D designation should be used in preparing all Superpave asphalt mix designs.

All new granular subbase material should consist of OPSS Granular B Type II, while the granular base material should consist of OPSS Granular A. All new granular material should meet the requirements of OPSS 1010, and be compacted to 100 percent of the Standard Proctor Maximum Dry Density (SPMDD) within 2 percent of Optimum Moisture Content (OMC). All granular material should be compacted in accordance with the requirements of OPSS.MUNI 501, and should be carried the entire width of the roadway platform to maintain appropriate drainage.

6.1.3 Pavement Subgrade Preparation

Pavement subgrade preparation should include removal of the existing pavement structure and all surficial vegetation, topsoil, organic or compressible material. Grading to the new top of subgrade should match or exceed the thickness of the existing pavement to maintain lateral drainage at the top of subgrade. The exposed subgrade should be compacted and proof-rolled with a heavy roller and examined to identify areas of unstable subgrade. Any soft/wet areas identified shall be subexcavated and replaced with approved material within 2% of Optimum Moisture Content (OMC), and compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD).

Bulk fill used to raise the road grade should be constructed as engineered fill, consisting of approved inorganic material, placed in maximum 200 mm thick lifts, within 2% of optimum moisture content, and compacted to at least 98% of SPMDD. Standard side slopes of 2H:1V or flatter should be suitable for embankment construction. Exposed embankment surfaces should be provided with a vegetation cover or otherwise protected against erosion in accordance with OPSS 804.

The top of the compacted subgrade should be graded smooth with a minimum crossfall of 3% towards subdrains. Continuity of drainage should be maintained at transitions from existing pavement to new pavement.

6.2 GO Transit Barrie Line Grade Separation

6.2.1 General

A grade separation structure is planned at the Kirby Road crossing of the GO Transit Barrie Line west of Keele Street. The rail grade separation may comprise either an overpass or underpass structure, to be determined.

Two boreholes (Boreholes 20-05 and 20-06) were drilled at the location of the proposed grade separation structure, to depths of 31.1 and 9.5 m. The subsurface stratigraphy encountered in the boreholes generally consisted of a topsoil or fill layer overlying firm to stiff native clayey silt, underlain by a 1.1 to 2.3 m thick layer of loose to compact sand, over various stiff to hard/compact to very dense deposits of silty clay till, silt and sand till, silt and sand, and clayey silt. Of note, the upper sand layer was encountered from 3.0 to 4.1 m depth (Elev. 288.0 and 286.9) in Borehole 20-05 (northwest quadrant) and from 4.9 to 7.2 m depth (Elev. 286.6 to 284.3) in Borehole 20-06 (southeast quadrant).

In a monitoring well installed to a depth of 29.1 m in the deep borehole, the highest groundwater level measured to date was at 26.6 m depth (Elev. 265.1). In a monitoring well installed to 7.0 m depth in the shallow borehole, the highest groundwater level measured to date was at 3.7 m depth (Elev. 287.8).

Preliminary comments and recommendations regarding design and construction of alternative foundation types to support the structure, as well as construction of approach fills or road cuts for the overpass and underpass options, are provided below. Selection of the preferred grade separation option and foundation system will be dictated by grade restraints, structural considerations, economic considerations and construction constraints.

The grade separation should be constructed in accordance with the American Railway Engineering and Maintenance-of-Way Association (AREMA) and/or METROLINX standards, Canadian Highway Bridge Design Code (CHBDC) and Ontario Provincial Standard Specifications (OPSS). The design consultant is responsible for use of the appropriate design standards, codes and practices, where applicable.

6.2.2 Overpass Structure

The preliminary profile drawings indicate that existing road/rail grades are near Elev. 292.3 and proposed road grade on the overpass will be near Elev. 302.5. Approach embankments will be in the order of 10 to 12 m high.

6.2.2.1 Preliminary Foundation Recommendations

Based on the preliminary borehole data, suitable bearing strata for support of spread footings capable of carrying heavy bridge loads are not available within practical excavation depths. Deep foundations (driven piles or augered caissons) will therefore be required to support the structure, and further recommendations regarding design of spread footings have not been developed for the overpass option.

From a geotechnical perspective, the preferred foundation option to support the overpass structure is expected to comprise driven steel H-piles developing axial resistance primarily by frictional resistance along the pile shaft. For preliminary design and planning purposes, it may be assumed that HP310x110 piles driven to depths in the order of 35 m will develop a factored geotechnical resistance of 1,200 kN at Ultimate Limit State (ULS) and a factored geotechnical resistance of 1,000 kN at Serviceability Limit State (SLS). For working stress design in accordance with AREMA, an allowable bearing capacity of 1,000 kN is recommended for design of HP310x110 piles. Prediction of the depth at which the piles will achieve the required resistance is particularly difficult at this site due to the variable subsurface conditions, and additional boreholes extended to greater depth will be required to confirm the pile design.

Augered caissons could be considered, however the axial geotechnical resistance may be limited and installation of caissons extending into or through cohesionless sand deposits below the groundwater level may be challenging. Construction will require use of a steel liner to maintain stability of the caisson sidewalls as well as techniques such as drilling slurry to prevent disturbance of the caisson base. As a result, the use of caissons is less preferred from a geotechnical viewpoint. For preliminary evaluation of the caisson option, a 1.5 m diameter caisson founded in the hard silty clay till near Elev. 277 may be designed using a factored geotechnical resistance at ULS of 2,000 kN, and factored geotechnical resistances at SLS of 1,700 kN (25 mm settlement) and 700 kN (10 mm settlement). For working stress design in accordance with AREMA, an allowable bearing capacity of 1,700 kN is recommended for caisson design Additional boreholes extending below the current exploration depth of 31.1 m will be required to identify caisson bearing strata capable of supporting higher resistances.

6.2.2.2 Foundation Excavation

Excavation for construction of pile caps for the overpass structure is expected to extend to depths of about 2 to 3 m below existing grade, to approximate Elev. 288 to 289. Excavation to this level will generally be carried out within the surficial fill and native firm to stiff clayey silt. In general, temporary excavations constructed with sidewalls inclined at 1H:1V in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario regulations are expected to be stable.

In general, the anticipated excavation depths are above the groundwater level measured during the investigation, and construction dewatering to lower the groundwater level is not expected to be required. It is anticipated that unwatering to remove any seepage entering the excavation would be less than 400,000 litres per day and thus application for a Permit to Take Water (PTTW) would not be required. Permanent drainage of groundwater would not be anticipated.

6.2.2.3 Approach Embankments

The foundation soils underlying the proposed approach embankments are expected to consist primarily of firm to stiff clayey silt overlying a layer of loose to compact sand, underlain by stiff to very stiff clay till. Based on the stratigraphy encountered in the boreholes, the stability of embankment slopes and settlement of the foundation soils under the new embankment loads are not expected to be a concern.

Embankments with standard side slope inclinations of 2H:1V are expected to be stable. Mid-height berms comprising 2 m wide benches must be incorporated along the length of embankments with heights exceeding 8 m. Where new embankment fill is placed against existing embankment slopes or on a sloping ground surface, the existing earth or fill slope must be benched in accordance with OPSD 208.010. Earth fill embankment slopes must be provided with erosion protection in accordance with OPSS.PROV 804.

Based on preliminary calculations, settlement of the foundation soils under the new embankment load is expected to be in the order of 100 to 150 mm, however additional laboratory testing and/or analysis is required to confirm these values. Depending upon construction schedules, preloading or surcharging may need to be considered to reduce post-construction settlement. The potential impact of embankment settlement on the railway tracks will need to be assessed.

6.2.3 Underpass Structure

The preliminary profile drawings indicate that existing road/rail grades are near Elev. 292.3 and proposed road grade in the underpass will be near Elev. 285.0. Roadway cut depths will be in the order of 7 to 8 m.

6.2.3.1 Preliminary Foundation Recommendations

Based on the preliminary borehole data, consideration could be given to supporting the grade separation structure on spread footings constructed on hard native clay till or very dense sand and silt till encountered approximately 2.5 to 3.0 m below the road cut grade (at approximate Elev. 282.3). Factored geotechnical resistances of 450 kPa at ULS and 300 kPa at SLS may be employed for preliminary design of spread footings at this level. For working stress design in accordance with AREMA, an allowable bearing capacity of 300 kPa is recommended for spread footing design.

From a geotechnical perspective, the preferred foundation option to support the underpass is spread footings due to ease of construction. The preferred option may change subject to additional investigation and dewatering assessment during detail design. To minimize the excavation depths and/or if higher capacities are required, deep foundations (driven piles or augered caissons) could also be employed, as outlined for the overpass option.

6.2.3.2 Road Cut and Foundation Excavation

Excavation for construction of the underpass is expected to extend to depths of about 7 to 8 m below existing grade, with a further 2 to 3 m for foundation construction, to approximate Elev. 282

to 283. Excavation to this depth is expected to extend 5 to 6 m below the measured groundwater level, through a relatively impermeable clayey silt layer, a permeable sand layer, and into silty clay till. The groundwater profile cannot be determined based on the limited data obtained during the preliminary investigation. In general, the groundwater level is expected to reflect the level of the ground surface and be near the ground surface in the low wet area to the west.

Prior to excavation of the road cut, permanent drainage of groundwater will be required to dewater the sand layer and lower the groundwater table at least 1.0 m below the excavation base, subject to approval by external agencies including TRCA. Lowering of the groundwater level could be effected by installation of perimeter wells and/or subdrains and permeable backfill leading to a pumping station or gravity drainage system. A shoring system comprising sheet piles or soldier pile and lagging could be employed for a drained system. If lowering of the groundwater table is not permitted, installation of a permanent shoring and groundwater control system (such as a sheet pile or contiguous caisson wall enclosure in conjunction with a watertight base slab) will be required to retain both soil and groundwater during and after construction. A secondary drainage system will be required to capture any seepage emanating from the face of the enclosure wall.

Provided permanent drainage of the sand layer is enacted, permanent slopes excavated at standard inclinations of 2H:1V are expected to be stable. Mid-height berms comprising 2 m wide benches must be incorporated along the length of slopes with heights exceeding 6 m. Earth slopes must be provided with erosion protection in accordance with OPSS.PROV 804.

Temporary foundation excavations extending below the base of the road cut should be constructed with sidewalls inclined no steeper than 1H:1V in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario regulations. Railway track protection and/or detours will be required during cut excavation and bridge construction.

Considering the need for drainage and dewatering of the sand layer, it is anticipated that a Category 3 Permit to Take Water (PTTW) will be required for construction.

6.2.4 Abutment Backfill and Lateral Earth Pressures

Backfill behind the grade separation structure abutments and retaining walls should consist of non-frost susceptible, free-draining granular material conforming to OPS Granular A or Granular B Type II specifications.

The lateral earth pressures acting on the walls, assuming full drainage from behind the walls, may be calculated from the following expression:

$p_h = K(\gamma h + q)$

Where: p_h = horizontal pressure on the wall at depth h (kPa)

K = earth pressure coefficient (see table below)

γ = unit weight of retained soil (see table below)

h = depth below top of fill where pressure is computed (m)

q = value of any surcharge (kPa)

Table 6.2 lists unfactored parameters for design purposes, assuming an essentially level ground surface behind and in front of the walls.

Table 6.2: Unfactored Earth Pressure Parameters

Retained Material	Unit Weight (kN/m^3)	Friction Angle (degrees)	Earth Pressure Coefficient		
			Active (K_a)	At-rest (k_o)	Passive (K_p)
Granular A or B Type II	22.8	35	0.27	0.43	3.7
Granular B Type I	21.2	32	0.31	0.47	3.3

If lateral movement is not permissible and/or the wall is restrained from lateral yielding, the at-rest earth pressure coefficient, K_o, should be used. If the wall design allows lateral yielding (non-rigid structure), the active earth pressure coefficient, K_a, may be used.

The earth pressure coefficients in the table above do not include potential compaction effects that must be included in the design. Compaction effects should be considered as per the CHBDC.

Design of the structures must incorporate measures such as weepholes to permit drainage of the backfill and avoid potential build-up of hydrostatic pressures behind the walls.

6.3 West Don River Culvert

It is understood that the existing corrugated steel pipe (CSP) culvert located approximately 750 m east of Jane Street will be replaced with a wider and longer culvert as part of the roadway reconstruction project.

The subsurface stratigraphy encountered in Borehole 20-03 drilled at this location consisted of a pavement structure, granular fill layer and 0.2 m thick layer of organic material underlain by native silty clay till at 2.2 m depth (Elev. 270.5), a dense silt and sand layer from 5.6 to 7.2 m depth

(Elev. 267.1 to 265.6), and firm silty clay to the exploration depth of 8.2m. Groundwater was measured at a highest level of 4.4 m (Elev. 268.4).

Based on the borehole information, an extension of the existing CSP or a new CSP or box culvert should be placed on the firm to hard silty clay till below the level of the fill and organic material, at or below Elev. 270.5. A minimum 300 mm thick layer of Granular A bedding material should be provided under the base of the CSP or box culvert. Alternatively, an open footing culvert may be supported on spread footings founded on very stiff native clay till at or below 3.0 m depth (Elev. 269.7) and designed using factored geotechnical resistances of 375 kPa at ULS and 250 kPa at SLS.

Construction dewatering is not expected to be an issue at the West Don River culvert provided excavations are maintained within the clay till above the surface of the water-bearing silt and sand layer, and temporary stream diversion measures are provided seasonally as required.

6.4 Frost Cover

The depth of frost penetration at this site is approximately 1.4 m. All spread footings or pile caps should be provided with a minimum of 1.4 m of earth cover as protection against frost action.

6.5 Embankment Slope near Dufferin Street

It is anticipated that widening of the embankment slope approaching Dufferin Street will be required. The foundation soils underlying the embankments are expected to consist primarily of compact to dense silt and sand till. In general, the stability of embankment slopes and settlement of the foundation soils under the embankment loads are not expected to be a concern.

Embankments with standard side slope inclinations of 2H:1V are expected to be stable. Mid-height berms comprising 2 m wide benches must be incorporated along the length of embankments with heights exceeding 8 m. Where new embankment fill is placed against existing embankment slopes or on a sloping ground surface, the existing earth or fill slope must be benched in accordance with OPSD 208.010. Earth fill embankment slopes must be provided with erosion protection in accordance with OPSS.PROV 804.

