GEOTECHNICAL INVESTIGATION AND PAVEMENT DESIGN REPORT
SCHEDULE 'C' CLASS ENVIRONMENTAL ASSESSMENT
PROPOSED WIDENING OF MISSISSAUGA ROAD
FROM FINANCIAL DRIVE TO QUEEN STREET WEST (LOCATION 1)
CITY OF BRAMPTON, ONTARIO

Submitted to:

THE REGIONAL MUNICIPALITY OF PEEL

c/o Amec Foster Wheeler Environment & Infrastructure,
a Division of Amec Foster Wheeler Americas Limited

3450 Harvester Road, Suite 100
Burlington, Ontario L7N 3W5
Canada

Submitted by:

Amec Foster Wheeler Environment & Infrastructure,
a Division of Amec Foster Wheeler Americas Limited

50 Vogell Road, Units 3 & 4
Richmond Hill, Ontario L4B 3K6
Canada
Tel: (905) 415-2632
Fax: (416) 415-1686

23 February 2018
Amec Foster Wheeler Reference: TP115085

TABLE OF CONTENTS

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited ("Amec Foster Wheeler"), was retained by The Regional Municipality of Peel ("Region") to conduct the following studies for Mississauga Road in Brampton, Ontario:

- Location 1 - Schedule 'C' Class Environmental Assessment (EA) for widening of Mississauga Road (from four to six lanes), from 380 m north of Financial Drive to 300 m north of Queen Street West (RR 6); and
- Location 2 – Technical Studies to support an addendum to previously-approved Schedule 'C' Class EA from 300 m north of Queen Street West (RR 6) to 100 m south of Bovaird Drive (RR 107).

This report presents the results of geotechnical investigation and recommendations for road widening in support of Schedule 'C' Class EA for Location 1 (about 2.2 km in length), as shown in Figure No. 1, which will be referred hereinafter to as "investigation limits". As the existing Mississauga Road was already a six-lane road at the intersection with Queen Street West at the time of this investigation, the geotechnical investigation was carried out only for the section with four lanes from about 380 m north of Financial Drive to slightly south of Queen Street West.

Based on the review of available information for Location 2 (an approximate length of 2.6 km), a Technical Memorandum (dated 4 May 2017) has been submitted separately, as per the required scope of the work, and is not part of this investigation.

The purpose of the geotechnical investigation for Location 1 was to obtain information on the subsurface and existing pavement conditions along the investigation limits (i.e., existing four-lane section) by means of a limited number of boreholes, in-situ tests and laboratory tests of selected soil samples. Based on Amec Foster Wheeler's interpretation of the data obtained, recommendations are provided on the geotechnical aspects of the project. The environmental aspects for soil management of this project are also presented in this report. The results of hydrogeological investigation and discussion are presented in a separate report.

The work carried out for the investigation was completed in accordance with the Terms of Reference / Scope of Work within Request for Proposal (RFP2015-129P) provided by the Region, dated 26 May 2015.

This report contains the findings of geotechnical investigation, together with recommendations and comments. These recommendations and comments are based on factual information, and are intended only for design engineers' use. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and different conditions may become apparent during construction which

were not detected at the borehole locations. The possible construction conditions are also discussed, but only to the extent that they may influence design decisions. Construction methods discussed, however, express Amec Foster Wheeler's opinion only and are not intended to direct contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all the factors that may have an effect upon the construction.

The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. Further, the recommendations and opinions in this report are applicable only to the proposed project as described herein.

On-going liaison with Amec Foster Wheeler during the final design and construction phase of the project is recommended to confirm that the recommendations in this report are applicable and/or correctly interpreted and implemented. Any queries concerning the geotechnical aspects of the proposed project should be directed to Amec Foster Wheeler for further elaboration and/or clarification.

1.1 Project Description

Mississauga Road is proposed to be widened from the existing 4-lane road to a 6-lane road from 380 m north of Financial Drive to Queen Street West (within the "investigation limits", i.e. from Station 10+000 to Station 11+500), with center turning lane plus auxiliary turn lanes at major intersections. This road section may also require resurfacing and/or reconstruction of the existing pavement. The road widening work includes the widening of the existing Huttonville Bridge over Credit River, possible construction of three retaining walls to accommodate the road widening, and possible reconstruction / replacement of the existing storm sewer under the road within the investigation limits. For the road widening, the existing bridge structure over Credit River is planned to be replaced with a new wider and longer bridge (existing bridge to be demolished). The road section from Queen Street West to 300 m north of Queen Street West within Location 1 was not included in this investigation, as it already consisted of six lanes. Proposed works for the Class EA are listed in Table 1.1. and shown in Figure No. 1.

Table 1.1 – Project Summary for Mississauga Road (Investigation limits)

No.	Work Description	Approximate Station	Location	Length of Structure
1	Widening of Mississauga Road	10+000 to 11+500	Queen Street West to about 380 m North of Financial Drive	Approx. 1.5 km
2	Replacement of Huttonville Bridge over Credit River	10+300 to 10+400	Mississauga Road at Credit River	Approx. 100 m
3	Retaining Wall No. 1	10+990 to 11+090	East of Mississauga Road, about 770 m North of Financial Drive	Approx. 100 m Height: 3 m
	Retaining Wall No. 2	11+050 to 11+080	About 800 m north of Financial Drive on West of Mississauga Road	Approx. 30 m Height: 2 m
	Retaining Wall No. 3	10+380 to10+470	Southeast of the bridge	Approx. 90 m Height: 5 m
4	Installation of Underground Utilities (Storm Sewer)	10+000 to 11+500	Mississauga Road. No new sewer under Credit River.	Approx. 1.5 km
5	Limited Soil Chemical Analysis for soil management	10+000 to 11+500	380 m North of Financial Drive to Queen Street West	Approx. 1.5 km

At the time of investigation, Mississauga Road was oriented generally in southeast – northwest direction (referred to as north – south direction for this report), within the investigation limits. The existing asphaltic-concrete paved road was a four-lane road with sidewalk on both sides, together with medians, centre turn lane and left and/or right turn lanes at various locations. The following roads intersected Mississauga Road within the investigation limits:

- *Lionhead Golf Club Road* was a two-lane asphaltic concrete paved road oriented generally in northeast direction (referred to as east - west direction for this report) and was located on both sides of Mississauga Road, at the south end of the investigation limit.
- *Embleton Road* was a two-lane asphaltic concrete paved road oriented generally in east-west direction and was located only on west side of Mississauga Road.
- *Queen Street West* was a four-lane asphaltic concrete paved road oriented generally in east - west direction, and was located only on the east side of Mississauga Road.
- *River Road* was a two-lane asphaltic concrete paved road oriented generally in east - west direction, and located only on the west side of Mississauga Road (opposite Queen Street West).

1.2 Regional Geology

Based on Map 2556 (Southern Sheet): 'Quaternary Geology of Ontario' prepared by the Ministry of Northern Development and Mines of Ontario (1991), the project site is situated in an area where the overburden has been identified as relatively young Halton tills, which comprises predominantly silt to silty clay matrix, with high carbonate content and clast poor. Glaciolacustrine deposits have

also been identified within the project site and characterized by silt and clay, sand, gravelly sand and gravel basin, nearshore and quiet water deposits.

Based on Map 2544 (Southern Sheet): 'Bedrock Geology of Ontario' prepared by the Ministry of Northern Development and Mines of Ontario (1991), the bedrock underlying the overburden at the project site is the Queenston Formation which comprises shale, dolostone, limestone and siltstone.

2.0 INVESTIGATION PROCEDURE

Based on the Terms of Reference ('TOR') for geotechnical investigation, the following tasks were carried out:

- Geotechnical investigation for:
  - road widening;
  - bridge widening;
  - retaining walls; and
  - underground utilities.
- Pavement investigation:
  - Visual pavement condition survey of existing road;
  - Falling Weight Deflectometer (FWD) survey; and
  - Borehole investigation for existing pavement.
- Laboratory testing for soil classification, including soil chemical analyses; and
- Installation of monitoring wells for hydrogeological investigation (reported in a separate cover).

The geotechnical investigation obtained information on the subsurface conditions at the site by means of sampled boreholes. A total of 48 boreholes were drilled along Mississauga Road during this investigation, which included:

- forty (40) boreholes for pavement widening / underground utilities (BH 1 to BH 42, except BH 34* and BH 37*);
- six (6) boreholes for bridge widening (BH B1 to BH B6); and
- two (2) boreholes (BH R1 and BH R2) for Retaining Wall No. 1.

* *As the borehole locations were close to each other, Boreholes BH B1 and BH 37 were drilled at the same location, and similarly, Boreholes BH B3 and BH 34 were drilled at the same location. Both BH B1 and BH B3 were drilled deeper than the borehole depth planned for BH 37 and BH 34. BH 37 and BH 34 are not referred hereinafter.*

2.1 Overall Investigation Approaches

The boreholes were advanced in the driving lanes, edge of pavement, shoulder of the road, the toe of slope or at top of slope. The depths of the boreholes ranged from about 1.5 m to 14.3 m below the existing grade.

Prior to drilling, utility locates were carried out to obtain clearances for existing underground utilities. The fieldwork was carried out between 12 June and 22 June 2017. The borehole locations and depths are described in Table 2.1 and the locations are shown in Figure No. 1.

Traffic control during the investigation was provided by Amec Foster Wheeler in accordance with the Ontario Traffic Manual – Temporary Conditions (Book 7).

The borehole locations were determined by Amec Foster Wheeler using a hand-held GPS device, and are shown on the Record of Boreholes. Ground elevations at the borehole locations were taken from the topographic survey map available for the project site. General details of the boreholes drilled during this investigation are provided in Table 2.1.