6.6 Municipal Service Installation

In general, excavation for open cut installation of municipal services to an assumed maximum depth of 3.0 m will extend through the existing roadway pavement structure and fill materials, and into native clayey silt to silty clay, and silty clay till. Layers of cohesionless silts and sands as well as organic materials may be encountered locally. Use of a hydraulic excavator should be suitable for trench excavation within these materials.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. In general, the native soils are classified as Type 3 soils above the groundwater level, and Type 4 soils if excavation extends below the water level without prior dewatering. Groundwater is not expected to pose construction issues during excavation of relatively shallow trenches, however some seepage, sloughing and base instability should be anticipated if excavation extends below the measured groundwater level, notably near Boreholes 20-01, 20-07 and 20-09.

Prior to placement of the pipe bedding, the base of the trench should be maintained in a dry condition, free of loose or disturbed material. The pipe must be placed on a uniformly competent subgrade. Pipe bedding materials, compaction and cover should follow OPSD 802.030 to 803.034, and/or City of Vaughan or York Region specifications.

Trench backfill materials should be placed in loose lift thicknesses not exceeding 200 mm and compacted to at least 98% of its SPMMD. Where utility trenches are located beneath the roadway, OPSS Granular A or B material, or unshrinkable fill should be employed as backfill.

For trenches located outside of the roadway, the portion of the trench above the pipe cover can be backfilled with excavated soil provided it is unfrozen and free of organics, debris and other deleterious materials. The placement moisture content should be within about 2% of the optimum moisture content for efficient compaction, and the till must be adequately broken down and compacted in the trench.

6.7 Geoenvironmental Considerations

The chemical sampling and testing program carried out during this investigation was completed for due diligence purposes to obtain a general understanding of the environmental quality of the soils on site. The environmental characteristics of the soils were inferred from a limited number of samples and sampling locations, and the extent of materials that may be encountered during construction was not delineated. As such, the environmental data and comments are provided as guidance to the planner on the requirements for reuse or disposal of materials generated during construction and should not be used to estimate quantities.

Where excavation of existing pavement structures is required, the asphalt from the existing pavement structure may be separated for transfer to a recycling facility, although asbestos testing should be carried out prior to stripping. Asphalt should not be mixed with excess soil as fill receivers may not accept excess soils containing asphalt. Excavated road granular materials may be reused on site for general fill purposes subject to geotechnical approval and verification analytical testing.

The results of the analytical laboratory testing indicate that the concentrations of the tested parameters met MECP Table 1 and Table 2 Standards and Table 2.1 Excess Soil Quality Standards (ESQS) with the exception of electrical conductivity (EC) and sodium adsorption ratio (SAR) in five of six samples.

Elevated EC and SAR are likely the result of de-icing activities on the roadway. The presence of SAR or EC does not impose a risk to human health, but rather may only impact the physical composition of the soil which could affect the growth of vegetation. Where salt has been applied on a highway for the purposes of keeping the highway safe for traffic under conditions of snow or ice or both, the applicable site conditions standard is deemed not to be exceeded under Section 48 (3) of O. Reg. 153/04.

In this regard, the EC and SAR impacted materials that are free of staining and odour may generally be suitable for reuse on Site provided the excavated materials are appropriate from a geotechnical perspective, or possibly reused off-site at properties requiring fill for a beneficial purpose. Prior to reuse, the environmental quality of the soil should be checked to verify the appropriate end use of the materials. This can be completed through additional testing prior to construction, or screened during construction through segregating into separate stockpiles, and sampled and tested.

There may be restrictions to the on- and off-site re-use of the fill materials due to the marginally elevated SAR value (e.g. placed in areas more than 30 m from the waterbody, 2 m from the groundwater table, and at least 100 m from a potable water supply etc.). Receiving site authorities will need to be notified of the salt-related impacts and provide consent in writing of their acceptance of the materials.

A more comprehensive level of testing should be carried out for the off-site reuse of excess fill or native soils to verify that the environmental quality of the excess soils meets the site’s analytical requirements and the requirements of O. Reg. 406/19 and the Excess Soil Quality Standards. In this regard and depending on the project design details, management strategies and receiving site requirements, the documentation and sampling and testing criteria of O. Reg. 406/19 may need to be met.

THURBER

6.8 Detailed Geotechnical Investigation

The information presented in this report is provided for preliminary design and planning purposes only. Detailed geotechnical investigation will be required to confirm the subsurface conditions and recommendations. This work should incorporate:

- A detailed pavement investigation including additional boreholes within the existing roadway pavement and widening areas to further define the subgrade conditions, determine topsoil thickness, and confirm the pavement design recommendations;
- Boreholes within the envelope of all structure foundation units to confirm the subsurface conditions at the structure locations and develop detailed geotechnical recommendations for design and construction of the new grade separation structures and culvert foundations;
- Additional investigation along the proposed high fill embankments or deep cuts, and temporary track and roadway protection locations;
- Further assessment of dewatering requirements and the need for a PTTW; and
- Supplemental chemical testing to confirm the requirements for reuse or disposal of excavated material, including additional samples at the railway crossing.

7. CLOSURE

We trust the above provides the information you require at this time. If you have any questions regarding this report, please do not hesitate to contact us.

Yours truly,

Thurber Engineering Ltd.

LICENSED PROFESSIONAL ENGINEER
K. A. FURBACHER
100166543
JUNE 6, 2022
PROVINCE OF ONTARIO

Karel Furbacher, P.Eng.
Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
M. R. ANDERSON
90267360
June 6/22
PROVINCE OF ONTARIO

Murray R. Anderson, M.Eng., P.Eng.
Senior Geotechnical Engineer

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Appendix A

Site Photographs

Kirby Road Class EA Study
Jane Street to Dufferin Street
Site Photographs

Photograph 1 – Kirby Road looking east from Borehole 20-01

Photograph 2 – Kirby Road looking east from Borehole 20-03

Kirby Road Class EA Study
Jane Street to Dufferin Street
Site Photographs

Photograph 3 – Kirby Road looking west from Borehole 20-03

Photograph 4 – View of West Don River culvert looking South near Borehole 20-03

Photograph 5 – Kirby Road looking west at Go Rail line near Borehole 20-06

Photograph 6 – Barrie Go Rail line crossing Kirby Road looking west

Photograph 7 – Barrie Go Rail line crossing Kirby Road looking south

Photograph 8 – Kirby Road looking west from Borehole 20-07

Photograph 9 – Kirby Road looking east from Borehole 20-08

Photograph 10 – Kirby Road looking west from Borehole 20-09

Photograph 11 – Kirby Road looking north towards wetland near Borehole 20-09

Photograph 12 – Kirby Road looking east from Borehole 20-10

THURBER

Kirby Road Class EA Study
Jane Street to Dufferin Street
Site Photographs

Photograph 13 – Kirby Road looking west from Borehole 20-11

Photograph 14 – Kirby Road looking west from Borehole 20-12

Appendix B

Record of Borehole Sheets

RECORD OF BOREHOLE 20-01

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 14, 2020
COMPLETED : July 14, 2020
N 4 860 322.3 E 616 958.3

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

Boring method: Hollow Stem Augers

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	COMMENTS
GROUND SURFACE	271.44				
ASPHALT (100mm)	0.10				
SAND and **GRAVEL**, trace to some silt, brown, moist: (FILL)	270.68 / 0.76				
CLAY, silty, some sand, trace gravel, stiff to hard, brown: (TILL)		1	SS	14	
		2	SS	15	
		3	SS	34	Grain Size Analysis: Gr 2%/ Sa 36%/ Si 46%/ Cl 16%
	268.04 / 3.40	4	SS	31	Grain Size Analysis: Gr 0%/ Sa 92%/ Si & Cl 8%
SAND, trace silt, trace clay, trace gravel, dense, brown, moist	267.33 / 4.11				
CLAY, silty, some sand, trace gravel, hard, brown: (TILL)		5	SS	42	
	266.26 / 5.18				

END OF BOREHOLE AT 5.18m.
Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.
WATER LEVEL READINGS:

DATE	DEPTH(m)	ELEV.(m)
Jul 21/20	2.73	268.71
Jul 28/20	2.68	268.76
Sep 25/20	3.11	268.33

Piezometer or standpipe installation: Flushmount Well Protector Set in Concrete; Bentonite; Filter Sand; Slotted Screen

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE; STRATA PLOT; SAMPLES; DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160); WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS
WATER LEVEL UPON COMPLETION
WATER LEVEL IN WELL/PIEZOMETER September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

THURBER2S 26130-TEL.GPJ 11/13/20

RECORD OF BOREHOLE 20-02

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 13, 2020
COMPLETED : July 13, 2020

N 4 860 411.5 E 617 250.0

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m	COMMENTS – DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		273.77							
	Hollow Stem Augers	**ASPHALT** (100mm)									
		SAND and **GRAVEL**, trace to some silt, very dense, brown, moist: (FILL)		0.10	1	GS					
1					2	SS	57				
		SAND, silty, trace gravel, compact, brown, moist		272.32 1.45	3	SS	15				
2		**CLAY**, silty, trace sand, trace gravel, firm, brown; with partings of silt		271.56 2.21	4	SS	7				
3					5	SS	6				
		END OF BOREHOLE AT 3.66m BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, ASPHALT AT SURFACE.		270.11 3.66							
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-03

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 13, 2020
COMPLETED : July 13, 2020

N 4 860 523.5 E 617 584.1

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

BORING METHOD: Hollow Stem Augers

DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	PIEZOMETER OR STANDPIPE INSTALLATION
GROUND SURFACE	272.72					Flushmount Well Protectors Set in Concrete; Bentonite
ASPHALT (100mm)	0.10					
GRAVEL, sandy to **SAND**, gravelly, dense to compact, brown, moist: (FILL)		1	GS		Grain Size Analysis: Gr 29%/ Sa 57%/ Si & Cl 14%	
		2	SS	50		Filter Sand
		3	SS	16		
ORGANIC SILT, some clay to clayey, trace sand, occasional decayed plant matter, compact, brown to black, wet	270.72 / 2.00					Slotted Screen
CLAY, silty, some sand, trace gravel, firm to hard, brown: (TILL)	2.21	4	SS	7		
		5	SS	21		
		6	SS	38		Deep (water level)
SILT and **SAND**, trace clay, dense, brown, wet	267.08 / 5.64					Filter Sand
		7	SS	35	Grain Size Analysis: Gr 0%/ Sa 55%/ Si 43%/ Cl 2%	Slotted Screen
CLAY, silty, trace sand, trace gravel, firm, brown to grey; with partings of silt	265.56 / 7.16					
		8	SS	7		
END OF BOREHOLE AT 8.23m.	264.49 / 8.23					

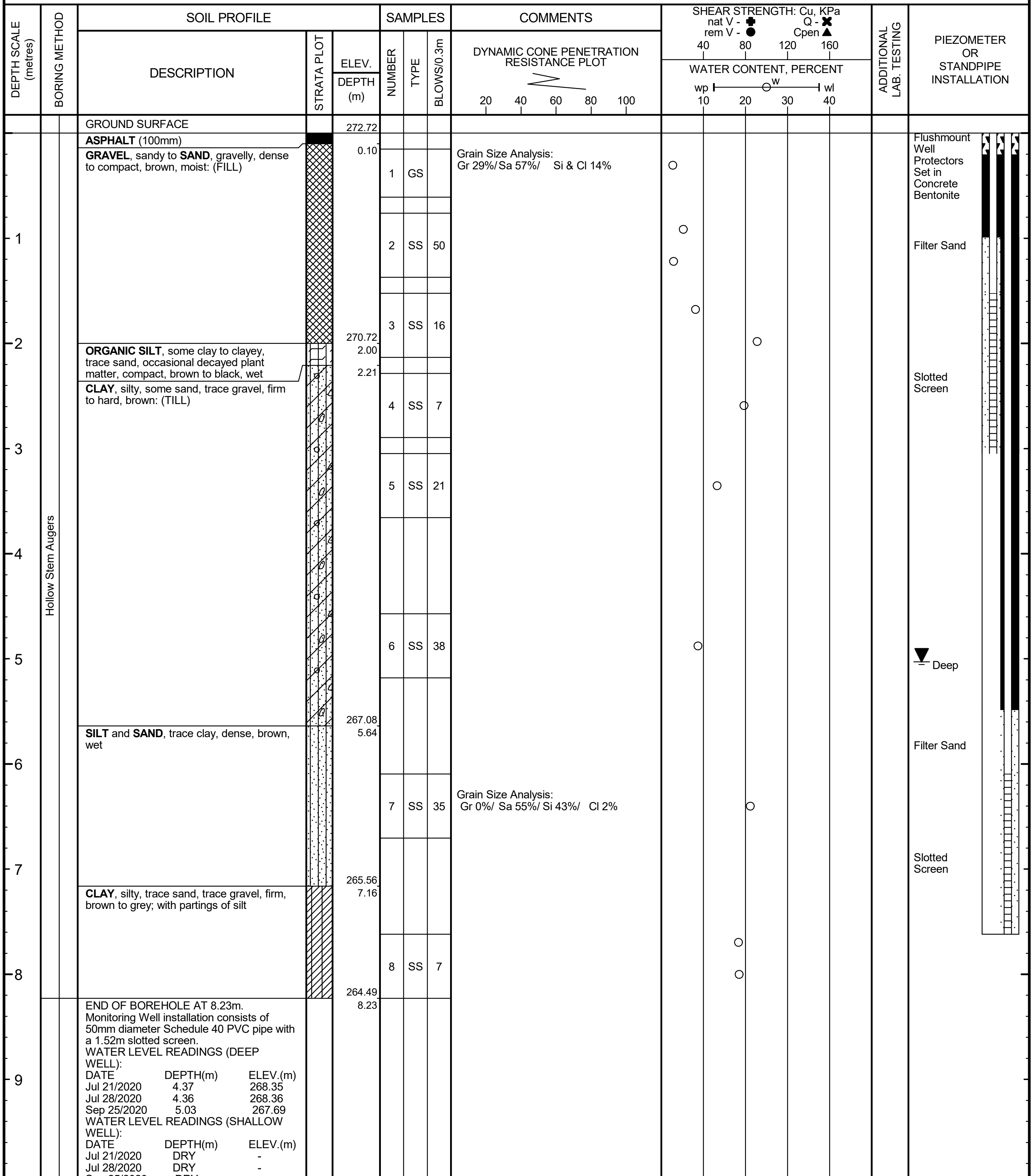
Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.

WATER LEVEL READINGS (DEEP WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	4.37	268.35
Jul 28/2020	4.36	268.36
Sep 25/2020	5.03	267.69

WATER LEVEL READINGS (SHALLOW WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	DRY	-
Jul 28/2020	DRY	-
Sep 25/2020	DRY	-



GROUNDWATER ELEVATIONS

WATER LEVEL UPON COMPLETION

WATER LEVEL IN WELL/PIEZOMETER September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-04

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 13, 2020
COMPLETED : July 13, 2020

N 4 860 613.3 E 617 876.3

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

BORING METHOD: Hollow Stem Augers

DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	277.43			
ASPHALT (100mm)	0.10			
SAND and **GRAVEL**, trace to some silt, brown, moist: (FILL)		1	GS	
	276.24	2	SS	28
TOPSOIL (300mm)	1.19			
	275.91			
CLAY, silty, some sand, trace gravel, firm to very stiff, brown; with partings of silt	1.52	3	SS	6
		4	SS	11
		5	SS	19
	273.77			
END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, ASPHALT AT SURFACE.	3.66			

DEPTH SCALE (metres): 1, 2, 3, 4, 5, 6, 7, 8, 9

COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ (40, 80, 120, 160)

WATER CONTENT, PERCENT — wp ⊢ ○w ⊣ wl (10, 20, 30, 40)

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

WATER LEVEL UPON COMPLETION

WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-05

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 8, 2020
COMPLETED : July 9, 2020

N 4 860 827.1 E 618 486.5

Project No. 26130
SHEET 1 OF 4
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT (%) (approx.)	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	290.97					
	Hollow Stem Augers	**TOPSOIL** (150mm)	0.00					Flushmount Well Protector Set in Concrete
		SILT, clayey, some sand, stiff to soft, brown; with partings of silty clay	0.15	1	SS	8		
1				2	SS	10		
2				3	SS	7		
				4	SS	4		
3	Mud Rotary/Tricone	**SAND**, some gravel, trace silt, loose, brown, moist to wet	288.00 2.97	5	SS	9		
4		**CLAY**, silty, some sand to sandy, trace gravel, stiff to very stiff, grey: (TILL)	286.86 4.11					
5				6	SS	14		
6				7	SS	10		
8				8	SS	23		
9		**SILT** and **SAND**, trace to some gravel, very dense, grey, moist: (TILL)	282.29 8.69	9	SS	101		

COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ (40, 80, 120, 160)

WATER CONTENT, PERCENT — wp ⊢ w ○ ⊣ wl (10, 20, 30, 40)

ADDITIONAL LAB. TESTING

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-05

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 8, 2020
COMPLETED : July 9, 2020

N 4 860 827.1 E 618 486.5

Project No. 26130

DATUM Geodetic

BORING METHOD: Mud Rotary/Tricone

DEPTH SCALE (metres)	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT, PERCENT (approx.)	PIEZOMETER OR STANDPIPE INSTALLATION
11			10	SS	68	○	
12	**SILT** and **SAND**, trace to some clay, trace gravel, very dense, grey, wet	279.27 11.70	11	SS	73	○ ○	
13							Bentonite
14	**CLAY**, silty, some sand to sandy, trace gravel, hard, brown: (TILL)	277.57 13.40	12	SS	58	○	
15			13	SS	61	○	
16	**SILT**, clayey, trace gravel, very stiff, grey, with partings of silty clay	274.67 16.31					
17			14	SS	81	○	
18			15	SS	27	○	
19							

COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100)

SHEAR STRENGTH: Cu, KPa — nat V - ✚, Q - ✖, rem V - ●, Cpen ▲ (40, 80, 120, 160)

WATER CONTENT, PERCENT — wp ⊢ w ○ ⊣ wl (10, 20, 30, 40)

ADDITIONAL LAB. TESTING

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-05

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 8, 2020
COMPLETED : July 9, 2020

N 4 860 827.1 E 618 486.5

Project No. 26130

DATUM Geodetic

Boring method: Mud Rotary/Tricone

DEPTH SCALE (metres)	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
			16	SS	20		~23	
21								
22								
23			17	SS	75		~11	
24								
	SAND, silty, dense, grey, wet	266.38 24.60						
25								
26			18	SS	24	Grain Size Analysis: Gr 0%/ Sa 73%/ Si 24%/ Cl 3%	~19	Filter Sand
27								▼ (water level)
	SILT, clayey, some gravel, very soft to stiff, grey	263.37 27.60						Slotted Screen
28								
29			19	SS	0*	*Weight of Hammer		

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-05

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 8, 2020
COMPLETED : July 9, 2020

N 4 860 827.1 E 618 486.5

Project No. 26130

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH: Cu, KPa nat V - ✚ rem V - ● Q - ✖ Cpen ▲ 40 80 120 160; WATER CONTENT, PERCENT wp ⊢ ○w ⊣ wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
					20	SS	14				
31		END OF BOREHOLE AT 31.09m. Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.		259.88 31.09							
32											
33											
34											
35											
36											
37											
38											
39											

WATER LEVEL READINGS:

DATE	DEPTH(m)	ELEV.(m)
Jul 21/20	26.63	264.34
Aug 28/20	26.59	264.38
Sep 25/20	26.75	264.22

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-06

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 10, 2020
COMPLETED : July 10, 2020
N 4 860 808.8 E 618 523.6

Project No. 26130
SHEET 1 OF 2
DATUM Geodetic

BORING METHOD: Hollow Stem Augers

DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	COMMENTS	PIEZOMETER OR STANDPIPE INSTALLATION
GROUND SURFACE	291.49					
SILT, clayey, some sand, trace gravel, stiff, brown; occasional organic inclusions: (FILL)	0.00	1	SS	11		Flushmount Well Protector Set in Concrete
		2	SS	8		
SILT, clayey, trace to some sand, firm to stiff, brown, with occasional sand seams, partings of silty clay	290.05 / 1.45	3	SS	6		
		4	SS	5		Bentonite
		5	SS	11		
SAND, trace silt, compact, brown, wet; with layers of clayey silt	286.62 / 4.88	6	SS	17		Filter Sand
		7	SS	19	Grain Size Analysis: Gr 6%/ Sa 86%/ Si & Cl 8%	Slotted Screen
CLAY, silty, some sand to sandy, trace gravel, very stiff to hard, grey: (TILL)	284.33 / 7.16	8	SS	25		
		9	SS	72/ 0.275		
END OF BOREHOLE AT 9.45m. Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.	282.04 / 9.45					

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE; STRATA PLOT; SAMPLES; COMMENTS — DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH: Cu, KPa — nat V - ✚, rem V - ●, Q - ✖, Cpen ▲ (40, 80, 120, 160); WATER CONTENT, PERCENT — wp, w, wl (10, 20, 30, 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION.

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

THURBER2S 26130-TEL.GPJ 11/13/20

RECORD OF BOREHOLE 20-06

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 10, 2020
COMPLETED : July 10, 2020
N 4 860 808.8 E 618 523.6

Project No. 26130
SHEET 2 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, Q - ✖, rem V - ●, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp ⊢ ○w ⊣ wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		WATER LEVEL READINGS: DATE / DEPTH(m) / ELEV.(m) Jul 21/20 / 3.73 / 287.76 Jul 28/20 / 3.77 / 287.72 Sep 25/20 / 3.97 / 287.52									
11											
12											
13											
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER
September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-07

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 13, 2020
COMPLETED : July 13, 2020
N 4 860 884.1 E 618 707.8

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

BORING METHOD: Hollow Stem Augers

DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	PIEZOMETER OR STANDPIPE INSTALLATION
GROUND SURFACE	298.20					
ASPHALT (150mm)	0.00					Flushmount Well Protector Set in Concrete
SAND and **GRAVEL** to **SAND**, gravelly, trace to some silt, brown, moist (FILL)	0.15	1	GS		Grain Size Analysis: Gr 29%/ Sa 50%/ Si & Cl 21%	Bentonite
CLAY, silty, sandy, trace gravel, stiff to firm, grey: (TILL)	297.44 / 0.76	2	SS	15	Grain Size Analysis: Gr 2%/ Sa 33%/ Si 45%/ Cl 20%	Filter Sand
		3	SS	6		
SILT and **SAND**, trace to some clay, very loose, brown, moist	296.10 / 2.10	4	SS	3	Grain Size Analysis: Gr 0%/ Sa 39%/ Si 55%/ Cl 6%	
CLAY, silty, some sand to sandy, trace gravel, stiff to very stiff, grey: (TILL)	295.23 / 2.97	5	SS	20		Slotted Screen
		6	SS	13		
END OF BOREHOLE AT 5.18m.	293.02 / 5.18					

END OF BOREHOLE AT 5.18m.
Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.
WATER LEVEL READINGS:

DATE	DEPTH(m)	ELEV.(m)
Jul 21/20	2.25	295.95
Aug 28/20	2.22	295.98
Sep 25/20	2.56	295.64

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ (40 80 120 160)
DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
WATER CONTENT, PERCENT — wp ⊢ w ○ ⊣ wl (10 20 30 40)
ADDITIONAL LAB. TESTING

DEPTH SCALE (metres): 1 2 3 4 5 6 7 8 9

GROUNDWATER ELEVATIONS
WATER LEVEL UPON COMPLETION
WATER LEVEL IN WELL/PIEZOMETER July 21, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-08

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 14, 2020
COMPLETED : July 14, 2020
N 4 861 038.5 E 619 130.8

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT
GROUND SURFACE	308.35					
ASPHALT (150mm)	0.00					
SAND and **GRAVEL** to **GRAVEL**, sandy, trace to some silt, brown, moist: (FILL)	0.15	1	GS		Grain Size Analysis: Gr 47%/ Sa 33%/ Si & Cl 20%	o
CLAY, silty, some sand, trace gravel, stiff, grey: (TILL)	307.59 / 0.76	2	SS	10		o
		3	SS	10		o
		4	SS	11		o
		5	SS	9		o
END OF BOREHOLE AT 3.66m BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, ASPHALT AT SURFACE.	304.70 / 3.66					

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE; STRATA PLOT; SAMPLES; COMMENTS – DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH: Cu, KPa nat V - ✚ Q - ✖ rem V - ● Cpen ▲ 40 80 120 160; WATER CONTENT, PERCENT wp w wl 10 20 30 40; ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

Depth scale: 1 2 3 4 5 6 7 8 9

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-09

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 15, 2020
COMPLETED : July 15, 2020
N 4 861 144.2 E 619 418.4

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT (%) / SHEAR STRENGTH	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Hollow Stem Augers	GROUND SURFACE	310.70							
		ASPHALT (125mm)								Flushmount Well Protector Set in Concrete
		SAND and **GRAVEL**, trace to some silt, brown, moist: (FILL)	0.13	1	GS					Bentonite
1		**CLAY**, silty, some sand, trace gravel, stiff to firm, grey: (FILL)	309.93 / 0.76	2	SS	12				Filter Sand
2				3	SS	7				Deep / Shallow
		ORGANIC SILT, clayey, soft, black; with occasional inclusions of peat	308.49 / 2.21					67		Slotted Screen
		SILT, sandy, trace gravel, loose, grey, moist; occasional organics	308.10 / 2.59	4	SS	4				
3		**CLAY**, silty, some sand to sandy, trace gravel, occasional cobbles, firm to very stiff, brown to grey: (TILL)	307.72 / 2.97	5	SS	9				
4										Filter Sand
5				6	SS	11	Grain Size Analysis: Gr 2%/ Sa 26%/ Si 49%/ Cl 23%			Slotted Screen
6				7	SS	16				
		END OF BOREHOLE AT 6.71m.	303.99 / 6.71							

Shear strength: Cu, KPa — nat V - ✚, rem V - ●, Q - ✖, Cpen ▲ (40, 80, 120, 160)
Dynamic cone penetration resistance plot (20, 40, 60, 80, 100)
Water content, percent: wp, w, wl (10, 20, 30, 40)

END OF BOREHOLE AT 6.71m.
Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.

WATER LEVEL READINGS (DEEP WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	2.56	308.14
Jul 28/2020	1.64	309.06
Sep 25/2020	1.87	308.83

WATER LEVEL READINGS (SHALLOW WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	1.88	308.82
Jul 28/2020	1.70	309.00
Sep 25/2020	1.90	308.80

GROUNDWATER ELEVATIONS
WATER LEVEL UPON COMPLETION
WATER LEVEL IN WELL/PIEZOMETER September 25, 2020

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-10

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 15, 2020
COMPLETED : July 15, 2020
N 4 861 284.5 E 619 860.3

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
GROUND SURFACE	291.73				
ASPHALT (125mm)					
SAND and **GRAVEL**, trace to some silt, brown, moist: (FILL)	0.13				
CLAY, silty, some sand to sandy, trace gravel, stiff, brown: (TILL)	290.97 / 0.76	1	SS	13	
		2	SS	11	Grain Size Analysis: Gr 3%/ Sa 27%/ Si 46%/ Cl 24%
SILT, some clay to clayey, trace sand, firm to very stiff; with occasional partings to layers of silt and silty clay	289.52 / 2.21	3	SS	5	
		4	SS	21	
		5	SS	14	Grain Size Analysis: Gr 0%/ Sa 3%/ Si 85%/ Cl 12%
		6	SS	18	
END OF BOREHOLE AT 6.71m.	285.02 / 6.71				

Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.