Table 2.1 – Borehole Schedule

Borehole No.	Approximate GPS Coordinates (UTM/NAD 83)		Approximate Station	Geodetic Ground Surface Elevation (m) [1]	Depth (m)	Purpose(s) of Borehole Information [2]
	Easting	Northing				
BH 1	597586	4832381	11+475	203.2	3.5	Pavement and underground utility
BH 2	597591	4832386	11+475	203.3	1.5	Pavement
BH 3	597564	4832412	11+425	203.1	1.5	Pavement
BH 4	597507	4832423	11+375	203.9	1.5	Pavement
BH 5	597504	4832423	11+375	203.8	1.5	Pavement
BH 6	597471	4832455	11+325	203.9	1.5	Pavement
BH 7	597454	4832502	11+275	204.0	1.5	Pavement
BH 8	597455	4832501	11+275	204.0	1.5	Pavement
BH 9	597423	4832537	11+225	204.2	1.5	Pavement
BH 10	597376	4832552	11+175	204.1	1.0	Pavement
BH 11	597372	4832550	11+175	204.0	1.5	Pavement
BH 12	597335	4832588	11+125	204.1	1.5	Pavement
BH 13	597316	4832640	11+075	202.3	3.5	Pavement and underground utility
BH 14	597319	4832640	11+075	202.7	1.5	Pavement
BH 15	597289	4832669	11+025	200.0	1.5	Pavement
BH 16	597225	4832709	10+075	193.0	1.5	Pavement
BH 17	597223	4832706	10+075	193.0	1.5	Pavement

Borehole No.	Approximate GPS Coordinates (UTM/NAD 83)		Approximate Station	Geodetic Ground Surface Elevation (m) [1]	Depth (m)	Purpose(s) of Borehole Information [2]
	Easting	Northing				
BH 18	597191	4832741	10+925	188.3	1.5	Pavement
BH 19	597166	4832785	10+875	185.2	1.5	Pavement
BH 20	597174	4832791	10+875	182.6	1.5	Pavement
BH 21	597130	4832826	10+825	183.0	1.5	Pavement
BH 22	597087	4832845	10+775	183.3	1.5	Pavement
BH 23	597085	4832842	10+775	183.4	5.2	Pavement and underground utility
BH 24	597052	4832869	10+725	182.9	1.5	Pavement
BH 25	597041	4832910	10+675	183.2	3.5	Pavement and underground utility
BH 26	597042	4832912	10+675	183.1	1.6	Pavement
BH 27	596990	4832967	10+625	182.9	1.5	Pavement
BH 28	596949	4832987	10+575	183.1	5.0	Pavement and underground utility
BH 29	596942	4832985	10+575	183.1	1.5	Pavement
BH 30	596903	4833017	10+525	183.3	1.7	Pavement
BH 31	596886	4833070	10+475	183.6	1.5	Pavement
BH 32	596881	4833067	10+475	183.7	1.5	Pavement
BH 33	596846	4833106	10+425	184.0	1.5	Pavement
BH 34	596792	4833139	10+375	-	-	Same location as Borehole BH B3. Not drilled separately
BH 35	596788	4833138	10+380	184.5	1.5	Pavement
BH 36	596725	4833205	10+275	185.3	1.5	Pavement
BH 37	596743	4833207	10+280	-	-	Same location as Borehole BH B1. Not drilled separately
BH 38	596746	4833212	10+280	185.4	2.1	Pavement
BH 39	596711	4833247	10+225	187.5	1.5	Pavement
BH 40	596663	4833293	10+175	192.6	1.5	Pavement
BH 41	596665	4833281	10+175	191.4	1.5	Pavement
BH 42	596602	4833362	10+125	200.3	1.5	Pavement
BH B1	596743	4833207	10+280	185.4	12.3	Bridge Widening
BH B2	596730	4833209	10+275	185.7	14.3	Bridge Widening
BH B3	596792	4833139	10+370	184.9	11.1	Bridge Widening

Borehole No.	Approximate GPS Coordinates (UTM/NAD 83)		Approximate Station	Geodetic Ground Surface Elevation (m) [1]	Depth (m)	Purpose(s) of Borehole Information [2]
	Easting	Northing				
BH B4	596806	4833143	10+380	184.9	11.6	Bridge Widening
BH B5	596768	4833155	10+385	180.4	3.0	Bridge Widening
BH B6	596757	4833206	10+290	185.1	6.2	Bridge Widening
BH R1	597319	4832643	11+075	204.3	8.1	Retaining wall
BH R2	597291	4832673	11+030	204.3	8.1	Retaining wall

Notes:
(1) Based on topographic survey map for the project site.
(2) Boreholes for pavement only were sampled without Standard Penetration Test (SPT).

The boreholes were advanced using solid-stem continuous-flight augers with truck-mounted and track-mounted power-auger drill rigs, equipped with an automatic hammer, supplied and operated by Drilltech Drilling Ltd. of Newmarket, Ontario. Borehole BH B5 located at the toe of a slope (which was inaccessible to a drill rig) was advanced by using hand-drilling method.

All boreholes drilled for sub-surface investigation for bridge widening / retaining walls / underground utilities were sampled while performing Standard Penetration Test (SPT) in accordance with ASTM D1586. Boreholes drilled solely for pavement investigation were drilled (augered) without SPT and samples were taken from auger cuttings.

Soil samples in the boreholes (with SPT) were collected at 0.76 m interval up to a depth of about 3.0 m, and at 1.5 m interval thereafter, while performing the SPT. The SPT consisted of freely dropping a 63.5 kg (140 lb) hammer for a vertical distance of 0.76 m (30 inches) to drive a 50 mm (2 inch) diameter O.D. split-spoon sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively-undisturbed ground to a vertical distance of 0.30 m (12 inches) was recorded as the SPT 'N' value of the soil which implied the consistency of cohesive soils and indicated the compactness of non-cohesive soils. For the borehole (BH B5) advanced using hand-drilling technique with SPT, a 31.75 kg (70 lb) was used and the number of blows of the hammer required for a penetration of 0.30 m was divided by 2 to obtain the SPT 'N" value of the soil.

The groundwater conditions, where encountered in the open boreholes, were observed throughout the drilling operations. Prior to backfilling, freestanding groundwater level was measured, if present, in each borehole. The measured groundwater conditions are shown on the Record of Boreholes.

A monitoring well was installed in two boreholes (BH B3 and BH B4) for hydrogeological investigation, the findings of which are presented in a separate report.

Upon completion of drilling, the boreholes without monitoring well were backfilled in accordance with the general requirements of Ontario Regulation 903.

A visual pavement condition survey of the existing road surface was carried out to evaluate the existing condition. Falling Weight Deflectometer (FWD) tests were performed to evaluate the current structural capacity of the existing pavement structure. Exp Services Incorporated ('Exp') was retained by Amec Foster Wheeler to conduct the FWD tests and provide analysis. Selected photographs showing the existing road condition and the results of FWD tests are included in Appendix A.

Soil samples were transported to Amec Foster Wheeler's Advanced Soil Laboratory in Scarborough for further review and laboratory testing (i.e., water content determination, grain size distribution analysis and Atterberg Limit test, where applicable). The soil conditions, groundwater levels, and the results of the in-situ and laboratory tests are presented on the corresponding Record of Boreholes. The laboratory test results are presented in Appendix B.

Upon recovery, selected soil samples were screened to assess for evidence of potential contamination, which included visual inspections. Samples were tested in the field for combustible gases using a portable detector (RKI Eagle 2). The results are presented on the Record of Boreholes. Selected soil samples were transported to AGAT laboratories, an accredited CAEL laboratory located in Mississauga for soil chemical analysis. The Certificates of Analyses for the soil chemical analyses are included in Appendix C.

Two (2) selected soil samples were submitted to AGAT Laboratories for corrosivity analysis (pH, soluble chloride, soluble sulphate, electrical conductivity and resistivity). The laboratory Certificates of Analysis are included in Appendix C.

2.2 Geotechnical Investigation

The boreholes drilled specifically for each planned work / structure are addressed in this section. All boreholes drilled are listed in Tables 2.1 and 2.3.

2.2.1 Road Widening

The investigation program for road widening is described in Section 2.3 (Pavement Investigation).

2.2.2 Bridge Widening

Six (6) boreholes (BH B1 to BH B6) as listed in Table 2.1 were drilled in the vicinity of the existing bridge over Credit River to obtain subsurface information for the proposed widening of the bridge.

2.2.3 Retaining Walls

Two (2) boreholes (BH R1 and BH R2) were drilled at the planned location of Retaining Wall No. 1 (Figure No. 1) to obtain subsurface information for design. The boreholes were drilled from the top of the existing slope (within the road right-of-way). For the planned Retaining Wall Nos. 2 and 3, the subsurface information from the boreholes located closest to the retaining wall alignments were utilized as listed in Table 2.2.

Table 2.2 - Boreholes for Retaining Wall Design

Structure	Approximate Station	Approximate Retaining Wall Height (m)	Approximate Retaining Wall Length (m)	Borehole Number
Retaining Wall No. 1	10+990 to 11+090	3	100	BH R1 and BH R2
Retaining Wall No. 2	11+050 to 11+080	2	30	BH 13, BH 14
Retaining Wall No. 3	10+380 to 10+470	5 to 6	90	BH B5 (TOS), BH B4, BH 33, BH 32, BH 31

2.2.4 Underground Utilities

A total of five (5) boreholes (BH 1, BH 13, BH 23, BH 25 and BH 28) were drilled to depths varying from 3.5 m to 5.0 m to obtain additional subsurface information for installation / replacement of underground utilities.

2.3 Pavement Investigation

A total of forty (40) boreholes (BH 1 to BH 42, except BH 34 and BH 37) were drilled for pavement investigation to depths ranging from 1.0 to 2.1 m below existing grade. As noted in Table 2.1, due to proximity to Boreholes BH B3 and BH B1, Boreholes BH 34 and BH 37 were not drilled separately. The pavement boreholes were drilled approximately at 50 m spacing on alternating sides of road centerline in pairs, consisting of one borehole on mid-driving lane (MDL) or edge of pavement (EP), and one borehole on mid-shoulder (MSH) or shoulder rounding (SHR) or toe of slope (TOS). The borehole locations on the road sections and depths are presented in Table 2.3 and the borehole locations are shown in Figure No. 1.

Table 2.3 - Boreholes for Pavement and Geotechnical Investigation

Planed Structure	Location	No. of Boreholes	Borehole No.	Depth (m)
Mississauga Road Widening	Mid-driving Lane (MDL)	6	BH 1*, BH 10**, BH 13*, BH 22, BH 25*, BH 28*	1.0 to 5.0
	Edge of Pavement (EP)	6	BH 6, BH 7, BH 16, BH 18, BH 19, BH 40	1.5
	Mid-shoulder / Shoulder Rounding (MSH / SHR)	14	BH 2, BH 4, BH 9, BH 11, BH 14, BH 21, BH 23*, BH 26, BH 30, BH 31, BH 33, BH 35, BH 38, BH 42	1.5 to 5.2
	Toe of Slope (TOS)	14	BH 3, BH 5, BH 8, BH 12, BH 15, BH 17, BH 20, BH 24, BH 27, BH 29, BH 32, BH 36, BH 39, BH 41	1.5
Bridge at Credit River	Mid-driving Lane / Toe of Slope (MDL/TOS)	6	BH B1*, BH B2*, BH B3*, BH B4*, BH B5*, BH B6*	3.0 (TOS) to 14.3
Retaining Walls	Top of Slope	2	BH R1*, BH R2*	8.1
Total Number of Boreholes		**48**		

Notes:
* Geotechnical boreholes with SPT sampling.
** Borehole BH 10 stopped at 1.0 m below ground surface due to refusal on concrete.

The pavement boreholes were augered through the asphaltic concrete pavement, where present, using truck and track-mounted drill rigs with solid-stem augers and/or hollow stem augers. Soil samples were obtained from the auger cuttings recovered from the boreholes without Standard Penetration Test (SPT), except for the geotechnical boreholes, in which the samples were obtained while performing SPT. The boreholes with SPT are shown in the Record of Boreholes. Borehole (BH B5) located at the toe of slope was advanced using manual drilling method due to inaccessibility for a drill rig. All boreholes were advanced under the oversight of Amec Foster Wheeler's personnel.

Boreholes, not fitted with monitoring wells, were backfilled in accordance with the general requirements of Ministry of the Environment and Climate Change (MOECC) Regulation 903, and road surface at the boreholes drilled through asphaltic concrete were patched with cold mix asphalt concrete and compacted.

The recovered soil samples were transported to Amec Foster Wheeler's geotechnical laboratory in Scarborough for visual examination, classification and laboratory testing. Borehole information prepared using terminology as per OPSD 100.060 for the pavement boreholes is presented in Borehole Log Data (Pavement Investigation), while the geotechnical borehole information is presented in the Record of Boreholes (Geotechnical Investigation).

3.0 ROAD WIDENING

Mississauga Road is proposed to be widened from the existing 4-lane road to a 6-lane road, with one additional lane (about 4 m wide) in each direction, within the investigation limits. The road widening will include cut and fill areas, with embankment height up to a maximum of about 6 m, and cut slope height up to a maximum of about 4 m.

A total 40 boreholes were drilled along alignment within the investigation limits to investigate the sub-surface and pavement structure condition, out of which five (5) of the boreholes (BH 1, BH 13, BH 23, BH 25 and BH 28) were drilled deeper (3.5 m to 5.2 m deep) than the rest of the boreholes, which were drilled to a depth of about 1.5 m for pavement investigation. SPT was carried out in the deeper boreholes, while the shallower boreholes were sampled from auger cutting (without SPT).

Additional boreholes drilled were for bridge foundations (BH B1 to B6) and retaining walls (BH R1 and BH R2). Bridge foundation and retaining walls are discussed Section 4.0 (Bridge over Credit River) and Sections 5.0 to 7.0 (Retaining Wall Nos. 1 to 3), respectively.

Proposed widening work may include installation of new underground utilities (storm sewer) and / or replacement of existing underground utilities, which is discussed in Section 8.0.

Pavement design is discussed in Section 10.0 (Pavement Investigation and Design).

The sub-surface conditions and geotechnical recommendations for road widening are discussed in the following sections.

3.1 Sub-surface Conditions

Based on the soil conditions encountered in the deeper boreholes drilled along the road alignment (BH 1, BH 13, BH 23, BH 25, BH 28, BH B1 (for BH 37) and BH B3 (for BH 34)), fill soils (sand and gravel, gravelly sand, sand, silty sand, sandy clayey silt, silty clay/clayey silt) were encountered below the surficial asphaltic concrete. The fill soils were underlain by natural deposits of sand and gravel, sandy gravel, sand, silty sand / sandy silt, silty sand / sandy silt till, silty clay / clayey silt till and/or weather shale. Weathered shale was encountered in BH B3 at a depth of about 10.7 m, but is not relevant for road widening. Groundwater was encountered in all boreholes upon completion of drilling, except in Borehole BH 13 which was dry.

The stratigraphic units and groundwater conditions are discussed in the following sections, and are presented in the Record of Boreholes. The following summary is to assist the designers of the project with an understanding of the soil conditions encountered at the investigated road section. The soil and groundwater conditions may vary between and beyond the borehole locations.

3.1.1 Asphaltic Concrete

The boreholes were generally drilled through the existing paved driving lanes, except Borehole BH 23 which was drilled on the shoulder. Asphaltic concrete encountered at the borehole locations varied in thickness from about 100 mm to 200 mm.

3.1.2 Fill Soils

Fill soils were encountered in all boreholes to depths varying from 2.1 m in BH 1 to the maximum depth of 5.6 m in Boreholes BH B1 and BH B3. The fill soils generally consisted of sand and gravel, gravelly sand, sand, silty sand fill ("non-cohesive fill") and/or sandy clayey silt, silty clay/clayey silt fill ("cohesive fill").

The non-cohesive fill was brown, dark brown, reddish brown and grey in colour, and contained trace to some clay, trace cobbles, with organic matter / wood chips / silty clay pockets. SPT 'N' values measured within the non-cohesive fill varied from 1 to over 50 blows per 0.3 m. Water contents measured in the non-cohesive fill samples varied from 3 % to 13 %.

The cohesive fill was brown in colour and contained trace gravel, with sand pockets. SPT 'N' values measured within the cohesive fill were 7 and 20 blows per 0.3 m. Water contents measured in the cohesive fill samples were 13 % and 15 %.

3.1.3 Silty Sand / Sandy Silt / Sand

Natural deposit of silty sand / sandy silt / sand was encountered in Boreholes BH 1, BH 13, BH 23 and BH B1, underlying the fill soils, and extended to depths ranging approximately from 3.0 m to 11.5 in Boreholes BH 23 and BH B1, respectively and to the termination depth of 3.5 m below the existing ground surface in Boreholes BH 1 and BH 13.

The silty sand / sandy silt / sand was brown, reddish brown and/or brownish grey in colour, and contained trace to some clay, some gravel, trace cobbles, with organic matter. SPT 'N' values measured in the silty sand / sandy silt / sand ranged from 9 to more than 50 blows per 0.3 m, indicating loose to very dense compactness. Water contents measured in the silty sand / sandy silt / sand were 11 % and 14 %.

Grain size analysis and Atterberg Limit test were completed on one selected sample of the silty sand from Borehole BH B1, the results of which are presented in Table 3.1 and shown in the Record of Boreholes.

Table 3.1 - Results of Grain Size Distribution Analysis and Atterberg Limits (Silty Sand)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				Atterberg Limits			USCS Modified Group Symbol
			Gravel	Sand	Fines		Liquid Limit	Plastic Limit	Plasticity Index	
					Silt	Clay				
			(%)	(%)	(%)	(%)				
BH B1	SS 10	10.7	14	53	25	8	15	11	4	SM

The grain size distribution curve is presented in Figure No. B1, and the corresponding Plasticity Chart is presented in Figure No. B2, in Appendix B.

3.1.4 Sandy Gravel / Gravelly Sand / Sand and Gravel

Natural sandy gravel / gravelly sand / sand and gravel was encountered in Boreholes BH 23, BH 25 and BH B1, underlying the fill soils, and extended to depths approximately 3.5 m and 5.2 m below existing ground surface (termination depth at Boreholes BH 25 and BH 23, respectively), and 10.0 m below the existing ground surface in Borehole BH B1.

The sandy gravel / gravelly sand / sand and gravel was brown, reddish brown and/or greyish grey in colour, and contained trace clay, some silt, trace cobbles and boulders. SPT 'N' values measured in the sandy gravel / gravelly sand / sand and gravel ranged from 31 to more than 50 blows per 0.3 m, indicating dense to very dense compactness. Water contents measured in the sandy gravel / gravelly sand / sand and gravel varied from 11 % to 15 %.

Grain size analysis was completed on one selected sample of the gravelly sand from Borehole BH B1, of which the results are presented in Table 3.2 and shown in the Record of Boreholes.

Table 3.2 - Results of Grain Size Distribution Analyses (Gravelly Sand / Sand and Gravel)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				USCS Modified Group Symbol
			Gravel	Sand	Fines		
					Silt	Clay	
			(%)	(%)	(%)	(%)	
BH B1	SS 7	6.1	32	50	15	3	SM

The grain size distribution curve is presented in Figure No. B3, in Appendix B.

3.1.5 Silty Sand / Sandy Silt Till

Natural deposit of silty sand / sandy silt till was encountered in Borehole BH 28, underlying the fill soils, and extended to the termination depth of 5.0 m below the existing ground surface.

The silty sand / sandy silt till was greyish brown in colour, and contained trace clay, some gravel to gravelly, cobbles and boulders. SPT 'N' values measured in the silty sand / sandy silt till were more than 50 blows per 0.3 m, indicating very dense compactness.

3.1.6 Silty Clay / Clayey Silt Till

Natural deposit of silty clay / clayey silt till was encountered in Boreholes BH B1 and BH B3, underlying the fill soils and natural silty sand, and extended to an approximate depth of 10.7 m below the existing ground surface in Borehole BH B3 and to the termination depth of 12.3 m in Borehole BH B1.

The silty clay / clayey silt till was greyish brown and reddish brown in colour, and contained some sand to sandy, trace gravel and cobbles, with shale and limestone fragments. SPT 'N' values measured in the silty clay / clayey silt till were over 50 blows per 0.3 m, implying hard consistency. Water contents measured in the silty clay / clayey silt till ranged from 8 % to 14 %.

Grain size analysis and Atterberg Limit test were completed on one selected sample of the silty clay / clayey silt till from Borehole BH B3, of which the results are presented in Table 3.3 and shown in the Record of Boreholes.

Table 3.3 - Results of Grain Size Distribution Analyses and Atterberg Limit Test (Silty Clay / Clayey Silt Till)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				Atterberg Limits			USCS Modified Group Symbol
			Gravel (%)	Sand (%)	Fines		Liquid Limit	Plastic Limit	Plasticity Index	
					Silt (%)	Clay (%)				
BH B3	SS 8	6.1	6	39	43	12	22	13	9	CL

The grain size distribution curve is presented in Figure No. B4, and the corresponding Plasticity Chart is presented in Figure No. B2, in Appendix B.

3.1.7 Weathered Shale

Grey weathered shale (Queenston Formation), which could be augered through, was encountered below the silty clay / clayey silt till, and extended to the termination depth of Borehole BH B3 where auger refusal was encountered.

SPT 'N' value measured in the weathered shale was greater than 50 blows per 0.3 m, implying hard consistency.

3.1.8 Groundwater Conditions

The groundwater conditions in the open boreholes were monitored throughout the drilling operations and measured upon completion of drilling. Groundwater was encountered in all boreholes upon completion of drilling, except in Borehole BH 13, which was dry.

A monitoring well (50 mm diameter PVC pipe) was installed at the location of Borehole BH B3, for subsequent groundwater level measurements. The results of groundwater level measurements are shown in Table 3.4 and on the Record of Boreholes.

Table 3.4 - Measured Groundwater Depths

Borehole No.	Groundwater Depth at Completion of Drilling (Geodetic Elevation) (m)	Groundwater Depth in Monitoring Wells (Geodetic Elevation) (m)	Groundwater Depth in Monitoring Wells (Geodetic Elevation) (m)	Groundwater Depth in Monitoring Wells (Geodetic Elevation) (m)
	13 to 19 June 2017	21 September 2017	25 September 2017	2 October 2017
BH 1	2.4 (201.7)	Not installed	Not installed	Not installed
BH 13	Dry (-)	Not installed	Not installed	Not installed
BH 23	2.3 (181.3)	Not installed	Not installed	Not installed
BH 25	2.1 (181.2)	Not installed	Not installed	Not installed
BH 28	2.4 (180.6)	Not installed	Not installed	Not installed
BH B1	4.3 (181.1)	Not installed	Not installed	Not installed
BH B3	4.4 (180.5)	4.9 (180.0)	5.4 (179.5)	5.4 (179.5)

Note: Groundwater depth measured from the existing ground surfaces.

It should be noted that the groundwater could fluctuate seasonally or with river water level and can be higher during the spring months and in response to major weather events.