WATER LEVEL READINGS (DEEP WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	DRY	-
Jul 28/2020	DRY	-
Sep 25/2020	DRY	-

WATER LEVEL READINGS (SHALLOW WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	DRY	-
Jul 28/2020	DRY	-
Sep 25/2020	DRY	-

DEPTH SCALE (metres): 1, 2, 3, 4, 5, 6, 7, 8, 9

BORING METHOD | STRATA PLOT

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● Cpen ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp ⊢ ○w ⊣ wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Flushmount Well Protector Set in Concrete; Bentonite; Filter Sand; Slotted Screen; Filter Sand; Slotted Screen

GROUNDWATER ELEVATIONS
▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-11

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 15, 2020
COMPLETED : July 15, 2020
N 4 861 403.7 E 620 200.5

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp ⊢ w ○ ⊣ wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		282.86							
	Hollow Stem Augers	**ASPHALT** (100mm)		0.10							
		SAND and **GRAVEL**, trace to some silt: (FILL)									
1		**SILT** and **SAND**, trace to some clay, trace gravel, loose to compact, brown, moist		281.79 / 1.07	1	SS	9				
2					2	SS	16				
					3	SS	20				
3		**SILT**, clayey, trace to some sand, firm, brown; with partings of silty clay		279.81 / 3.05	4	SS	7				
		END OF BOREHOLE AT 3.66m BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, ASPHALT AT SURFACE.		279.20 / 3.66							
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : KF

THURBER

THURBER2S 26130-TEL.GPJ 11/13/20

RECORD OF BOREHOLE 20-12

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 14, 2020
COMPLETED : July 14, 2020
N 4 861 548.2 E 620 682.8

Project No. 26130
SHEET 1 OF 2
DATUM Geodetic

Description	Elev. / Depth (m)	Sample Number	Type	Blows/0.3m	Comments	Water Content (%)	Piezometer or Standpipe Installation
GROUND SURFACE	295.59						
ASPHALT (30mm)	0.03						Flushmount Well Protector Set in Concrete
SAND and **GRAVEL**, trace to some silt, brown, moist: (FILL)		1	GS		Grain Size Analysis: Gr 45%/ Sa 38%/ Si & Cl 17%		Bentonite
SILT and **SAND**, trace gravel, loose to compact, brown, moist: (FILL)	294.91 / 0.69	2	SS	15			Filter Sand
		3	SS	28	Grain Size Analysis: Gr 1%/ Sa 37%/ Si 60%/ Cl 2%		Slotted Screen
		4	SS	12			
		5	SS	9			
SILT and **SAND**, trace gravel, trace clay, compact to dense, brown, moist: (TILL)	291.48 / 4.11	6	SS	40			
		7	SS	26			
		8	SS	41			
SILT, trace sand and clay, loose to compact, brown, wet	286.91 / 8.69						Filter Sand
		9	SS	5	Grain Size Analysis: Gr 0%/ Sa 3%/ Si 92%/ Cl 5%		Slotted Screen

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE: DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m); SAMPLES: NUMBER, TYPE, BLOWS/0.3m; COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH: Cu, KPa (nat V - ✚, Q - ✖, rem V - ●, Cpen ▲; 40, 80, 120, 160); WATER CONTENT, PERCENT (wp, w, wl; 10, 20, 30, 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

GROUNDWATER ELEVATIONS

WATER LEVEL UPON COMPLETION

WATER LEVEL IN WELL/PIEZOMETER
August 28, 2020

LOGGED : RB
CHECKED : KF

THURBER

THURBER2S 26130-TEL.GPJ 11/13/20

RECORD OF BOREHOLE 20-12

PROJECT : Kirby Road Class EA Study

LOCATION : Kirby Road, Vaughan, Ontario

STARTED : July 14, 2020

COMPLETED : July 14, 2020

N 4 861 548.2 E 620 682.8

Project No. 26130

DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
											Deep
11					10	SS	11		w ≈ 19		
		END OF BOREHOLE AT 11.28m. Monitoring Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		284.31 / 11.28							
12											
13											
14											
15											
16											
17											
18											
19											

WATER LEVEL READINGS (DEEP WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	10.18	285.41
Jul 28/2020	10.14	285.45
Sep 25/2020	DRY	-

WATER LEVEL READINGS (SHALLOW WELL):

DATE	DEPTH(m)	ELEV.(m)
Jul 21/2020	DRY	-
Jul 28/2020	DRY	-
Sep 25/2020	DRY	-

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION

▼ WATER LEVEL IN WELL/PIEZOMETER August 28, 2020

LOGGED : RB

CHECKED : KF

THURBER

RECORD OF BOREHOLE 20-13

PROJECT : Kirby Road Class EA Study
LOCATION : Kirby Road, Vaughan, Ontario
STARTED : July 14, 2020
COMPLETED : July 14, 2020

N 4 860 225.8 E 616 744.8

Project No. 26130
SHEET 1 OF 1
DATUM Geodetic

Boring method: Hollow Stem Augers

Description	Elev. / Depth (m)	Sample Number	Type	Blows/0.3m	Comments
GROUND SURFACE	268.83				
ASPHALT (110mm)	0.11				
SAND and **GRAVEL**, trace to some silt, brown, moist: (FILL)	268.22 / 0.61	1	GS		
CLAY, silty, some sand to sandy, trace gravel, stiff, brown: (FILL)	267.38 / 1.45	2	SS	12	
CLAY, silty, some sand, trace gravel, firm to very stiff, brown: (TILL)	265.17 / 3.66	3	SS	7	
		4	SS	21	Grain Size Analysis: Gr 3%/ Sa 22%/ Si 54%/ Cl 21%
		5	SS	23	
END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG, ASPHALT AT SURFACE.					

Column headings: DEPTH SCALE (metres) 1–9; BORING METHOD; SOIL PROFILE; STRATA PLOT; SAMPLES; COMMENTS; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH: Cu, KPa nat V - ✚ Q - ✖ rem V - ● Cpen ▲ 40 80 120 160; WATER CONTENT, PERCENT wp ⊢ w ⊣ wl 10 20 30 40; ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

WATER LEVEL UPON COMPLETION   WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : KF

THURBER

THURBER

Appendix C

Borehole Location Plans

LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE (BH) LOCATION WITH MONITORING WELL (MW)

20 0 20 40m

SCALE 1:1000

PLAN PROIVDED BY HDR CORPORATION DRAWING FILE NO.10195722-C01-100-BP01.dwg

HDR Corporation

Kirby Road Class EA Study
Kirby Road from Jane Street to Dufferin Street
Vaughn, Ontario

BOREHOLE LOCATION PLAN

JOB# 26130

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
OCTOBER 2020	1:1000	26130-1

FILENAME: H:\Drafting\26000\26130\TED-26130-BHPL.dwg
PLOTDATE: Nov 13, 2020 - 9:27 AM

LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE (BH) LOCATION WITH MONITORING WELL (MW)

20 0 20 40m

SCALE 1:1000

PLAN PROIVDED BY HDR CORPORATION DRAWING FILE NO.10195722-C01-100-BP01.dwg

HDR Corporation

Kirby Road Class EA Study
Kirby Road from Jane Street to Dufferin Street
Vaughn, Ontario

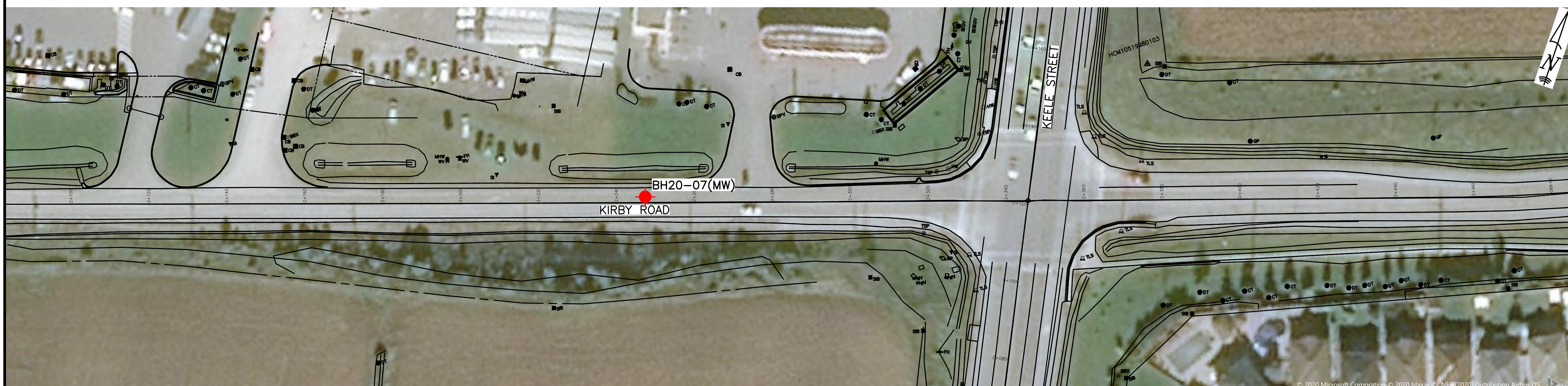
BOREHOLE LOCATION PLAN

JOB# 26130

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
OCTOBER 2020	1:1000	26130-2

FILENAME: H:\Drafting\26000\26130\TED-26130-BHPL.dwg
PLOTDATE: Nov 13, 2020 - 9:27 AM



LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE (BH) LOCATION WITH MONITORING WELL (MW)

20 0 20 40m
SCALE 1:1000

PLAN PROIVDED BY HDR CORPORATION DRAWING FILE NO.10195722-C01-100-BP01.dwg

HDR Corporation

Kirby Road Class EA Study
Kirby Road from Jane Street to Dufferin Street
Vaughn, Ontario

BOREHOLE LOCATION PLAN

JOB# 26130

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
OCTOBER 2020	1:1000	26130-3

FILENAME: H:\Drafting\26000\26130\TED-26130-BHPL.dwg
PLOTDATE: Nov 13, 2020 - 9:27 AM

LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE (BH) LOCATION WITH MONITORING WELL (MW)

20 0 20 40m

SCALE 1:1000

PLAN PROIVDED BY HDR CORPORATION DRAWING FILE NO.10195722-C01-100-BP01.dwg

HDR Corporation

Kirby Road Class EA Study
Kirby Road from Jane Street to Dufferin Street
Vaughn, Ontario

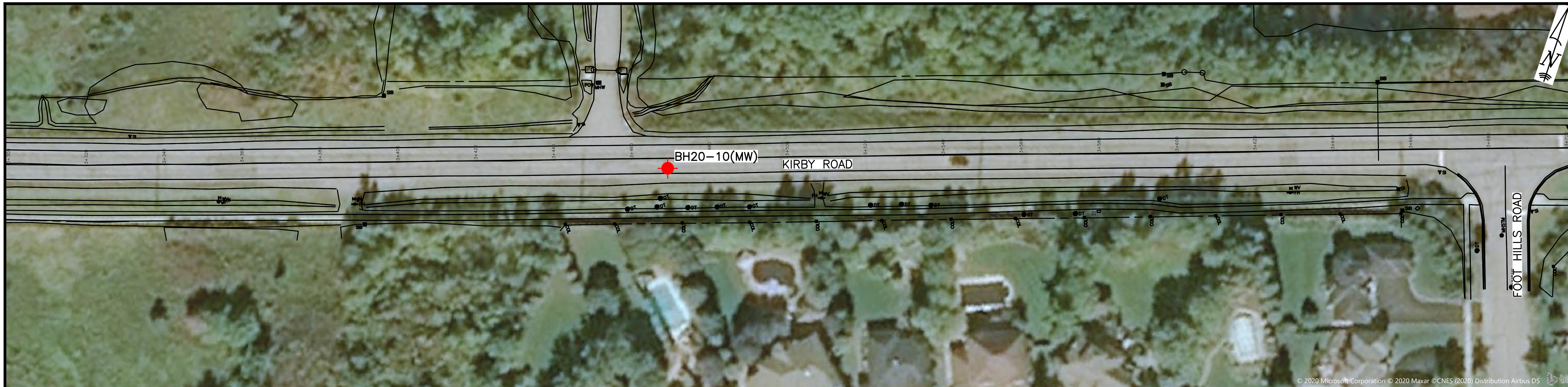
BOREHOLE LOCATION PLAN

JOB# 26130

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE : OCTOBER 2020	SCALE : 1:1000	DRAWING No. 26130-4

FILENAME: H:\Drafting\26000\26130\TED-26130-BHPL.dwg
PLOTDATE: Nov 13, 2020 - 9:27 AM



LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE (BH) LOCATION WITH MONITORING WELL (MW)

20 0 20 40m

SCALE 1:1000

PLAN PROIVDED BY HDR CORPORATION DRAWING FILE NO.10195722-C01-100-BP01.dwg

HDR Corporation

Kirby Road Class EA Study
Kirby Road from Jane Street to Dufferin Street
Vaughn, Ontario

BOREHOLE LOCATION PLAN

JOB# 26130

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
OCTOBER 2020	1:1000	26130-5

FILENAME: H:\Drafting\26000\26130\TED-26130-BHPL.dwg
PLOTDATE: Nov 13, 2020 - 9:27 AM

LEGEND

- BOREHOLE (BH) LOCATION
- BOREHOLE (BH) LOCATION WITH MONITORING WELL (MW)

20 0 20 40m

SCALE 1:1000

PLAN PROIVDED BY HDR CORPORATION DRAWING FILE NO.10195722-C01-100-BP01.dwg

HDR Corporation

Kirby Road Class EA Study
Kirby Road from Jane Street to Dufferin Street
Vaughn, Ontario

BOREHOLE LOCATION PLAN

JOB# 26130

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
KF	BH	MRA
DATE :	SCALE :	DRAWING No.
OCTOBER 2020	1:1000	26130-6

FILENAME: H:\Drafting\26000\26130\TED-26130-BHPL.dwg
PLOTDATE: Nov 13, 2020 - 9:28 AM

Appendix D

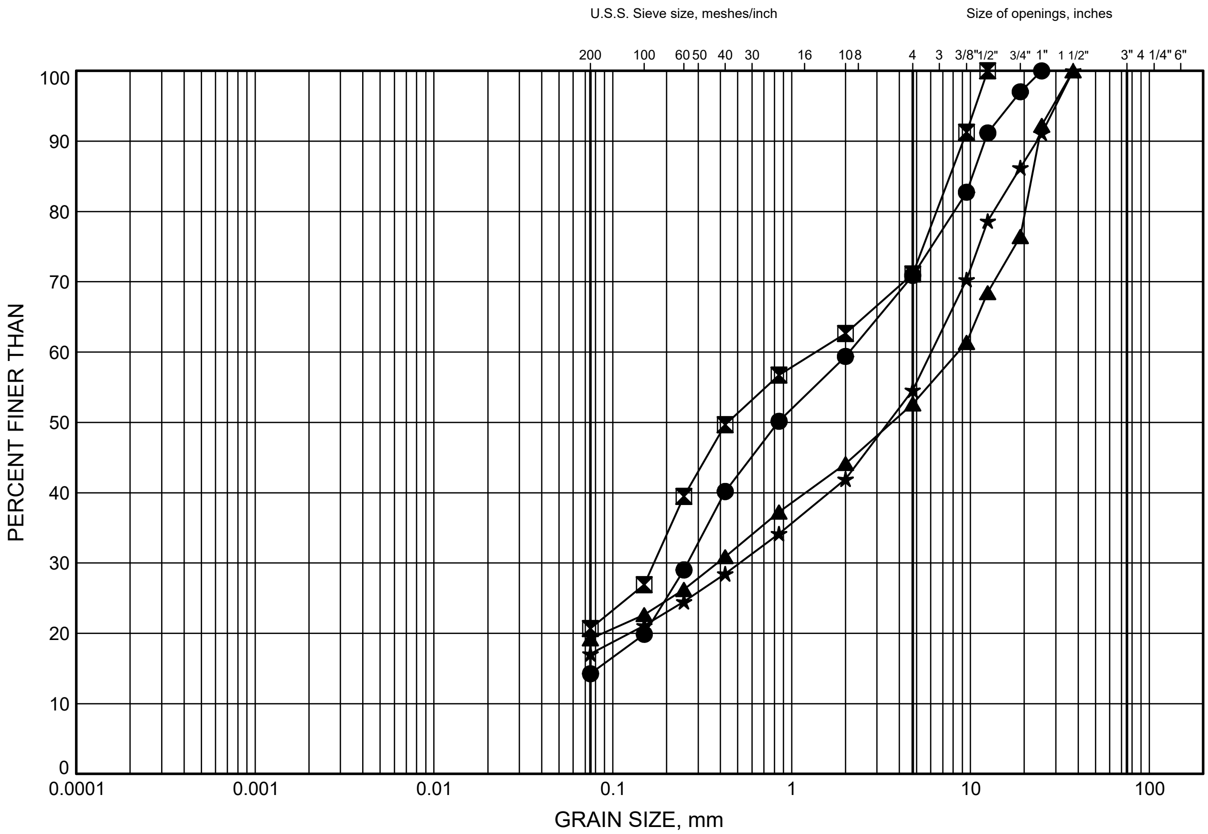
Geotechnical Laboratory Soil Test Results