3.2 Discussions and Recommendations for Road Widening

The overall subsurface soil profile encountered within drilled geotechnical boreholes consisted of surficial asphaltic concrete underlain by fill soils overlying natural deposits (sand and gravel, sandy gravel, sand, silty sand / sandy silt, silty sand / sandy silt till, silty clay / clayey silt till) and/or weathered shale. Weathered shale was encountered in BH B3 at a depth of about 10.7 m below ground surface. The existing fill soils at some locations were in very loose conditions, e.g., in the vicinity of Borehole BH 28 to a depth of about 3.1 m below the existing ground surface, and in firm

conditions in the vicinity of Boreholes BH B3 and BH B1 to depths of approximately 4.0 m and 5.6 m, respectively. Groundwater was encountered in all boreholes upon completion of drilling except in Borehole BH 13, which was dry.

The proposed road widening will involve both fill and cut sections along the investigation limits. Some road sections will require cut of existing slopes, including construction of a retaining wall, where the road right-of-way (ROW) does not permit construction of a slope. The embankment / cut slope heights within the investigation limits vary from 0 m to a maximum of about 6 m, including at the bridge. Retaining walls are discussed in Sections 5.0 to 7.0.

The embankment required for road widening should be constructed with compacted engineered fill at 2H:1V (or flatter) side slopes. Similarly, the cut areas should also be constructed at a slope of 2H:1V or flatter, subject to slope stability analysis. If a steeper than 2H:1V slope is required or if the height of the embankment / cut slope is greater than 4.5 m, slope stability analysis should be carried out to assess stability of the planned slope.

Generally, underground utilities and manholes / catch basins may be founded on the natural soils and/or engineered fill (if required). Any loose / soft soils found during construction should be replaced with engineered fill and/or re-compacted to support road pavement structure and underground utilities.

3.2.1 Site Preparation for Road Widening

The widening of Mississauga Road from 4 to 6 lanes will require, as a minimum, stripping the existing ground surface cover (topsoil, asphaltic concrete, vegetation cover, surficial fill soils, etc.) from the area required for road widening. As per information available, planned widening will generally be constructed in the same elevation as the existing road surface, except in some locations. Some cut and fill work would be required, e.g., stripping, cutting into road side slope, filling up side road ditches. Grading should follow OPSS 206 (Construction Specification for Grading) or the Region's requirements.

Backfilling, if required, for site grading (e.g., for subgrade raise, replacement of soft soil) should be placed as engineered fill. Engineered fill may be used to replace soft/incompetent soils and/or raising grade. Engineered fill should be prepared according to the Region' standards / contract specifications. Guidelines for engineered fill are included in Section 11.2.

Grading, backfilling and compacting should be carried out in accordance with Region's Standards and / or OPSS 401 (Construction Specification for Trenching, Backfilling and Compacting), OPSS 501 (Construction Specification for Compacting) and / or OPSS 206 (Construction Specification for Grading), as applicable.

3.2.2 Embankment Widening

The widening work to accommodate new lanes will require filling over existing embankment slope and beyond. Based on available information, the maximum height of the embankment slope would be about 6 m, including the area close to the bridge (bridge approach areas). High embankments were present on the east of road between Station 10+900 to 11+000, and in the vicinity of the bridge. A retaining wall is planned on the southeast side of the bridge over Credit River (discussed in Section 7.0). Embankment at the bridge approach areas is described in Section 4.0. The embankment should be constructed with a side slope of 2H:1V (or flatter).

For the high fill areas (height greater than 4.5 m), additional geotechnical investigation and/or slope stability analysis may be required. If a slope steeper than 2H:1V is required, slope stability analysis should be carried out to confirm long term stability of the slope.

Care should be exercised to minimize disturbance to the subgrade during preparation and the construction of embankment. Widening of existing embankments should be in accordance with the Region's requirement and/or OPSD - 208.010 (Benching of Earth Slopes). The embankment construction should be in accordance with OPSS 501 (Construction Specification for Compacting).

The fill soils used for embankment widening should consist of approved clean fill (e.g., Select Subgrade Materials - OPSS 1010).

3.2.3 Cut Slope Above Road Surface

The widening work will also require cutting into existing slopes in the section between Station 11+000 to 11+100. Based on available information, the maximum height of the cut slope would be about 4 m. A high cut area (with maximum existing height about 4 m) is located on the east side of the road, for which a retaining wall (Retaining Wall No. 1) is planned. Similarly, a new retaining wall (Retaining Wall No. 2) is planned for the west side of the road (approximate Station 11+050 to 11+080). There is an existing approximately 2 m high gabion retaining wall in this section. The heights of the planned walls should be constructed to match the ground elevation of the slopes, where possible. Retaining walls are discussed in Sections 5.0 and 6.0.

New cut areas without retaining walls should be constructed at a slope of 2H:1V or flatter, subject to slope stability analysis, if the top of the cut slope does not extend beyond the right-of-way. Otherwise, a retaining wall will be required. The retaining wall should be designed to support the slope above the wall and the type of retaining wall should consider construction method. Boreholes may be required to determine the soil conditions for the slope to be retained and slope stability analysis may be required.

4.0 BRIDGE OVER CREDIT RIVER

The existing bridge (Huttonville Bridge) over Credit River is a three-span concrete structure, consisting of concrete deck slab placed over girders supported by two piers and abutments. The existing structure (about 18.3 m wide and 76.9 m long) carries four lanes of Mississauga Road (two in each direction), with sidewalks on both sides of the bridge. Based on the as-built drawings, the abutments and piers are founded on spread / strip footings at an approximate elevation of 177 m to 178 m. The bearing capacity value used for design was not shown on the as-built drawings. It is to be noted that there is an existing watermain running close to the bridge foundation along the west side of the bridge, which should be taken into account for the design and construction of the widening.

The existing bridge is planned to be replaced with a new wider and longer three-span bridge (about 27.2 m wide and 103.0 long) which will include six lanes (three lanes in each direction), 1.5 m wide shoulder on both sides bridge, a 3.0 m wide sidewalk on the east side and parapet walls on both sides of the bridge. The existing bridge is planned to be completely demolished. The road grade at the bridge location is planned to be raised by about 2.0 m (from about Elevation 185 m to about 187 m). The existing piers / abutments will not be used for the new bridge, as the new piers / abutments are planned to be constructed at different locations.

The geotechnical investigation program conducted consisted of drilling a total of six (6) boreholes (BH B1 to BH B6) on both sides of the existing bridge location as shown in Figure No. 1. Four boreholes (BH B1 to BH B4) were drilled to auger refusal from the existing road surface to termination depths of 11.1 m to 14.3 m. The remaining two boreholes (BH B5 and BH B6) were drilled at or close to the toe of the existing embankment at the south and north ends of the bridge. The soil profiles are shown in Record of Boreholes and the laboratory test results are presented in Appendix B.

The abutments and the piers at the areas to be widened of the structure can be founded on deep foundation (driven piles or augered cast-in-place caissons) or spread / strip footings. Construction of spread / strip footings, if founded at similar elevation as the existing bridge, will require excavation of minimum of about 2 m below river bed at the pier locations, and about 4 m below the existing ground surface at the abutments. Deep foundations should be founded within the weathered shale. All foundations for new abutments and piers should be the same type, without the mixed use of deep and shallow foundations.

Based on the planned footing locations, construction of the piers may require partial diversion of the river water away from the work zone. A temporary river dyke (or similar) may be used for the diversion.

The sub-surface conditions and geotechnical recommendations for design and construction of the bridge footing are discussed in the following sections.

4.1 Sub-surface Conditions

Based on the soil conditions observed in the boreholes drilled for the bridge (BH B1 to BH B6), the subsurface profile at the bridge location generally consisted of non-cohesive fill (i.e., sand and gravel, sandy gravel, gravelly sand, sand, silty sand), and/or cohesive fill (i.e., silty clay / clayey silt, sandy clayey silt), underlying topsoil or asphaltic concrete. Natural sand and gravel, silty clay / clayey silt till and/or weathered shale were encountered underlying the fill soils in all boreholes.

The stratigraphic units and groundwater conditions at the bridge location are presented in the Record of Boreholes (Geotechnical Investigation). The following summary is to assist the designers of the project with an understanding of the soil conditions encountered at the bridge location. The soil and groundwater conditions may vary between and beyond the borehole locations.

4.1.1 Surficial Cover – Asphaltic Concrete

At Boreholes BH B1 to BH B4, which were drilled through the existing pavement, the asphaltic concrete thickness encountered at the road surface varied from about 150 mm to 300 mm.

4.1.2 Surficial Cover – Topsoil

At Borehole BH B5, 120 mm thick topsoil was encountered below ground surface.

4.1.3 Fill Soils

Fill soils were encountered below the asphaltic concrete, topsoil or at the ground surface. The fill soils were encountered at the ground surface in Borehole BH B6. The fill soils consisted of non-cohesive fill (i.e., sand and gravel, sandy gravel, gravelly sand, sand, silty sand), and/or cohesive fill soils (i.e., silty clay / clayey silt, sandy clayey silt) and extended to depths varying from about 1.8 m below the existing ground surface in Borehole BH B5 to about 5.6 m below ground surface at Boreholes BH B1 to BH B4 and BH B6.

The non-cohesive fill soils (sand and gravel, sandy gravel, gravelly sand, sand, silty sand fill) were brown, dark brown, greyish brown and/or reddish brown in colour and contained trace to some clay, trace cobbles, with silty clay / clayey silt pockets, and rootlets and organic matters in Borehole BH B5. SPT 'N' values measured within the non-cohesive fill ranged from 3 to 50 blows per 0.3 m. Water contents measured in the non-cohesive fill ranged from 3 % to 13 %.

The cohesive fill *(*silty clay / clayey silt, sandy clayey silt fill) were brown, dark brown and reddish brown in color and contained some sand to sandy, with sand pockets. SPT 'N' values measured within the cohesive fill soils ranged from 6 to 20 blows per 0.3 m. Water contents measured in the cohesive fill soil samples ranged from 13 % to 16 %.

Grain size analyses were completed on two (2) selected samples of the sand / sandy gravel fill from Boreholes BH B2 and BH B6, respectively, the results of which are presented in Table 4.1 and shown in the Record of Boreholes.

Table 4.1 - Results of Grain Size Distribution Analyses (Sand / Sandy Gravel Fill)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				USCS Modified Group Symbol
			Gravel	Sand	Fines		
					Silt	Clay	
			(%)	(%)	(%)	(%)	
BH B2	SS 5	3.1	9	71	16	4	SM
BH B6	SS 6	4.6	68	25	7		GW

The grain size distribution curves are presented in Figure No. B5, in Appendix B.

4.1.4 Sand and Gravel / Gravelly Sand

Natural sand and gravel / gravelly sand was encountered in Boreholes BH B1, BH B2, BH B5 and BH B6, underlying the fill soils. The sand and gravel / gravelly extended to approximate depths of 10.0 m and 11.5 m below existing ground surface in Boreholes BH B1 and BH B2 and to the termination depths of 3.0 and 6.2 m below existing ground surface in Boreholes BH B5 and BH B6, respectively.