Kirby Road Class EA Study

GRAIN SIZE DISTRIBUTION

FIGURE D1

SAND and GRAVEL FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-03	0.30	272.42
⧗	20-07	0.38	297.82
▲	20-08	0.38	307.97
★	20-12	0.30	295.29

Date October 2020

Project 26130

THURBER

Prep'd AN

Chkd. KF

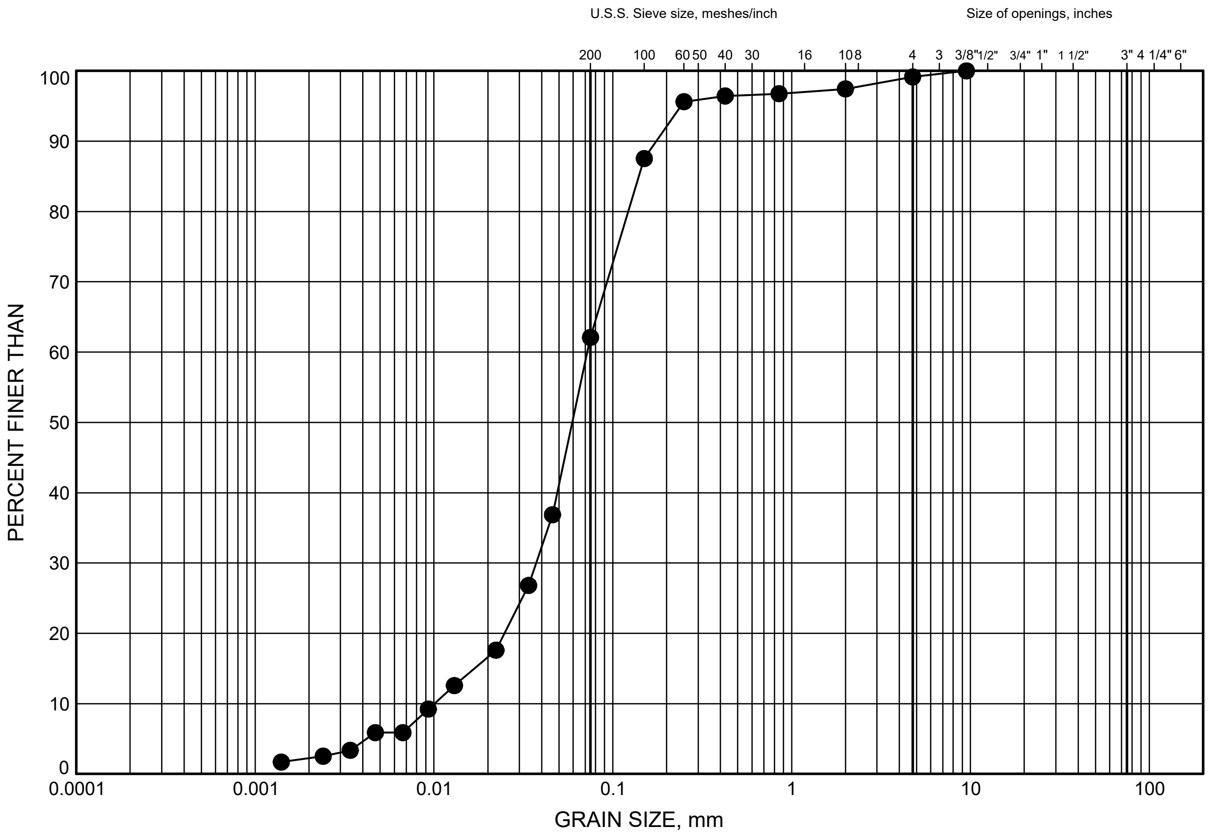
GRAIN SIZE DISTRIBUTION - THURBER 26130-TEL.GPJ 10/20/20

Kirby Road Class EA Study

GRAIN SIZE DISTRIBUTION

FIGURE D2

SILT and SAND FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-12	1.83	293.76

Date October 2020

Project 26130

THURBER

Prep'd AN

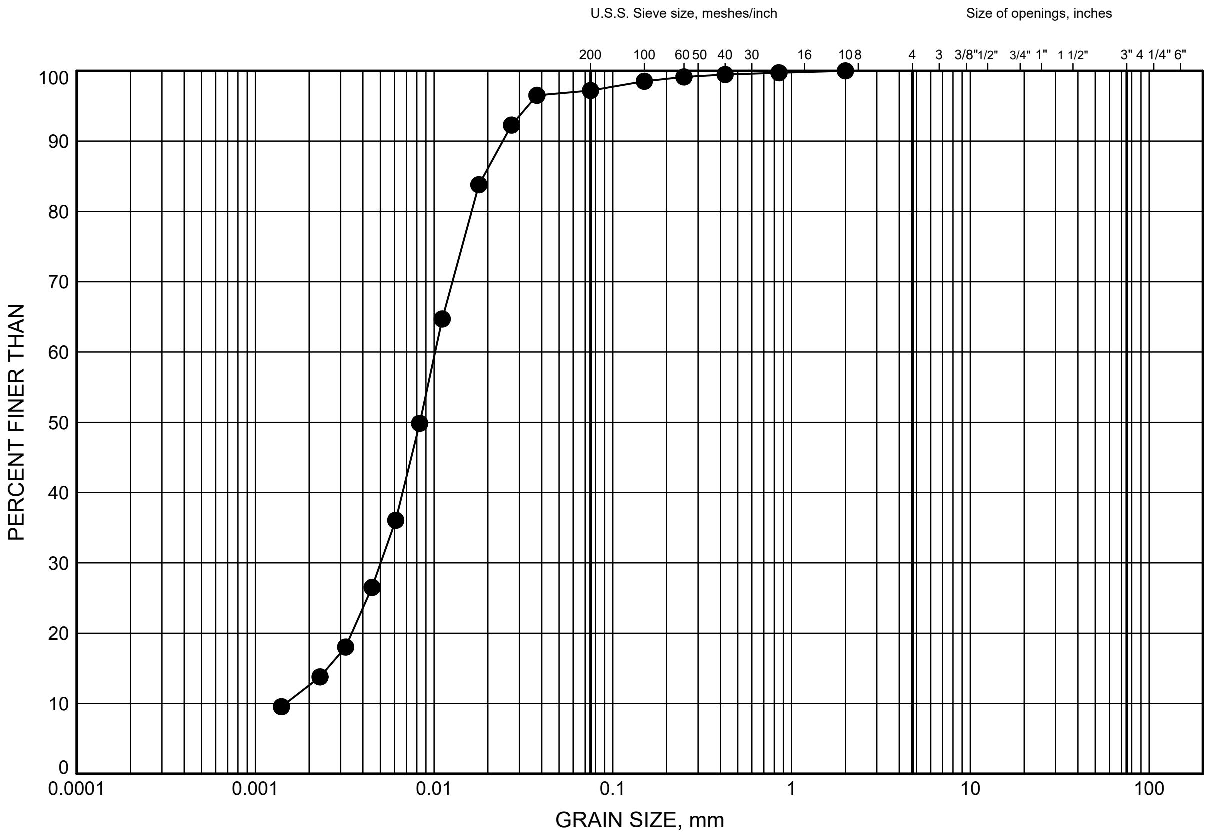
Chkd. KF

Kirby Road Class EA Study

GRAIN SIZE DISTRIBUTION

FIGURE D4

Clayey SILT



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-10	4.88	286.79

Date October 2020

Project 26130

THURBER

Prep'd AN

Chkd. KF

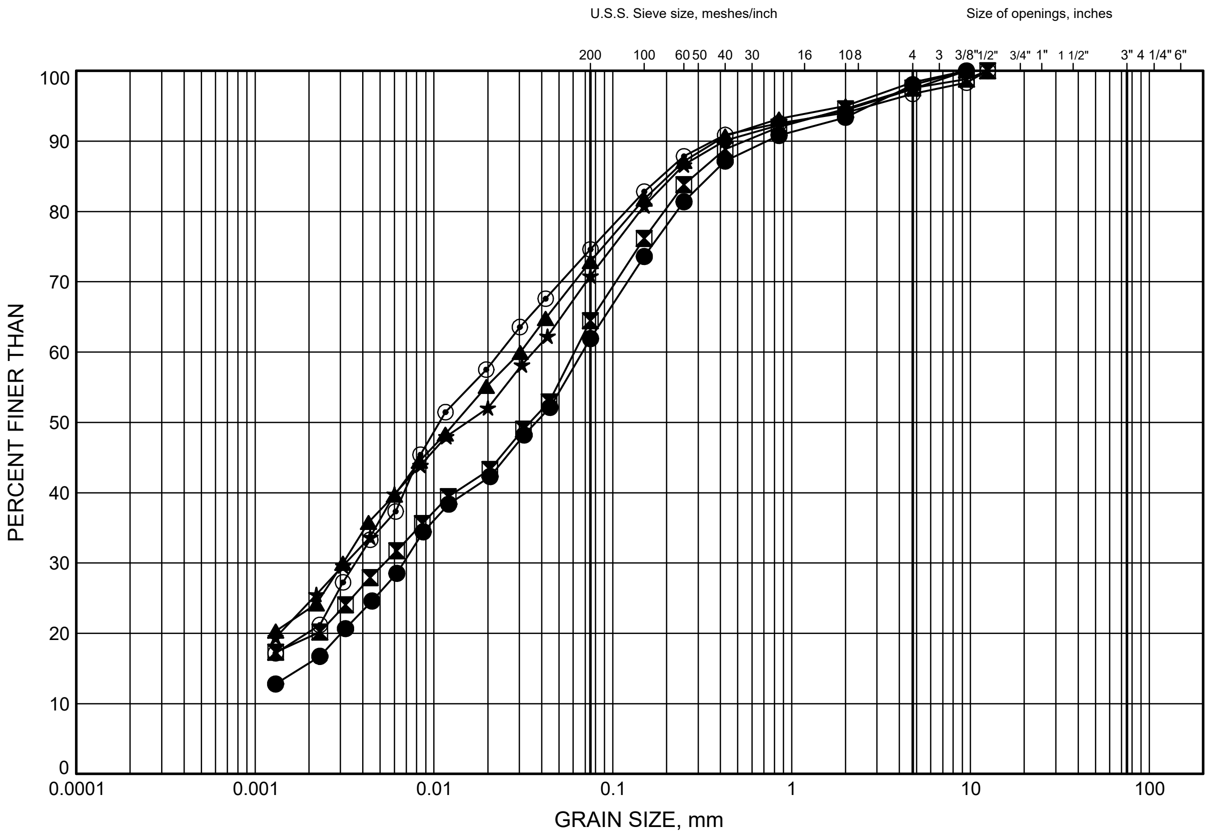
GRAIN SIZE DISTRIBUTION - THURBER 26130-TEL.GPJ 10/20/20

Kirby Road Class EA Study

GRAIN SIZE DISTRIBUTION

FIGURE D3

CLAY TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-01	3.15	268.29
⧗	20-07	1.07	297.13
▲	20-09	4.88	305.82
★	20-10	1.83	289.84
⊙	20-13	2.59	266.24

Date October 2020

Project 26130

THURBER

Prep'd AN

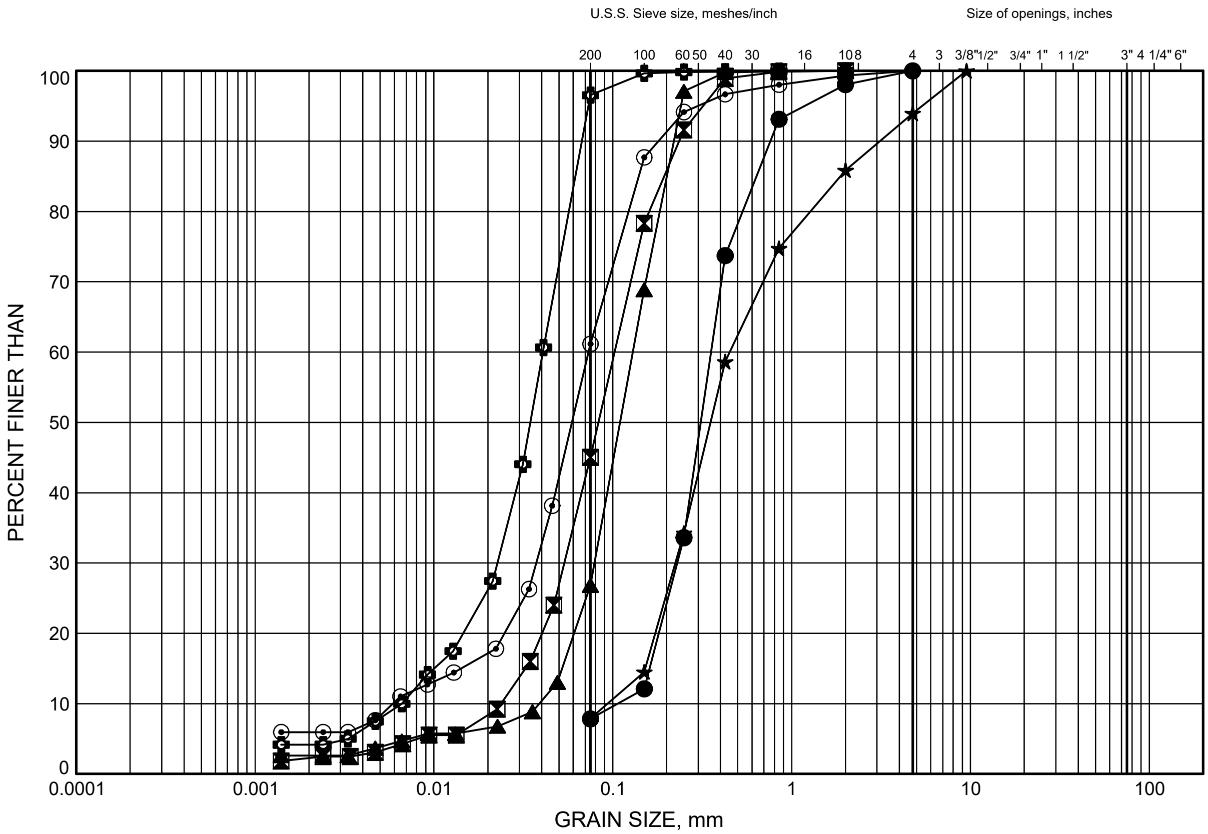
Chkd. KF

Kirby Road Class EA Study

GRAIN SIZE DISTRIBUTION

FIGURE D5

SILT, SILT and SAND, Silty SAND, SAND



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-01	3.45	267.99
⧗	20-03	6.40	266.32
▲	20-05	26.21	265.43
★	20-06	6.40	285.09
⊙	20-07	2.59	295.61
✿	20-12	9.45	286.14

Date October 2020

Project 26130

THURBER

Prep'd AN

Chkd. KF

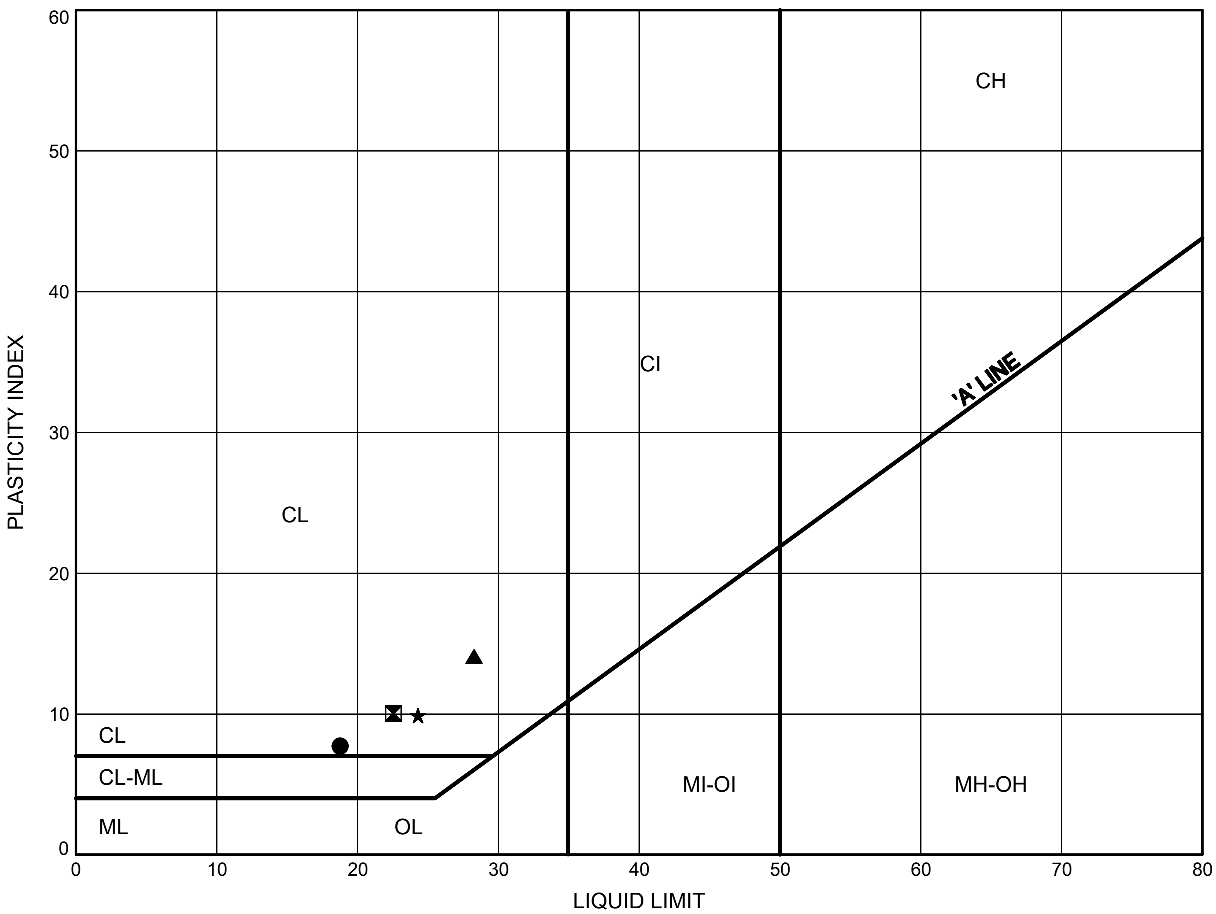
GRAIN SIZE DISTRIBUTION - THURBER 26130-TEL.GPJ 10/20/20

Kirby Road Class EA Study

ATTERBERG LIMITS TEST RESULTS

FIGURE D6

CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-07	1.07	297.13
⧗	20-09	4.88	305.82
▲	20-10	1.83	289.84
★	20-13	2.59	266.24

Date October 2020

Project 26130

THURBER

Prep'd AN

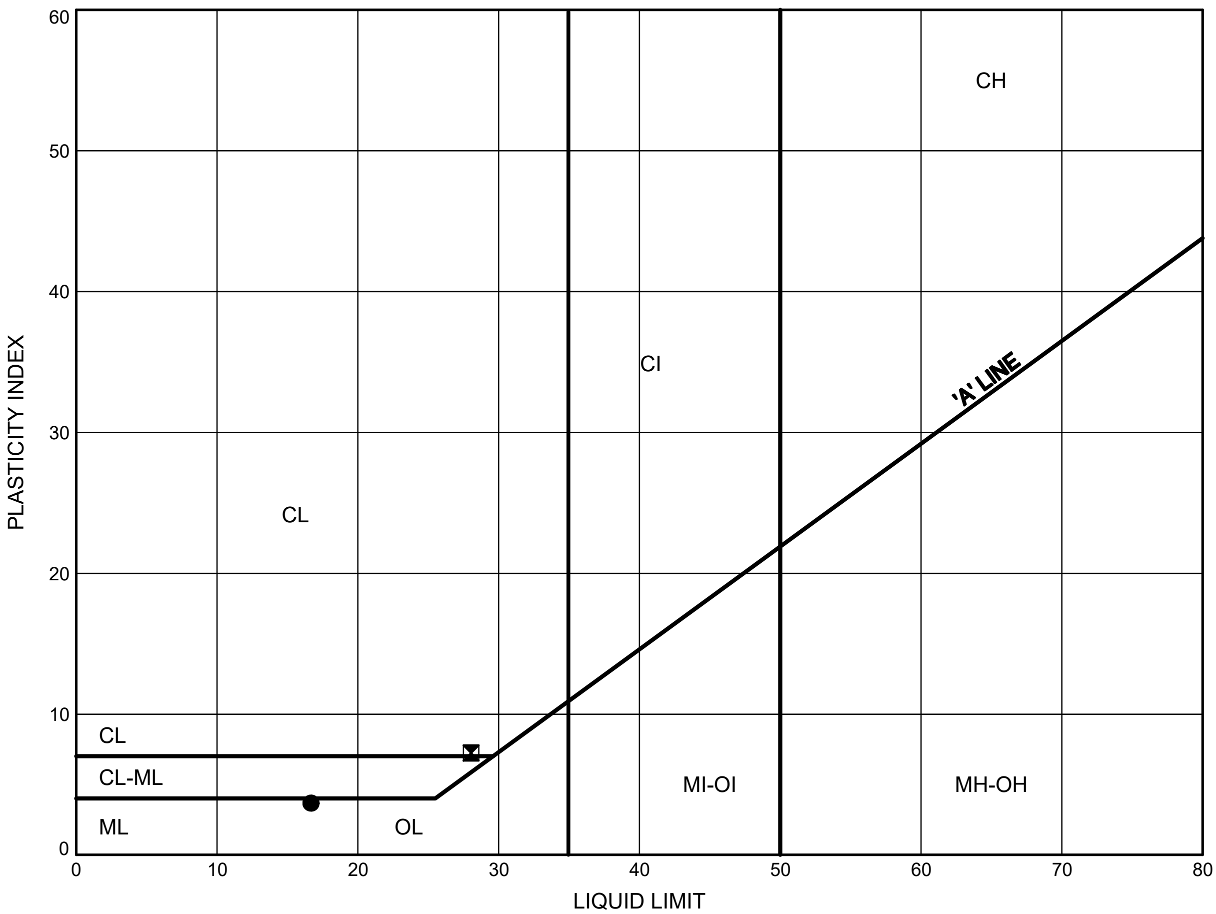
Chkd. KF

Kirby Road Class EA Study

ATTERBERG LIMITS TEST RESULTS

FIGURE D7

CLAYEY SILT, SILT and SAND



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20-07	2.59	295.61
⧗	20-10	4.88	286.79

Date October 2020

Project 26130

THURBER

Prep'd AN

Chkd. KF

THURBER

Appendix E

Laboratory Certificates of Analysis
Soil Environmental Quality

FINAL REPORT

CA15886-JUL20 R1

26130, Kirby Road EA

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Jill Campbell, B.Sc.,GISAS
		Laboratory	SGS Canada Inc.
Address	103 2010 Winston Park Drive Oakville, ON L6H 5R7, Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	2165
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	jill.campbell@sgs.com
Email	kfurbacher@thurber.ca	SGS Reference	CA15886-JUL20
Project	26130, Kirby Road EA	Received	07/17/2020
Order Number		Approved	07/23/2020
Samples	Soil (6)	Report Number	CA15886-JUL20 R1
		Date Reported	10/21/2020

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.

Benzo(b)fluoranthene results for comparison to the standard are reported as benzo(b+j)fluoranthene. Benzo(b)fluoranthene and benzo(j)fluoranthene co-elute and cannot be reported individually by the analytical method used.

Temperature of Sample upon Receipt: 8 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:1

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

Jill Campbell

TABLE OF CONTENTS

FINAL REPORT

Client: Thurber Engineering Ltd.
Project: 26130, Kirby Road EA
Project Manager: Karel Furbacher
Samplers: Rachel Bourassa

PACKAGE: **REG406 - BTEX** (SOIL)

L1 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED

L2 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED

				Sample Number	12
				Sample Name	BH20-06 SS2
				Sample Matrix	Soil
				Sample Date	10/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**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	0.2	< 0.05
Xylene (total)	µg/g	0.05	0.091	0.091	< 0.05
m/p-xylene	µg/g	0.05			< 0.05
o-xylene	µg/g	0.05			< 0.05

PACKAGE: **REG406 - Hydrides** (SOIL)

L1 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED

L2 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED

				Sample Number	10	11	12	13	14	15
				Sample Name	BH20-03 SS4	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3	BH20-09 SS7	BH20-12 SS5
				Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
				Sample Date	13/07/2020	08/07/2020	10/07/2020	13/07/2020	13/07/2020	14/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Hydrides										
Antimony	µg/g	0.8	40	7.5	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	18	1.8	2.0	1.7	1.7	1.9	1.7
Selenium	µg/g	0.7	5.5	2.4	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

FINAL REPORT

CA15886-JUL20 R1

Client: Thurber Engineering Ltd.

Project: 26130, Kirby Road EA

Project Manager: Karel Furbacher

Samplers: Rachel Bourassa

PACKAGE: **REG406 - Metals and Inorganics**
(SOIL)

L1 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED

L2 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED

				Sample Number	10	11	12	13	14	15
				Sample Name	BH20-03 SS4	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3	BH20-09 SS7	BH20-12 SS5
				Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
				Sample Date	13/07/2020	08/07/2020	10/07/2020	13/07/2020	13/07/2020	14/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics										
Moisture Content	%	-			17.1	16.1	12.2	12.2	11.6	12.7
Barium	µg/g	0.1	670	390	44	79	58	73	90	36
Beryllium	µg/g	0.02	8	4	0.29	0.45	0.43	0.36	0.42	0.30
Boron	µg/g	1			4	7	4	6	7	4
Cadmium	µg/g	0.02	1.9	1.2	0.06	0.08	0.17	0.05	0.07	0.08
Chromium	µg/g	0.5			14	20	18	17	20	13
Cobalt	µg/g	0.01	80	22	5.7	8.1	6.6	6.8	7.5	5.3
Copper	µg/g	0.1	230	140	12	17	12	13	15	13
Lead	µg/g	0.1	120	120	5.3	7.4	8.7	6.5	7.3	5.2
Molybdenum	µg/g	0.1	40	6.9	0.2	0.2	0.5	0.3	0.3	0.2
Nickel	µg/g	0.5	270	100	12	18	14	15	17	12
Silver	µg/g	0.05	40	20	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Thallium	µg/g	0.02	3.3	1	0.10	0.17	0.12	0.12	0.13	0.10
Uranium	µg/g	0.002	33	23	0.43	0.50	0.49	0.80	0.66	0.44
Vanadium	µg/g	3	86	86	22	29	27	25	28	22
Zinc	µg/g	0.7	340	340	25	42	41	32	38	28
Water Soluble Boron	µg/g	0.5	2	1.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

SGS

FINAL REPORT

CA15886-JUL20 R1

Client: Thurber Engineering Ltd.

Project: 26130, Kirby Road EA

Project Manager: Karel Furbacher

Samplers: Rachel Bourassa

PACKAGE: **REG406 - Other (ORP)** (SOIL)

L1 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED

L2 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED

				Sample Number	10	11	12	13	14	15
				Sample Name	BH20-03 SS4	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3	BH20-09 SS7	BH20-12 SS5
				Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
				Sample Date	13/07/2020	08/07/2020	10/07/2020	13/07/2020	13/07/2020	14/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Other (ORP)										
Mercury	µg/g	0.05	0.27	0.27	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	No unit	0.2	12	5	5.2	4.5	4.0	16.6	< 0.2	7.1
SAR Calcium	mg/L	0.09			10.4	10.3	16.8	60.6	34.8	29.7
SAR Magnesium	mg/L	0.02			2.2	1.5	6.7	11.9	2.2	8.6
SAR Sodium	mg/L	0.15			141	58.3	105	541	2.9	195
Conductivity	mS/cm	0.002	1.4	0.7	0.72	0.34	0.53	3.1	0.23	1.1
pH	pH Units	0.05			7.83	7.88	7.60	7.87	7.80	7.96
Chromium VI	µg/g	0.2	8	8	< 0.2	< 0.2	0.4	< 0.2	< 0.2	< 0.2
Free Cyanide	µg/g	0.05	0.051	0.051	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

FINAL REPORT

CA15886-JUL20 R1

Client: Thurber Engineering Ltd.