The sand and gravel / gravelly sand was brown, reddish brown and/or reddish brown in colour, and contained trace clay, trace to some silt, trace cobbles, with organic matter. SPT 'N' values measured in the sand and gravel ranged from 32 to more than 50 blows per 0.3 m, indicating very dense compactness. Water contents measured in the sand and gravel varied from 5 % to 15 %.

Grain size analyses were completed on two (2) selected samples of the gravelly sand / sand and gravel from Boreholes BH B1 and BH B2, the results of which are presented in Table 4.2 and shown in the Record of Boreholes.

Table 4.2 - Results of Grain Size Distribution Analyses (Gravelly Sand / Sand and Gravel)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				USCS Modified Group Symbol
			Gravel	Sand	Fines		
					Silt	Clay	
			(%)	(%)	(%)	(%)	
BH B1	SS 7	6.1	32	50	15	3	SM
BH B2	SS 7	6.1	35	40	19	6	SM

Grain size distribution curves are presented in Figure No. B3, in Appendix B.

4.1.5 Silty Sand

Natural silty sand deposit was encountered in Borehole BH B1 underlying the sand and gravel, and extended to an approximate depth of 11.5 m below existing ground surface.

The silty sand was brown and/or brownish grey in colour, and contained trace clay, some gravel, trace cobbles. A SPT 'N' value measured in the silty sand was more than 50 blows per 0.3 m, indicating a very dense compactness. A water content measured in the silty sand was 11 %.

Grain size analysis and Atterberg Limit test were completed on one selected sample of the silty sand from Borehole BH B1, the results of which are presented in Table 3.1 (Section 3.1.3) and shown in the Record of Boreholes.

4.1.6 Silty Clay / Clayey Silt Till

Natural silty clay / clayey silt till was encountered in Boreholes BH B1 to BH B5 underlying the fill soils and natural silty sand / sand and gravel, and extended to depths varying from about 7.2 m to 13.0 m below existing ground surface in Boreholes BH B2 to BH 4, or to the termination depths in Boreholes BH B1 and BH B5.

The silty clay / clayey silt till was greyish brown and/or reddish brown in colour, and contained trace sand to sandy, trace gravel and cobbles, with shale and limestone fragments. SPT 'N' values measured within the silty clay / clayey silt till were greater than 50 blows per 0.3 m, implying hard consistency. Water contents measured in the silty clay / clayey silt till ranged from 7 % to 14 %.

Grain size analyses and Atterberg Limit tests were completed on two (2) selected samples of the silty clay / clayey silt till from Boreholes BH B3 and BH B4, the results of which are presented in Table 4.3 and are shown in the Record of Boreholes.

Table 4.3 - Results of Grain Size Distribution Analyses and Atterberg Limit Test (Silty Clay / Clayey Silt Till)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				Atterberg Limits			USCS Modified Group Symbol
			Gravel (%)	Sand (%)	Fines		Liquid Limit	Plastic Limit	Plasticity Index	
					Silt (%)	Clay (%)				
BH B3	SS 8	6.1	6	39	43	12	22	13	9	CL
BH B4	SS 7	6.1	3	32	49	16	27	16	11	CL

Grain size distribution curves are presented in Figure No. B4, and the corresponding Plasticity Chart is presented in Figure No. B2, in Appendix B.

4.1.7 Weathered Shale

Weathered shale was encountered below the natural silty clay / clayey silt till, and extended to the auger-refusal depths in Boreholes BH B2 to BH B4.

The weathered shale was reddish brown and/or grey in colour and contained limestone fragments.

SPT 'N'-values measured in the weathered shale were greater than 50 blows per 0.3 m, implying hard consistency. Measured water contents in the weathered shale samples varied from 7 % to 14 %.

4.1.8 Groundwater Conditions

Groundwater conditions were observed during and on completion of drilling in the borehole. Freestanding groundwater was encountered in Boreholes BH B1 to BH B3 and BH B6 on completion of drilling. The groundwater depth measured upon completion of drilling varied from 1.8 m to 5.5 m below ground surface.

Monitoring well was installed at the location of Boreholes BH B3 and BH B4 for subsequent for hydrogeological study (report submitted separately). The results of groundwater level measurements are shown in Table 4.4 and on the Record of Boreholes.

Table 4.4 - Measured Groundwater Depths

Borehole No.	Groundwater Depth at Completion of Drilling (Geodetic Elevation) (m)	Groundwater Depth in Monitoring Wells (Geodetic Elevation) (m)	Groundwater Depth in Monitoring Wells (Geodetic Elevation) (m)	Groundwater Depth in Monitoring Wells (Geodetic Elevation) (m)
	14 to 19 June 2017	21 September 2017	25 September 2017	2 October 2017
BH B1	4.3 (181.1)	No monitoring well installed	No monitoring well installed	No monitoring well installed
BH B2	5.5 (180.2)	No monitoring well installed	No monitoring well installed	No monitoring well installed
BH B3	4.4 (180.5)	4.9 (180.0)	5.4 (179.5)	5.4 (179.5)
BH B4	Dry (-)	4.6 (180.3)	5.3 (179.5)	4.7 (180.2)
BH B5	Dry (-)	No monitoring well installed	No monitoring well installed	No monitoring well installed
BH B6	1.8 (183.2)	No monitoring well installed	No monitoring well installed	No monitoring well installed

Note: Groundwater depth measured from the existing ground surfaces.

It should be noted that the groundwater could fluctuate seasonally or with river water level and can be expected to be somewhat higher during the spring months and in response to major weather events.

4.2 Discussions and Recommendations for Bridge Widening

Mississauga Road, along with the Huttonville bridge over Credit River, is proposed to be widened to support six driving lanes. The existing bridge is a three-span structure with concrete deck (18.8 m wide and 76.9 m long) supported by girders resting on two piers and abutments. Based bridge rehabilitation drawings (Sheets S1 to S12, Plan No. 36914-D, dated Jan 2004), the original 18.3 m wide bridge deck slab had been replaced by the existing deck slab (18.8 m wide), which included sidewalks and parapet walls on both sides of the bridge.

From as-built drawings (Drawing Nos. 6705-1 to -10) provided by the Region, the existing abutments were founded on strip / spread footings at Elevation 178.4 m (north abutment) and 177.7 m (south abutment). Both pier strip / spread footings were founded at Elevation 177.4 m. The river bottom was at approximate Elevation 179.3 m. The bearing capacity used for the design of the existing footings was not shown in the drawings provided by the Region.

For the planned road widening project, the existing bridge is planned to be completely demolished and replaced with a new wider and longer bridge (27.2 m wide and 103.0 m long), which will include six driving lanes, 1.5 m wide shoulders on both sides, a 3 m wide sidewalk on east side and parapet walls on both sides. The road grade is also planned to be raised by about 2 m (existing approximate Elevation 185 m to about Elevation 187 m. The abutments of the planned bridge will be located further away for the river (than the existing footings). Similarly, both piers will also be located closer to the river banks (compared to existing piers).

Shallow foundation (strip / spread footing) or deep foundation (driven pile or augered cast-in-place caissons) are feasible. Similar type of footings should be used for all abutments and piers to prevent substantial differential settlement.

Construction of the new footings may require excavation of up to about 2 m below river bed at the piers, and up to about 6 m below the existing ground elevation at the abutments, depending the foundation type. For construction of the piers, river dyke (or similar) around the construction zone will be required to provide dry work area.

During detail design, slope stability analysis should be carried out for abutments, retaining wall(s) and/or side slopes at the abutments to assess long term slope stability.

The following discussions and recommendations are based on the available mentioned information and should be revised and/or supplemented, if and as necessary.

4.2.1 Shallow Foundations

Based on the soil profiles observed at the borehole locations, shallow foundation (strip / spread footings) founded on hard silty clay / clayey silt till and/or weathered shale are feasible. Recommended values for the geotechnical reaction at Serviceability Limit State (SLS) and the factored geotechnical resistance at Ultimate Limit State (ULS) at the borehole locations are provided in Table 4.5. If required, a detailed analysis can be carried out to confirm the capacities and corresponding settlement, once the footing design is available. The foundation design should be in accordance to the Canadian Highway Bridge Design Code (CHBDC).

Table 4.5 - Approximate Footing Depths with SLS and ULS for Strip / Spread Footings [(1)]

Founding Stratum	Depth Below Existing Road Surface (Elevation) (m)	Geotechnical Pressure Reaction at SLS [(2)] (kPa)	Factored Geotechnical Pressure Resistance at ULS[(2)] [(3)] (kPa)
Very Dense Sand and Gravel / Very Dense Gravelly Sand / Very Dense Silty Sand / Hard Silty Clay / Clayey Silt Till / Hard Weathered Shale	About 6 m & below (about 179 m & below)	400	600

[(1)] Recommended values are based on condition observed at the borehole locations (BH B1 to BH B6). If soil condition of lesser consistency or compactness is encountered at the footing locations, the subgrade should be sub-excavated to competent soil and backfilled with concrete up to the bottom of the footing elevation.
[(2)] Higher SLS/ULS values may be achievable, subject to detail foundation analysis.
[(3)] A resistance factor of $\Phi = 0.5$ has been applied to the ULS values provided.

For footings designed with the recommended SLS values, the total and differential settlements could be up to 25 mm and 20 mm, respectively. Detail foundation analysis should be carried out once the footing size and loads are available.

It is to be noted that there is an existing underground watermain crossing the river at the west side of the bridge, about 0.6 m west of the existing footings, at an elevation of about 178 m. Above ground existing cables and gas lines also cross the river, the support system for which are attached to the bridge soffit. All existing underground and over-ground utilities and structures should be considered for design of the bridge widening, and should be protected during construction.

During construction, the sand and gravel, silty sand, silty clay / clayey silt till or weathered shale subgrade should be protected (e.g. by placing mud slab or similar) against disturbance due to groundwater seepage and / or construction activities. Weathered shale, if exposed, should be protected immediately (with mud slab or similar), as shale can become soft or degraded after excavation and being exposed to the weather, especially if it comes in contact with surface water or there is groundwater seepage.

The design frost penetration for the City of Brampton is 1.2 m. Therefore, a permanent soil cover of at least 1.2 m or its equivalent synthetic thermal insulation is required for frost protection of foundations.

The excavations and dewatering consideration for the construction of bridge foundations are discussed in Section 4.2.5. General consideration for excavation and dewatering discussed in Section 11.3 should also be followed, as applicable.

4.2.2 Deep Foundations

Deep foundation, using driven piles or augered cast-in-place caissons, is a feasible option for abutments and piers (if accessible by a pile driving rig). Driving piles through the hard / dense to very dense soil is likely to be difficult. The deep foundation should be designed in accordance with the latest Canadian Foundation Engineering Manual.

4.2.2.1 Driven Piles

Driven steel piles (i.e., HP 310 x 110) may be considered with the following axial geotechnical forces:

Factored Axial Resistance at Ultimate Limit States	= 900 kN (including resistance factor = 0.4)

Based on the soil observed at the borehole locations, weathered shale was encountered at depths varying from 7.2 m to 13.0 m (Elevation 177.7 m to 172.7 m) below existing road level. The piles should be driven into the weathered shale. The factored ULS for pile shown above is conservative for pile tips within weathered shale in order to prevent pile damage. Piles should be embedded at least 1 m into the weathered shale. Minimum pile length should be specified by a structural engineer. The actual pile length will depend on the weathered shale conditions, the minimum pile length required and the pile driving criteria to achieve the pile capacity specified.

Accordingly, piles should be founded within weathered shale. Depths of weathered shale encountered in the boreholes are listed in Table 4.6, and in Record of Boreholes. Soil profile along the bridge is shown in Figure No. 2.

Table 4.6 – Approximate Depth and Elevation of the Top of Weathered Shale at Borehole Locations

Location	Approximate Depth Below Existing Ground Surface (m)	Approximate Geodetic Elevation (m)	Remarks
BH B1	12.3	173.1*	* Bottom of borehole, where auger refusal was encountered on possible shale.
BH B2	13.0	172.7	
BH B3	10.7	174.2	
BH B4	7.2	177.7	
BH B5	2.9	177.5	
BH B6	Below 6.2	Below 178.9	Weathered shale not encountered within borehole depth

The pile capacity provided could lead up to 10 mm of settlement of the pile group. If necessary, the pile group settlement should be calculated using the design pile group configuration.

If integral abutments are used, a 3.0 m long flexible zone may be required for piles (as per Ministry of Transportation of Ontario Structural Office Standard). The flexible zone consists of a space in between the driven pile and a concentric corrugated steel pipe (typically 600 mm diameter surrounding the H-pile. The space between the H-pile and the corrugated steel pipe is filled with uniform sand.

The top of the piles should be at or below the frost penetration depth of 1.2 m, unless designed for. Below the 1.2 m frost penetration depth, a modulus of horizontal subgrade reaction of 10 MN/m^3 for the fill and 20 MN/m^3 for the natural soil may be considered for lateral load resistance, if applicable. Soil resistances within the frost penetration depth should not be considered.

The spacing of the piles should not be closer than 2.5 times the pile size.

The pile capacity should be verified during pile driving, as a minimum, through the use of Hiley's Formula according to MTO's standards. If necessary, the pile capacity should be verified by conducting field tests, i.e., Pile Driving Analyzer and/or static pile load testing in accordance with ASTM procedures.

It should be noted that cobbles and/or boulders may be encountered within the soil / till strata.

4.2.2.2 Caissons

Augered cast-in-place caissons should be founded on hard weathered shale. Approximate elevations of weathered shale encountered at borehole location are shown in Table 4.6, may

be used if driven piles are not applicable. Approximate elevations of the weathered shale is also shown in the Figure No. 2 (soil profile along Huttonville Bridge). End bearing SLS value of 900 kPa and factored ULS value of 1100 kPa may be used for preliminary design. For the SLS value provided, the caissons could undergo a total settlement of up to 25 mm. The capacity of the caisson will depend of its depth and size, side friction and end bearing. For conservative design, side-resistances from the fill soils and the soils within the frost penetration depth should not be considered.

Minimum caisson depth should be specified by a structural engineer. Caissons should be embedded at least 1 m into the weathered shale.

The spacing of the caissons should not be closer than 2.5 times the caisson size. The top of caissons should be at or below the frost penetration depth of 1.2 m, unless designed for. Modulus of horizontal subgrade reactions provided in Section 4.2.2.1 may be considered for design of caissons. Other design parameters provided in Section 4.2.3 may be used, as applicable.

Steel liners and/or dewatering may be required during caisson construction. After inserting reinforcing steel cage in the caisson hole, concrete should be placed by tremie method, while pulling the steel liner out without necking.

Excavation and dewatering for the construction of the footings are discussed in Section 4.2.5.

4.2.3 Soil Parameters for Design

Soil parameters for design are provided in Table 9.1 (Section 9.0).

4.2.4 Approach Embankment

The maximum height of existing approach embankments to the bridge was about 5 m, at the southeast area of the bridge. As per the proposed plan, the road grade at the bridge is planned to be increased by about 2 m. However, as the planned bridge will be longer than the existing bridge, new abutments and piers will be located further away from the existing footings toward the shore. The maximum height of embankment at the new abutments may be similar to or slightly higher (about 6 m at the southeast area) than the existing embankment due to the grade raise. A retaining wall (Retaining Wall No. 3) is planned for the southeast area of the bridge, as discussed in Section 7.0 and as shown in Figure No. 1. For the rest of the approach areas, the soil condition, recommendation and discussions provided in Section 3.0 (Road Widening) should be considered. The new embankment slopes should be constructed at a slope of 2H:1V or flatter. For high embankments (heights greater than 4.5 m), slope stability analysis should be carried during final design.

For backfilling behind the abutments / retaining walls, OPSD 3101.150 (Walls, Abutment, Backfill, Minimum Granular Requirement) should be considered.

4.2.5 Excavation and Dewatering for Bridge Foundation

The construction of new footings may require excavations to depths of about 2 m below the bottom of the river for piers or up to 6 m below existing ground surface for abutments. River water will have to be diverted around the excavation of pier footings in order to reduce water seepage into the excavation.

For the construction of the pier, river dykes (or similar) will likely be required around the construction zone.

Dewatering within the excavation will be required in order to keep the excavation dry during construction. Dewatering requirements discussed in the hydrogeological report (submitted in a separate cover) should be considered for dewatering plans. The control of water during construction and the control of the water prior to discharge of water from dewatering operations to the natural environment should be according to OPSS 517 (Dewatering of Pipeline, Utility and Associated Structure Excavation) and OPSS 518 (Construction Specification for Control of Water from Dewatering Operations). Environmental protection for construction in and around waterbodies and on waterbody banks should follow OPSS.PROV 182 (General Specification for Environmental Protection for Construction in Waterbodies and on Waterbody Banks). Temporary erosion and sediment control measures, including to control the discharge of water, should be according to OPSS 805 (Construction Specification for Temporary Erosion and Sediment Control Measures).

General recommendations on excavation and dewatering, provided in Section 11.3, should also be considered for design and construction.

4.2.6 Scour Protection

The bridge footings will require protection against scour and erosion, especially at the piers. Scour protection may be provided by rip-rap, gabions, granular soil, or equivalent to protect the foundations. Scour protection should be designed by an experienced Engineer according to OPSS 805 (Temporary Erosion and Sediment Control Measures).

If rip-rap protection is used, it should be separated from the natural soils with a geotextile filter fabric (e.g., Terrafix 270R or better or similar) in accordance with OPSS 1860 (Geotextiles) or a filter zone of granular material. The geotextile filter fabric should be selected based on size / type of protection used and manufacturer's recommended geotextile..

4.2.7 Earthquake Considerations

Based on the soil types encountered in the boreholes for bridge foundation (very dense sand and gravel, hard silty clay / clayey silt till and hard weathered shale) and in conformance with Section 4.4.3.2 of the Canadian Highway Bridge Design Code (CHBDC, CAN/CSA-S6-14), the project site conditions may be classified as "Site Class C" (very dense soil and soft rock). Site Coefficient should be considered as per Table 4.2 to 4.9, Section 4.4.3.3 of CHBDC.

5.0 RETAINING WALL NO. 1

The planned Retaining Wall No. 1 will be located on the east side of Mississauga Road, approximately between Station 10+990 to 11+090 (about 100 m long), as shown in Figure No. 1. At this location, the retaining wall will be in a cut area. The maximum height of the existing slope at the planned Retaining Wall No. 1 is about 4 m.

Two boreholes (BH R1 and BH R2) were drilled from the top of the existing slope along the plan wall location. Based on the conditions at the borehole locations, the soil profile generally consisted of surficial topsoil underlain by fill soils up to a depth of about 2.1 m, overlying loose to compact natural silty sand / sand / silt. The retaining wall should be founded on the compact silty sand / sand / silt (natural soils), which would be the encountered at the location, based on soil condition at the borehole location. Loose sand was observed in BH R2 at a depth of about 7.6 m below existing ground surface. The observed low SPT "N" value, which could possibly be due to loosening of the sand below groundwater, may not represent the actual condition. However, any soft or loose soil encountered at the founding level should be sub-excavated down to competent soil and replaced with engineered fill. Based on the groundwater encountered at the borehole locations, dewatering should be minimal of construction of the retaining wall. Surface water and / or seepage from cut slope (perched water) should be considered for dewatering requirements.

Gravity type wall, reinforced-concrete cantilever wall (with the leg toward the road) or pile wall without anchor (due to limited ROW) would be feasible types of wall, depending on height of wall. For construction of the retaining wall, a temporary slope of 1H:1V or flatter will be required along the wall alignment. If the available right-of-way does not allow for a slope temporary excavation, temporary shoring system (e.g. trench box, soldier piles with lagging and rakers or similar) will be required.

5.1 Sub-surface Conditions

The two boreholes (BH R1 and BH R2) were drilled to depths of 8.1 m below ground surface. The boreholes were located in the vicinity of existing top of slope. Groundwater was encountered at about 6.1 m below existing ground surface on completion of drilling at each borehole locations.

The stratigraphic units and groundwater conditions in BH R1 and BH R2 are presented in the Record of Boreholes (Geotechnical Investigation). The laboratory test results are presented in Appendix B. The following summary is to assist the designers of the project with an understanding of the soil conditions encountered at the proposed retaining wall location. The soil and groundwater conditions might vary between and beyond the borehole locations.

5.1.1 Surficial Cover – Topsoil

At each borehole location (BH R1 and BH R2), 150 mm thick topsoil was encountered at the ground surface.

5.1.2 Fill Soils

Fill soils were encountered below the topsoil and consisted of silty sand fill, which extended to depths of about 2.1 m and 1.4 m below the existing ground surface in Boreholes BH R1 and BH R2, respectively.

The silty sand fill was brown and/or reddish brown in colour, and contained trace clay and gravel, with rootlets and organic matter. SPT 'N' values measured within the silty sand fill ranged from 2 to 5 blows per 0.3 m. Water contents measured in the silty sand fill samples ranged from 6 % to 14 %.

5.1.3 Silty Sand / Sand

Natural silty sand / sand was encountered in each borehole underlying the silty sand fill, and extended to the termination depth of 8.1 m in Borehole BH R1 and 7.1 m below ground surface in Borehole BH R2.

The silty sand / sand was brown and/or light brown in colour, and contained trace clay and silt, trace gravel. SPT 'N' values measured in silty sand /sand varied from 6 to 18 blows per 0.3 m, implying a loose to compact state of compactness. Water contents measured in the silty sand / sand ranged from 2 % to 25 %.

A grain size analysis was completed on one selected sample of sand from Borehole BH R1. The results are presented in Table 5.1 and shown in the Record of Boreholes.

Table 5.1 - Results of Grain Size Distribution Analysis (Sand)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				USCS Modified Group Symbol
			Gravel	Sand	Fines		
					Silt	Clay	
			(%)	(%)	(%)	(%)	
BH R1	SS 8	7.6	0	94	4	2	SP

Grain size distribution curve is presented in Figure No. B6, in Appendix B.