Project: 26130, Kirby Road EA

Project Manager: Karel Furbacher

Samplers: Rachel Bourassa

PACKAGE: **REG406 - PAHs** (SOIL)

L1 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED

L2 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED

				Sample Number	11	12	13
				Sample Name	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3
				Sample Matrix	Soil	Soil	Soil
				Sample Date	08/07/2020	10/07/2020	13/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**
PAHs							
Acenaphthene	µg/g	0.05	2.5	2.5	< 0.05	< 0.05	< 0.05
Acenaphthylene	µg/g	0.05	0.093	0.093	< 0.05	< 0.05	< 0.05
Anthracene	µg/g	0.05	0.16	0.16	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	µg/g	0.05	0.92	0.5	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	µg/g	0.05	0.31	0.31	< 0.05	< 0.05	< 0.05
Benzo(b+j)fluoranthene	µg/g	0.05			< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	µg/g	0.1	13	6.6	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	µg/g	0.05	3.1	3.1	< 0.05	< 0.05	< 0.05
Chrysene	µg/g	0.05	9.4	7	< 0.05	< 0.05	< 0.05
Dibenzo(a,h)anthracene	µg/g	0.06	0.7	0.57	< 0.06	< 0.06	< 0.06
Fluoranthene	µg/g	0.05	2.8	0.69	< 0.05	< 0.05	< 0.05
Fluorene	µg/g	0.05	6.8	6.8	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.1	0.76	0.38	< 0.1	< 0.1	< 0.1
1-Methylnaphthalene	µg/g	0.05			< 0.05	< 0.05	< 0.05
2-Methylnaphthalene	µg/g	0.05			< 0.05	< 0.05	< 0.05
Methylnaphthalene, 2-(1-)	µg/g	0.05	0.59	0.59	< 0.05	< 0.05	< 0.05
Naphthalene	µg/g	0.05	0.2	0.2	< 0.05	< 0.05	< 0.05
Phenanthrene	µg/g	0.05	12	6.2	< 0.05	< 0.05	< 0.05
Pyrene	µg/g	0.05	28	28	< 0.05	< 0.05	< 0.05

PACKAGE: **REG406 - PHCs** (SOIL)

L1 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED

L2 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED

					Sample Number	12
					Sample Name	BH20-06 SS2
					Sample Matrix	Soil
					Sample Date	10/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**		**Result**
PHCs						
F1 (C6-C10)	µg/g	10	25	25		< 10
F1-BTEX (C6-C10)	µg/g	10				< 10
F2 (C10-C16)	µg/g	10	26	10		< 10
F3 (C16-C34)	µg/g	50	240	240		< 50
F4 (C34-C50)	µg/g	50	3300	2800		< 50
Chromatogram returned to baseline at nC50	Yes / No	-				YES

PACKAGE: **REG406 - SVOC Surrogates** (SOIL)

L1 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED

L2 = REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED

					Sample Number	11	12	13
					Sample Name	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3
					Sample Matrix	Soil	Soil	Soil
					Sample Date	08/07/2020	10/07/2020	13/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**		**Result**	**Result**	**Result**
SVOC Surrogates								
Surr Nitrobenzene-d5	Surr Rec %	-				91	97	91
Surr 2-Fluorobiphenyl	Surr Rec %	-				81	94	91
Surr 4-Terphenyl-d14	Surr Rec %	-				103	106	105
Surr 2-Fluorophenol	Surr Rec %	-				92	88	91
Surr Phenol-d6	Surr Rec %	-				95	93	94
Surr 2,4,6-Tribromophenol	Surr Rec %	-				99	97	98

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG406 / SOIL / - - Appendix 1 Table 2.1 - Industrial/Commercial/Community - UNDEFINED L1	REG406 / SOIL / - - Appendix 1 Table 2.1 - Residential/Parkland/Industrial - UNDEFINED L2
BH20-03 SS4					
Conductivity	EPA 6010/SM 2510	mS/cm	0.72		0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	5.2		5
BH20-07 SS3					
Conductivity	EPA 6010/SM 2510	mS/cm	3.1	1.4	0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	16.6	12	5
BH20-12 SS5					
Conductivity	EPA 6010/SM 2510	mS/cm	1.1		0.7
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	7.1		5

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	EWL0286-JUL20	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	SKA5071-JUL20	μg/g	0.05	<0.05	ND	20	100	80	120	100	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A I Internal ref.: ME-CA-[ENV]SKA-LAK-AN-012

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	SKA5077-JUL20	ug/g	0.2	<0.2	0	20	92	80	120	90	75	125

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	EMS0100-JUL20	µg/g	0.05	<0.05	7	20	108	80	120	95	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	ESG0052-JUL20	mg/L	0.09	<0.09	5	20	96	80	120	101	70	130
SAR Magnesium	ESG0052-JUL20	mg/L	0.02	<0.02	13	20	94	80	120	104	70	130
SAR Sodium	ESG0052-JUL20	mg/L	0.15	<0.15	5	20	94	80	120	107	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	EMS0100-JUL20	ug/g	0.05	<0.05	4	20	99	70	130	99	70	130
Arsenic	EMS0100-JUL20	µg/g	0.5	<0.5	9	20	101	70	130	90	70	130
Barium	EMS0100-JUL20	ug/g	0.1	<0.1	9	20	107	70	130	97	70	130
Beryllium	EMS0100-JUL20	µg/g	0.02	<0.02	11	20	101	70	130	94	70	130
Boron	EMS0100-JUL20	µg/g	1	<1	8	20	100	70	130	94	70	130
Cadmium	EMS0100-JUL20	µg/g	0.02	<0.02	3	20	101	70	130	107	70	130
Cobalt	EMS0100-JUL20	µg/g	0.01	<0.01	14	20	100	70	130	113	70	130
Chromium	EMS0100-JUL20	µg/g	0.5	<0.5	11	20	103	70	130	116	70	130
Copper	EMS0100-JUL20	µg/g	0.1	<0.1	9	20	102	70	130	105	70	130
Molybdenum	EMS0100-JUL20	µg/g	0.1	<0.1	8	20	95	70	130	112	70	130
Nickel	EMS0100-JUL20	ug/g	0.5	<0.5	11	20	99	70	130	108	70	130
Lead	EMS0100-JUL20	ug/g	0.1	<0.1	4	20	102	70	130	101	70	130
Antimony	EMS0100-JUL20	µg/g	0.8	<0.8	ND	20	104	70	130	122	70	130
Selenium	EMS0100-JUL20	µg/g	0.7	<0.7	ND	20	105	70	130	107	70	130
Thallium	EMS0100-JUL20	µg/g	0.02	<0.02	13	20	105	70	130	105	70	130
Uranium	EMS0100-JUL20	µg/g	0.002	<0.002	13	20	99	70	130	96	70	130
Vanadium	EMS0100-JUL20	µg/g	3	<3	12	20	106	70	130	117	70	130
Zinc	EMS0100-JUL20	µg/g	0.7	<0.7	ND	20	106	70	130	104	70	130

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)	GCM0285-JUL20	µg/g	10	<10	ND	30	108	80	120	95	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)	GCM0294-JUL20	µg/g	10	<10	ND	30	103	80	120	107	60	140
F3 (C16-C34)	GCM0294-JUL20	µg/g	50	<50	ND	30	103	80	120	107	60	140
F4 (C34-C50)	GCM0294-JUL20	µg/g	50	<50	ND	30	103	80	120	107	60	140

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	ARD0067-JUL20	pH Units	0.05		0	20	100	80	120			

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3541/8270D I 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
1-Methylnaphthalene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	84	50	140	90	50	140
2-Methylnaphthalene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	82	50	140	89	50	140
Acenaphthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	82	50	140	85	50	140
Acenaphthylene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	84	50	140
Anthracene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	81	50	140	85	50	140
Benzo(a)anthracene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140
Benzo(a)pyrene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	80	50	140	86	50	140
Benzo(b+j)fluoranthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	80	50	140	81	50	140
Benzo(ghi)perylene	GCM0288-JUL20	µg/g	0.1	< 0.1	ND	40	79	50	140	84	50	140
Benzo(k)fluoranthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	80	50	140	86	50	140
Chrysene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140
Dibenzo(a,h)anthracene	GCM0288-JUL20	µg/g	0.06	< 0.06	ND	40	78	50	140	84	50	140
Fluoranthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140
Fluorene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	81	50	140	83	50	140
Indeno(1,2,3-cd)pyrene	GCM0288-JUL20	µg/g	0.1	< 0.1	ND	40	79	50	140	85	50	140
Naphthalene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	82	50	140	88	50	140
Phenanthrene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	84	50	140
Pyrene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/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 (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Benzene	GCM0285-JUL20	µg/g	0.02	<0.02	ND	50	107	60	130	98	50	140
Ethylbenzene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	103	60	130	98	50	140
m/p-xylene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	104	60	130	98	50	140
o-xylene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	103	60	130	97	50	140
Toluene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	105	60	130	98	50	140

Water Soluble Boron

Method: O.Reg. 15 3/04 | 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 (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Water Soluble Boron	ESG0048-JUL20	µg/g	0.5	<0.5	ND	20	97	80	120	112	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.

-- End of Analytical Report --

SGS

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Request for Laboratory Services and CHAIN OF CUSTODY

No: 1

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: [signature]
Received Date (mm/dd/yy): 07/17/2020
Received Time: 1245

Received By (signature): [signature]
Custody Seal Present: ☐
Custody Seal Intact: ☐

Cooling Agent Present: ☐
Temperature Upon Receipt (°C) 8c×3

LAB LIMS #: CA-15886-Jul20

REPORT INFORMATION

Company: Thurber Engineering Ltd.
Contact: Karel Furbacher
Address: 103-2010 Winston Park Drive
Oakville, Ontario
Phone: 289-455-7296
Email: kfurbacher@thurber.ca
Email:

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #:
P.O. #:
Project #: 26130
Site Location/ID: Kirby Road EA

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:
Rush Confirmation ID:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04:
☑ Table 1 ☐ R/P/I
☐ Table 2 ☑ I/C/C
☑ Table 3 ☐ A/O
☐ Table ____

Soil Texture: ☑ Coarse ☐ Medium ☐ Fine

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

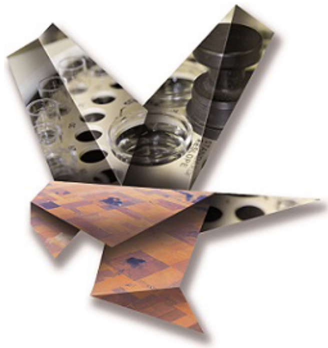
ANALYSIS REQUESTED

#	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☑ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☑ VOC ☐ BTEX ☑ BTEX/F1 ☐ F2-F4 ☐	VOC ☐ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	BH20-03 SS4	7/13/20	10:00 A.M.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
2	BH20-05 SS6	7/8/20	12:00 P.M.	4	SOIL		☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3	BH20-06 SS2	7/10/20	8:00 A.M.	4	SOIL		☑	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4	BH20-07 SS3	7/13/20	11:00 A.M.	4	SOIL		☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5	BH20-09 SS7	7/15/20	1:00 P.M.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6	BH20-12 SS5	7/14/20	3:00 P.M.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Rachel Bourassa	Signature:	Date: 07/16/20 (mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	Signature: Karel (Digitally signed by Karel Date: 2020.07.16 18:19:57 -04'00')	Date: 07/16/20 (mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018



FINAL REPORT

CA15886-JUL20 R

26130, Kirby Road EA

Prepared for

Thurber Engineering Ltd.

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Thurber Engineering Ltd.	Project Specialist	Jill Campbell, B.Sc.,GISAS
		Laboratory	SGS Canada Inc.
Address	103 2010 Winston Park Drive Oakville, ON L6H 5R7, Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Karel Furbacher	Telephone	2165
Telephone	289-455-7296	Facsimile	705-652-6365
Facsimile		Email	jill.campbell@sgs.com
Email	kfurbacher@thurber.ca	SGS Reference	CA15886-JUL20
Project	26130, Kirby Road EA	Received	07/17/2020
Order Number		Approved	07/23/2020
Samples	Soil (6)	Report Number	CA15886-JUL20 R
		Date Reported	07/23/2020

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.

Benzo(b)fluoranthene results for comparison to the standard are reported as benzo(b+j)fluoranthene. Benzo(b)fluoranthene and benzo(j)fluoranthene co-elute and cannot be reported individually by the analytical method used.

Temperature of Sample upon Receipt: 8 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:1

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

Jill Campbell

TABLE OF CONTENTS

FINAL REPORT

CA15886-JUL20 R

Client: Thurber Engineering Ltd.

Project: 26130, Kirby Road EA

Project Manager: Karel Furbacher

Samplers: Rachel Bourassa

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

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	12
				Sample Name	BH20-06 SS2
				Sample Matrix	Soil
				Sample Date	10/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**
BTEX					
Benzene	µg/g	0.02	0.02	0.32	< 0.02
Ethylbenzene	µg/g	0.05	0.05	9.5	< 0.05
Toluene	µg/g	0.05	0.2	68	< 0.05
Xylene (total)	µg/g	0.05	0.05	26	< 0.05
m/p-xylene	µg/g	0.05			< 0.05
o-xylene	µg/g	0.05			< 0.05

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

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11	12	13	14	15
				Sample Name	BH20-03 SS4	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3	BH20-09 SS7	BH20-12 SS5
				Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
				Sample Date	13/07/2020	08/07/2020	10/07/2020	13/07/2020	13/07/2020	14/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Hydrides										
Antimony	µg/g	0.8	1.3	40	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	18	1.8	2.0	1.7	1.7	1.9	1.7
Selenium	µg/g	0.7	1.5	5.5	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

FINAL REPORT

CA15886-JUL20 R

Client: Thurber Engineering Ltd.