5.1.4 Silt

Natural silt was encountered in Borehole BH R2 underlying the natural silty sand and extended to the termination depth of 8.1 m below existing ground surface.

The silt was brown in colour, and contained trace clay and gravel, some sand. A SPT 'N' value measured in the silt was 15 blows per 0.3 m, indicating a compact condition. A water content measured in the silt sample was 20 %.

A grain size analysis and Atterberg Limit tests were completed on one selected sample of silt from Borehole BH R2. The results are presented in Table 5.2 and shown in the Record of Boreholes.

Table 5.2 - Results of Grain Size Distribution Analysis and Atterberg Limit Test (Silt)

Borehole No.	Sample No.	Depth (m)	Grain Size Distribution				Atterberg Limits			USCS Modified Group Symbol
			Gravel	Sand	Fines					
					Silt	Clay	Liquid Limit	Plastic Limit	Plasticity Index	
			(%)	(%)	(%)	(%)				
BH R2	SS 8	7.6	2	12	78	8	18	15	3	ML

Grain size distribution curve is presented in Figure No. B7, and the corresponding Plasticity Chart is presented in Figure No. B5, in Appendix B.

5.1.5 Groundwater Conditions

Groundwater conditions were observed during and on completion of drilling in the open borehole. Freestanding groundwater was encountered in each borehole on completion of drilling. Groundwater depths were measured upon completion of drilling in Boreholes BH R1 and BH R2 and were 6.1 m below existing ground surface in each borehole.

It should be noted that the groundwater could fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

5.2 Discussions and Recommendations for Retaining Wall No. 1

The location of the proposed Retaining Wall No. 1 (about 100 m long, from Station 10+990 to 11+090) is shown in Figure No. 1. Factors, such as site condition (e.g., availability of space), constructability, cost, height of wall etc., should be considered in selecting the type of wall. Gravity wall, reinforced-concrete cantilever wall, and pile walls are feasible options for the retaining wall. Typically, cantilever walls may not be practical if the height of wall is greater than 3 m, unless buttresses or rakers or similar are constructed. Pile wall should be used only if it can be constructed without anchors, as anchors beyond the right-of-way may not be acceptable.

Based on the boreholes drilled at the retaining wall, the planned retaining wall should be founded on compact natural sand / silty sand / silt or engineered fill. The recommended values for the geotechnical reaction at Serviceability Limit State (SLS) and geotechnical resistance at Ultimate Limit State (ULS) values provided in Table 5.3 may be used for design.

Table 5.3 – Recommended ULS / SLS Bearing Values for Retaining Wall No.1 Foundations

Retaining Wall (Location)	Borehole No.	Founding Stratum	Depth Below Existing Grade (Elevation) (m)	Geotechnical Reaction at SLS (kPa)	Factored Geotechnical Resistance at ULS[1] (kPa)
Retaining Wall No.1 (Station 10+990 to 11+090)	BH R1	Fill Compact Sand	above 2.5 (±) 2.5 and below (201.7 and below)	not recommended 150	not recommended 225
	BH R2	Fill Loose [2] to Compact Sand / Silty Sand / Compact Silt	above 1.5 (±) 1.5 and below (202.8 and below)	not recommended 150	not recommended 225
	Engineered Fill [2]			150	225

Notes:
[1] A resistance factor of Φ = 0.5 has been applied to the ULS values provided.
[2] All engineered fill should be placed according to Region's Standards or OPSS recommendations.

Under the SLS pressures, foundation settlements could be up to 25 mm (total). Detailed foundation analysis should be carried out, if necessary, to confirm SLS/ULS and corresponding settlements.

The design frost depth penetration in the project area is 1.2 m. All foundations should be covered by at least 1.2 m of soil or equivalent synthetic thermal insulation.

General recommendations related to engineered fill are presented in Section 11.2 and related to excavation and dewatering are presented in Section 11.3.

General recommendations for soil reuse and backfill are presented in Section 11.4.

Slope stability analysis should be carried out once the detail design of the retaining wall is finalized.

5.2.1 Soil Parameters for Design

The unfactored soil parameters listed in Table 9.1 (Section 9.0) may be used for design of Retaining Wall No. 1.

5.2.2 Earthquake Considerations

Based on the soil types encountered in the boreholes for retaining wall foundation (compact to loose sand / silty sand / silt) and in conformance with Section 4.4.3.2 of the Canadian Highway Bridge Design Code (CHBDC, CAN/CSA-S6-14), the project site conditions may be classified as "Site Class D" (stiff soil). Site Coefficient should be considered as per Table 4.2 to 4.9, Section 4.4.3.3 of CHBDC.

6.0 RETAINING WALL NO. 2

The planned Retaining Wall No. 2 will be located on the west side of Mississauga Road, approximately between Station 11+050 to 11+080 (about 30 m long), as shown in Figure No. 1. At this location, the retaining wall will be in a cut area. There is an existing gabion retaining wall (about 2 m high) at this location, which appeared to be stable during the investigation. A new wall of similar height (i.e., 2 m) is planned at the location for the road to be widened.

The existing soil condition at the wall location is not known, as a separate borehole was not drilled. The soil condition at the retaining wall should be verified during construction, or by drilling additional borehole(s) at the wall location. Based on the soil condition observed at the borehole (BH 13) drilled closest to the location, the soil profile would generally consist of asphaltic concrete placed on fill soils up to a depth of about 0.9 m, overlying compact natural sand. The retaining wall can be founded on the compact sand and / or engineered fill. Any soft or loose soil encountered at the founding level should be sub-excavated and replaced with engineered fill. Groundwater was not encountered in the borehole (3.5 m deep). However, if excavation is required, dewatering should be considered for surface water or perched water.

Gravity type wall, cantilever wall (with the leg toward the road) or pile wall without anchor (due to limited ROW) would be feasible type of wall. For construction of the retaining wall, a temporary

slope of 1H:1V or flatter will be required along the wall alignment. If this is not possible, temporary shoring system (e.g. trench boxes or similar) may be required.

6.1 Sub-surface Conditions

The borehole closest to the planned location of Retaining Wall No. 2 was Borehole BH 13 (about 20 m east at the west side of Mississauga Road). The stratigraphic units and groundwater conditions observed in BH 13 are presented in the Record of Boreholes (Geotechnical Investigation). The soil condition at the wall should be verified by a geotechnical engineer during construction, or by drilling additional borehole(s) at the wall location.

6.2 Discussions and Recommendations for Retaining Wall No. 2

The location of the proposed Retaining Wall No. 2 (about 30 m long, from Station 11+050 to 11+080) is shown in Figure No. 1. Based on the borehole BH 13, the proposed retaining wall should be founded on competent sand or engineered fill. Gravity wall, cantilever wall with leg toward the road, pile wall (without anchor) are feasible options for the retaining wall types. For the planned wall, a gabion wall, similar to the existing one, should be considered.

For soil similar to the one observed at Borehole BH 13, i.e., compact sand, a geotechnical reaction at Serviceability Limit State (SLS) of 150 kPa and a geotechnical resistance at Ultimate Limit State (ULS) of 225 kPa may be used for design.

To achieve the recommended bearing capacity, the retaining wall should be founded on compact sand. The exposed subgrade should be proof-rolled to verify soil condition. If soft or loose soils should be should be sub-excavated and backfilled with engineered fill. Under the SLS pressures, foundation settlements could be up to 25 mm.

The unfactored soil parameters listed in Table 9.1 (Section 9.0) may be used for design of Retaining Wall No. 2. Recommendations / discussions provided in Section 5.0 should also be considered for design of Retaining Wall No. 2, as applicable.

Earthquake consideration discussed in Section 5.2.2 may be used for design consideration.

7.0 RETAINING WALL NO. 3

Retaining Wall No. 3 (about 90 m long, approximate Station 10+380 to 10+470) is planned at the southeast side of the bridge over Credit River, as shown in Figure No. 1. The existing embankment (at the existing abutment) is about 5 m high, with the Credit River close to the toe of the slope. The road grade at the bridge is planned to be increased by about 2 m. The new abutments would be located further away from the river than the existing abutment, as the new

bridge is longer than the existing bridge. The maximum height of slope at the location of Retaining Wall No. 3 may be similar to or slightly higher (about 6 m) than the existing slope height.

Borehole BH B5 was drilled at the toe of the existing slope, as shown in Figure No. 1 to confirm the soil condition observed in Borehole BH B4. Based on the soil conditions at the borehole locations (BH B4 and B5), the soil profile generally consisted of surficial topsoil underlain by fill soils up to a depth of about 1.8 m, overlying dense natural sand and gravel and hard silty clay / clayey silt till. The retaining wall can be founded on the dense sand and gravel, and/or hard silty clay and/or engineered fill. Any soft or loose soil encountered at the founding level should be sub-excavated and replaced with engineered fill. Groundwater was not encountered in Borehole BH B5 during the field investigation. However, in the monitoring well installed in BH B4, groundwater was encountered at levels close the ground surface at BH B5. Therefore, if excavation is required for construction of the wall, dewatering will likely be required, and may be carried out by using a sump and pump system.

Gravity wall (including mechanically stabilized earth (MSE) wall) and pile walls (with anchors) are feasible wall types. As there are existing underground utilities / structures (sewer / sewer outlet) in the area, protection and/or relocation of the utilities / structures should be considered for design and construction of the wall. Constructability and accessibility for construction should also be considered in selecting the wall type.

7.1 Sub-surface Conditions

Boreholes BH B4 and BH B5 provide the available soil conditions encountered at the planned retaining wall location. The following summary is to assist the designers of the project. The stratigraphic units and groundwater conditions observed in Boreholes BH B4 and BH B5 are discussed in Section 4.1 and presented in the Record of Boreholes. The laboratory test results are presented in Appendix B. It should be noted that the soil and groundwater conditions might vary beyond the borehole location.

At the borehole locations, the soil profile generally consisted of surficial cover (topsoil / asphaltic concrete) overlying fills soil, which was underlain natural soils and / or weathered shale.

At Borehole BH B4 location (ground elevation 184.9 m), which was drilled at the existing road surface, the soil profile consisted of 300 mm thick asphaltic concrete, underlain by fill soils (sand and gravel / gravelly sand / silty sand / sand / sandy gravel fill), which extended to a depth of about 5.6 m below the existing ground surface. The fill soil was underlain by hard silty clay / clayey silt till, which extended to a depth of about 7.2 m below existing ground surface. Weathered shale was encountered below the silty clay / clayey silt till to the termination depth of the borehole at 11.6 m below ground surface. The borehole was terminated due to auger refusal (possible bedrock).

At Borehole BH B5 location (ground elevation 180.5 m), the soil profile consisted of 120 mm thick topsoil, underlain by fill soil consisting of silty sand fill, which extended to a depth of about 1.8 m

below the existing ground surface. The fill soil was underlain by dense natural sand and gravel, and extended to about 2.9 m below ground surface. Hard silty clay / clayey silt till was encountered below the sand and gravel, and extended to the termination depth of the borehole at 3.0 m below existing ground surface. The borehole was terminated due to (hand) auger refusal (possible bedrock/weathered shale).