Project: 26130, Kirby Road EA

Project Manager: Karel Furbacher

Samplers: Rachel Bourassa

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

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11	12	13	14	15
				Sample Name	BH20-03 SS4	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3	BH20-09 SS7	BH20-12 SS5
				Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
				Sample Date	13/07/2020	08/07/2020	10/07/2020	13/07/2020	13/07/2020	14/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics										
Moisture Content	%	-			17.1	16.1	12.2	12.2	11.6	12.7
Barium	µg/g	0.1	220	670	44	79	58	73	90	36
Beryllium	µg/g	0.02	2.5	8	0.29	0.45	0.43	0.36	0.42	0.30
Boron	µg/g	1	36	120	4	7	4	6	7	4
Cadmium	µg/g	0.02	1.2	1.9	0.06	0.08	0.17	0.05	0.07	0.08
Chromium	µg/g	0.5	70	160	14	20	18	17	20	13
Cobalt	µg/g	0.01	21	80	5.7	8.1	6.6	6.8	7.5	5.3
Copper	µg/g	0.1	92	230	12	17	12	13	15	13
Lead	µg/g	0.1	120	120	5.3	7.4	8.7	6.5	7.3	5.2
Molybdenum	µg/g	0.1	2	40	0.2	0.2	0.5	0.3	0.3	0.2
Nickel	µg/g	0.5	82	270	12	18	14	15	17	12
Silver	µg/g	0.05	0.5	40	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Thallium	µg/g	0.02	1	3.3	0.10	0.17	0.12	0.12	0.13	0.10
Uranium	µg/g	0.002	2.5	33	0.43	0.50	0.49	0.80	0.66	0.44
Vanadium	µg/g	3	86	86	22	29	27	25	28	22
Zinc	µg/g	0.7	290	340	25	42	41	32	38	28
Water Soluble Boron	µg/g	0.5		2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5

FINAL REPORT

CA15886-JUL20 R

Client: Thurber Engineering Ltd.

Project: 26130, Kirby Road EA

Project Manager: Karel Furbacher

Samplers: Rachel Bourassa

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

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	10	11	12	13	14	15
				Sample Name	BH20-03 SS4	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3	BH20-09 SS7	BH20-12 SS5
				Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
				Sample Date	13/07/2020	08/07/2020	10/07/2020	13/07/2020	13/07/2020	14/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Other (ORP)										
Mercury	µg/g	0.05	0.27	3.9	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Sodium Adsorption Ratio	No unit	0.2	2.4	12	5.2	4.5	4.0	16.6	< 0.2	7.1
SAR Calcium	mg/L	0.09			10.4	10.3	16.8	60.6	34.8	29.7
SAR Magnesium	mg/L	0.02			2.2	1.5	6.7	11.9	2.2	8.6
SAR Sodium	mg/L	0.15			141	58.3	105	541	2.9	195
Conductivity	mS/cm	0.002	0.57	1.4	0.72	0.34	0.53	3.1	0.23	1.1
pH	pH Units	0.05			7.83	7.88	7.60	7.87	7.80	7.96
Chromium VI	µg/g	0.2	0.66	8	< 0.2	< 0.2	0.4	< 0.2	< 0.2	< 0.2
Free Cyanide	µg/g	0.05	0.051	0.051	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

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

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	11	12	13
				Sample Name	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3
				Sample Matrix	Soil	Soil	Soil
				Sample Date	08/07/2020	10/07/2020	13/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**
PAHs							
Acenaphthene	µg/g	0.05	0.072	96	< 0.05	< 0.05	< 0.05
Acenaphthylene	µg/g	0.05	0.093	0.15	< 0.05	< 0.05	< 0.05
Anthracene	µg/g	0.05	0.16	0.67	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	µg/g	0.05	0.36	0.96	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	µg/g	0.05	0.3	0.3	< 0.05	< 0.05	< 0.05
Benzo(b+j)fluoranthene	µg/g	0.05	0.47	0.96	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	µg/g	0.1	0.68	9.6	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	µg/g	0.05	0.48	0.96	< 0.05	< 0.05	< 0.05
Chrysene	µg/g	0.05	2.8	9.6	< 0.05	< 0.05	< 0.05
Dibenzo(a,h)anthracene	µg/g	0.06	0.1	0.1	< 0.06	< 0.06	< 0.06
Fluoranthene	µg/g	0.05	0.56	9.6	< 0.05	< 0.05	< 0.05
Fluorene	µg/g	0.05	0.12	62	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.1	0.23	0.76	< 0.1	< 0.1	< 0.1
1-Methylnaphthalene	µg/g	0.05			< 0.05	< 0.05	< 0.05
2-Methylnaphthalene	µg/g	0.05			< 0.05	< 0.05	< 0.05
Methylnaphthalene, 2-(1-)	µg/g	0.05	0.59	76	< 0.05	< 0.05	< 0.05
Naphthalene	µg/g	0.05	0.09	9.6	< 0.05	< 0.05	< 0.05
Phenanthrene	µg/g	0.05	0.69	12	< 0.05	< 0.05	< 0.05
Pyrene	µg/g	0.05	1	96	< 0.05	< 0.05	< 0.05

Client: Thurber Engineering Ltd.

Project: 26130, Kirby Road EA

Project Manager: Karel Furbacher

Samplers: Rachel Bourassa

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

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	12
				Sample Name	BH20-06 SS2
				Sample Matrix	Soil
				Sample Date	10/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**
PHCs					
F1 (C6-C10)	µg/g	10	25	55	< 10
F1-BTEX (C6-C10)	µg/g	10			< 10
F2 (C10-C16)	µg/g	10	10	230	< 10
F3 (C16-C34)	µg/g	50	240	1700	< 50
F4 (C34-C50)	µg/g	50	120	3300	< 50
Chromatogram returned to baseline at nC50	Yes / No	-			YES

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

L1 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED

				Sample Number	11	12	13
				Sample Name	BH20-05 SS6	BH20-06 SS2	BH20-07 SS3
				Sample Matrix	Soil	Soil	Soil
				Sample Date	08/07/2020	10/07/2020	13/07/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**
SVOC Surrogates							
Surr Nitrobenzene-d5	Surr Rec %	-			91	97	91
Surr 2-Fluorobiphenyl	Surr Rec %	-			81	94	91
Surr 4-Terphenyl-d14	Surr Rec %	-			103	106	105
Surr 2-Fluorophenol	Surr Rec %	-			92	88	91
Surr Phenol-d6	Surr Rec %	-			95	93	94
Surr 2,4,6-Tribromophenol	Surr Rec %	-			99	97	98

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED L1	REG153 / SOIL / COARSE - TABLE 3 - Industrial/Commercial - UNDEFINED L2
BH20-03 SS4					
Conductivity	EPA 6010/SM 2510	mS/cm	0.72	0.57	
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	5.2	2.4	
BH20-05 SS6					
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	4.5	2.4	
BH20-06 SS2					
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	4.0	2.4	
BH20-07 SS3					
Conductivity	EPA 6010/SM 2510	mS/cm	3.1	0.57	1.4
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	16.6	2.4	12
BH20-12 SS5					
Conductivity	EPA 6010/SM 2510	mS/cm	1.1	0.57	
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	7.1	2.4	

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	EWL0286-JUL20	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	SKA5071-JUL20	μg/g	0.05	<0.05	ND	20	100	80	120	100	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A I Internal ref.: ME-CA-[ENV]SKA-LAK-AN-012

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	SKA5077-JUL20	ug/g	0.2	<0.2	0	20	92	80	120	90	75	125

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	EMS0100-JUL20	µg/g	0.05	<0.05	7	20	108	80	120	95	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	ESG0052-JUL20	mg/L	0.09	<0.09	5	20	96	80	120	101	70	130
SAR Magnesium	ESG0052-JUL20	mg/L	0.02	<0.02	13	20	94	80	120	104	70	130
SAR Sodium	ESG0052-JUL20	mg/L	0.15	<0.15	5	20	94	80	120	107	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	EMS0100-JUL20	ug/g	0.05	<0.05	4	20	99	70	130	99	70	130
Arsenic	EMS0100-JUL20	µg/g	0.5	<0.5	9	20	101	70	130	90	70	130
Barium	EMS0100-JUL20	ug/g	0.1	<0.1	9	20	107	70	130	97	70	130
Beryllium	EMS0100-JUL20	µg/g	0.02	<0.02	11	20	101	70	130	94	70	130
Boron	EMS0100-JUL20	µg/g	1	<1	8	20	100	70	130	94	70	130
Cadmium	EMS0100-JUL20	µg/g	0.02	<0.02	3	20	101	70	130	107	70	130
Cobalt	EMS0100-JUL20	µg/g	0.01	<0.01	14	20	100	70	130	113	70	130
Chromium	EMS0100-JUL20	µg/g	0.5	<0.5	11	20	103	70	130	116	70	130
Copper	EMS0100-JUL20	µg/g	0.1	<0.1	9	20	102	70	130	105	70	130
Molybdenum	EMS0100-JUL20	µg/g	0.1	<0.1	8	20	95	70	130	112	70	130
Nickel	EMS0100-JUL20	ug/g	0.5	<0.5	11	20	99	70	130	108	70	130
Lead	EMS0100-JUL20	ug/g	0.1	<0.1	4	20	102	70	130	101	70	130
Antimony	EMS0100-JUL20	µg/g	0.8	<0.8	ND	20	104	70	130	122	70	130
Selenium	EMS0100-JUL20	µg/g	0.7	<0.7	ND	20	105	70	130	107	70	130
Thallium	EMS0100-JUL20	µg/g	0.02	<0.02	13	20	105	70	130	105	70	130
Uranium	EMS0100-JUL20	µg/g	0.002	<0.002	13	20	99	70	130	96	70	130
Vanadium	EMS0100-JUL20	µg/g	3	<3	12	20	106	70	130	117	70	130
Zinc	EMS0100-JUL20	µg/g	0.7	<0.7	ND	20	106	70	130	104	70	130

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 (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
F1 (C6-C10)	GCM0285-JUL20	µg/g	10	<10	ND	30	108	80	120	95	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 (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
F2 (C10-C16)	GCM0294-JUL20	µg/g	10	<10	ND	30	103	80	120	107	60	140
F3 (C16-C34)	GCM0294-JUL20	µg/g	50	<50	ND	30	103	80	120	107	60	140
F4 (C34-C50)	GCM0294-JUL20	µg/g	50	<50	ND	30	103	80	120	107	60	140

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	ARD0067-JUL20	pH Units	0.05		0	20	100	80	120			

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3541/8270D | 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
1-Methylnaphthalene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	84	50	140	90	50	140
2-Methylnaphthalene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	82	50	140	89	50	140
Acenaphthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	82	50	140	85	50	140
Acenaphthylene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	84	50	140
Anthracene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	81	50	140	85	50	140
Benzo(a)anthracene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140
Benzo(a)pyrene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	80	50	140	86	50	140
Benzo(b+j)fluoranthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	80	50	140	81	50	140
Benzo(ghi)perylene	GCM0288-JUL20	µg/g	0.1	< 0.1	ND	40	79	50	140	84	50	140
Benzo(k)fluoranthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	80	50	140	86	50	140
Chrysene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140
Dibenzo(a,h)anthracene	GCM0288-JUL20	µg/g	0.06	< 0.06	ND	40	78	50	140	84	50	140
Fluoranthene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140
Fluorene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	81	50	140	83	50	140
Indeno(1,2,3-cd)pyrene	GCM0288-JUL20	µg/g	0.1	< 0.1	ND	40	79	50	140	85	50	140
Naphthalene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	82	50	140	88	50	140
Phenanthrene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	84	50	140
Pyrene	GCM0288-JUL20	µg/g	0.05	< 0.05	ND	40	83	50	140	86	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/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
Benzene	GCM0285-JUL20	µg/g	0.02	<0.02	ND	50	107	60	130	98	50	140
Ethylbenzene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	103	60	130	98	50	140
m/p-xylene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	104	60	130	98	50	140
o-xylene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	103	60	130	97	50	140
Toluene	GCM0285-JUL20	µg/g	0.05	<0.05	ND	50	105	60	130	98	50	140

Water Soluble Boron

Method: O.Reg. 15 3/04 | 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	ESG0048-JUL20	µg/g	0.5	<0.5	ND	20	97	80	120	112	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.

-- End of Analytical Report --

SGS Environment, Health & Safety

Request for Laboratory Services and CHAIN OF CUSTODY

- Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 1

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: [signature]
Received Date (mm/dd/yy): 07/17/2020
Received Time: 1245

Received By (signature): [signature]
Custody Seal Present: ☐
Custody Seal Intact: ☐

Cooling Agent Present: ☐
Temperature Upon Receipt (°C) 8°c×3

LAB LIMS #: CA-15886-Jul20

REPORT INFORMATION

Company: Thurber Engineering Ltd.
Contact: Karel Furbacher
Address: 103-2010 Winston Park Drive, Oakville, Ontario
Phone: 289-455-7296
Email: kfurbacher@thurber.ca
Email:

INVOICE INFORMATION

☑ (same as Report Information)
Company:
Contact:
Address:
Phone:
Email:

PROJECT INFORMATION

Quotation #:
P.O. #:
Project #: 26130
Site Location/ID: Kirby Road EA

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:
Rush Confirmation ID:

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04:
☑ Table 1 ☐ Table 2 ☑ Table 3 ☐ Table ____
☐ R/P/I ☑ I/C/C ☐ A/O
Soil Texture: ☑ Coarse ☐ Medium ☐ Fine

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

#	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics	PAH ☑ ABN ☐ SVOC(all) ☐	PCB Total ☐ Aroclor ☐	PHC F1-F4 ☑ VOC ☐ BTEX ☑ BTEX/F1 ☐ F2-F4 ☐	VOC ☐ BTEX ☐ THM ☐	Pesticides OC ☐ OP ☐	TCLP M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit. ☐	Water Pkg Gen. ☐ Ext. ☐	Sewer Use:	Corrosivity/Resistivity					COMMENTS:
1	BH20-03 SS4	7/13/20	10:00 A.M.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
2	BH20-05 SS6	7/8/20	12:00 P.M.	4	SOIL		☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3	BH20-06 SS2	7/10/20	8:00 A.M.	4	SOIL		☑	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4	BH20-07 SS3	7/13/20	11:00 A.M.	4	SOIL		☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5	BH20-09 SS7	7/15/20	1:00 P.M.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
6	BH20-12 SS5	7/14/20	3:00 P.M.	1	SOIL		☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
11							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
12							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Observations/Comments/Special Instructions

Sampled By (NAME): Rachel Bourassa	Signature:	Date: 07/16/20	(mm/dd/yy)	Pink Copy - Client
Relinquished by (NAME): Karel Furbacher	Signature: Karel (Digitally signed by Karel Date: 2020.07.16 18:19:57 -04'00')	Date: 07/16/20	(mm/dd/yy)	Yellow & White Copy - SGS

Revision #: 1.1
Date of Issue: 04 April, 2018