No freestanding groundwater was not observed in the open borehole on completion of drilling. However, groundwater was measured at a depth about 4.7 m (Elevation 180.2 m) below ground surface in the monitoring well installed in Borehole BH 4.

It should be noted that the groundwater could fluctuate seasonally or with river water level and can be expected to be somewhat higher during the spring months and in response to major weather events.

7.2 Discussions and Recommendations for Retaining Wall No. 3

The location of the planned Retaining Wall No. 3 (about 90 m long, from Station 10+380 to 10+470) is shown in Figure No. 1. Based on the boreholes drilled in the vicinity, the retaining wall can be founded on the dense sand and gravel, hard silty clay / clayey silt till, weathered shale or engineered fill. Gravity wall (including MSE) and pile wall with anchor are feasible. The retaining wall will be located between the road and Credit River, and close to the river. Also, based on sewer outlets observed at the bottom of the slope, there are existing sewers under the road. Constructability of the wall should be considered in selecting the wall type. Temporary retaining structure may be required along the existing road to prepare access to the wall site.

The recommended values for the geotechnical reaction at Serviceability Limit State (SLS) and geotechnical resistance at Ultimate Limit State (ULS) values provided in Table 7.1 may be used for design.

Table 7.1 – Recommended ULS / SLS Bearing Values for Retaining Wall Foundations

Retaining Wall (Location)	Borehole No.	Founding Stratum	Depth Below Existing Grade (m)	Geotechnical Reaction at SLS (kPa) (1)	Factored Geotechnical Resistance at ULS (1) (2) (kPa)
Retaining Wall No. 3 (Station 10+380 to 10+470)	BH B4	Fill	Above 5.6 (±) (179.3 and above)	Not recommended	Not recommended
		Hard Silty Clay / Clayey Silt Till /	5.6 to 7.2 (±) (178.8 to177.7)	300	450
		Hard weathered shale	7.2 and below (177.7 and below)	400	600
	BH B5	Fill	above 1.8 (±)	not recommended	not recommended
		Dense Sand and Gravel	1.8 to 2.9 (±) (178.5 to 177.5)	200	300
		Hard Silty Clay / Clayey Silt Till	2.9 and below (177.5 and below)	300	450
	Engineered Fill(3)			150 to 200(4)	225 to 300(4)

Notes:
(1) Footing should not be placed on the slope.
(2) A resistance factor of Φ = 0.5 has been applied to the ULS values provided.
(3) All engineered fill should be placed according to Region's Standards or OPSS recommendations.
(4) Depending on the subgrade conditions and soil types used.

Under the SLS pressures, foundation settlements could be up to 25 mm. Detail foundation analysis should be carried out, if necessary, to confirm SLS/ULS and corresponding settlements.

The unfactored soil parameters provided in Section 9.0 may be used for design of the proposed Retaining Wall No. 3.

Earthquake consideration discussed in Section 4.2.7 may be used for design consideration.

The design frost depth penetration in the project area is 1.2 m. All foundations should be covered by at least 1.2 m of soil or equivalent synthetic thermal insulation.

General recommendations related to engineered fill are presented in Section 11.2 and related to excavation and dewatering are presented in Section 11.3.

General recommendations for soil reuse and backfill are presented in Section 11.4.

Slope stability analysis should be carried out once the detail design of the retaining wall is finalized.

8.0 UNDERGROUND UTILITES

As per the information provided, new storm sewer and / or relocation of existing storm sewer is planned along the road. There is an existing watermain which crosses Credit River, just east of the bridge. No sewer and / or watermain is planned across Credit River. The existing underground utilities should be protected and taken into consideration for design and construction of the road widening, bridge and retaining walls. Sub-surface conditions discussed for road widening (Section 3.1), bridge foundation (Section 4.1) and retaining walls (Sections 5.1, 6.1 and 7.1) should be considered for design and construction of the underground utilities.

8.1 General Sub-Surface Conditions

Based on the investigation results, the subsurface soils consisted of fill soils to depths varying from 2.1 m to 5.6 m below the ground surface, which were underlain by natural deposits of sand and gravel, sandy gravel, sand, silty sand / sandy silt, silty sand / sandy silt till, silty clay / clayey silt till and/or weathered shale.

8.2 Subgrade for Underground Utilities

It is recommended that underground utilities (e.g., sewers, manholes, etc.) be founded on competent soil (existing fill or natural soil) or engineered fill. The fill soils encountered in the boreholes were generally firm to very stiff or very loose to very dense. The natural soils were generally loose to very dense or hard. The underground utilities / manholes should be founded on compact to very dense or firm to hard subgrade (for both fill and natural soils). If very soft / soft / very loose / loose soils are encountered at the invert or founding level of underground utilities / manholes, the existing subgrade soils should be re-compacted, if possible, or sub-excavate and replace with compacted engineered fill.

Manholes (or similar structures) may be founded on compact to very dense or firm to hard subgrade engineered fill.

The frost penetration depth for the project area should be considered as 1.2 m.

Based on groundwater levels encountered in the boreholes, substantial dewatering is not expected during construction of the underground utilities. Where required, dewatering may be achieved using sump and pump system and / or gravity drainage (or a combination thereof). Discussion about excavation and dewatering included in Section 11.3 should also be considered.

8.3 Pipe Bedding

It is recommended that a minimum of 150 mm thick bedding material (Class 'B' Type or better) be placed below the pipe invert. The thickness of the bedding may have to be increased depending on the pipe diameter, or if wet or weak subgrade conditions are encountered. If the subgrade is

weak, it should be sub-excavated and replaced with engineered fill to support the pipes and allow the use of Class 'B' Type bedding. Lean concrete (minimum 100 mm thick) may be used in lieu of engineered fill to provide a workable surface and support the pipes. Construction of underground pipes should be carried out in accordance with the relevant OPSS 410 (Construction Specification for Pipe Sewer Installation in Open Cut), or other relevant applicable municipal / regional standards.

Should the pipes be installed in soft clay soils, the joints should be restrained from movements and the backfill around the pipes should be properly compacted in order to prevent long-term movements. The possibility of underground pipe movements in soft clayey soils, during and after installation, should be considered in the design and construction of the underground pipes.

Bedding for underground pipes should be placed in accordance to OPSD 802.10 for flexible pipes and OPSD 802.30, 802.31 and 802.32 for rigid pipes.

9.0 SOIL PARAMETERS FOR DESIGN

The unfactored soil parameters listed in Table 9.1 may be used for design of structures.

It should be noted that the above design soil parameters assume level ground surface and backfill behind the retaining structure, and are based on published information and/or semi-empirical / theoretical relationships. The parameters provided are conservative and should be verified by field / laboratory testing if more representative parameters are required.

Table 9.1 - Unfactored Static Soil Parameters for Design

Material	Total Stress Analysis		Effective Stress Analysis		Earth Pressure Coefficients [1]			Bulk Unit Weight (kN/m^3)	Coefficient of Friction between Concrete and Soil
	C (kPa)	Φ (deg)	c' (kPa)	Φ' (deg)	Active K_a	At-Rest K_o	Passive K_p		
Very dense sand and gravel	0	35	0	35	0.27	0.43	3.7	21	0.45
Hard silty clay / clayey silt till / weathered shale	100	0	0	30	0.33	0.50	3.0	20	0.40
Loose to compact silty sand / sand / silt	0	30	0	30[3]	0.33	0.50	3.0	19	0.35
Engineered Fill [2]									
Granular A (OPSS 1010)	0	35	0	35	0.27	0.43	3.7	24[3]	0.40
Granular A (OPSS 1010)	0	35	0	35	0.27	0.43	3.7	24[3]	

[1] Values based on semi-empirical relationships. For SLS, K_p values should be reduced to 1/3 of indicated value to limit lateral movement.
[2] All engineered fill should be compacted to at least 100 % SPMDD for supporting foundations.
[3] Unit weight values for engineered fill compacted to 100 % SPMDD. For backfill of retaining wall, unit weights for Granular A and Granular B compacted to 95 % SPMDD may be taken as 22 kN/m^3 and 21 kN/m^3, respectively.

10.0 PAVEMENT INVESTIGATION AND DESIGN

10.1 Pavement Evaluation

10.1.1 Visual Pavement Condition Survey

Amec Foster Wheeler completed a visual pavement condition survey of the existing road surface within the project area to identify any distress. The identification and classification of the pavement distresses were carried out in accordance with MTO's "*Flexible Pavement Condition Rating Manual – Guidelines for Municipalities*", SP-022.

Generally, Mississauga Road (RR1) is a north-south Regional Arterial Road that extends from Caledon in the north, through the City of Brampton, and to the City of Mississauga in the south. The existing asphaltic concrete surface within the investigation limits of Mississauga Road from 380 m north of Financial Drive to Queen Street West ranged from 'Good to Fairly Good Condition'. Selected photographs showing the existing condition of the investigated road section are presented in Appendix A.

10.1.2 Falling Weight Deflectometer

Amec Foster Wheeler retained Exp Services Incorporated ('Exp') as a sub-consultant to undertake Falling Weight Deflectometer (FWD) testing, analysis and reporting. In-situ FWD testing was carried out at an interval of 50 m staggered within each pavement sections in all lanes and travelled directions in order to evaluate the current structural capacity of the pavement sections.

The dynamic applied load varied from 30 kN to 75 kN (four (4) drops per location), and normalized to 40 kN for conventional asphalt pavement testing. The test locations adopted for FWD survey, data collection, analysis and conclusions are detailed in a separate report prepared by Exp, which is included in Appendix 'A'. The FWD back-calculation is summarized in Table 10.1, which has been extracted from the Exp report.

The subgrade resilient modulus was found to range from 50.8 MPa to 106.6 MPa and the effective structure numbers are ranged from 185 to 239 mm, based on the calculations from each of the FWD test locations.

Table 10.1 - Summary of FWD Testing and Analysis of Mississauga Road

Road Sections	Normalized d_0 (mm)	Normalized d_0/d_{200} (mm)	Normalized Area (mm)	MR_{DES} (MPa)	SN_{eff} (mm)
Mississauga Road NBL1 (300 m North of Financial Drive to Queen Street West)	0.158	1.28	512	78.0	207.4
Mississauga Road NBL2 (300 m North of Financial Drive to Queen Street West)	0.187	1.26	516	72.2	196.1
Mississauga Road SBL1 (300 m North of Financial Drive to Queen Street West)	0.161	1.29	515	73.5	222.7
Mississauga Road SBL2 (300 m North of Financial Drive to Queen Street West)	0.179	1.27	519	67.9	215.2

Notes:

d_0: Centre Plate Deflection (primarily measures the subgrade strength and the pavement stiffness) – Maximum 0.6 mm.

d_0/d_{200}: Ratio of Centre Plate Deflection to Sensor Deflection at 200 mm from the Centre Plate (subgrade strength versus other structural strengths) – Maximum 1.8 mm

Area: Normalized Area is the Area of the Deflection Basin (overall ability of the pavement to effectively distribute vehicular loading) – Minimum 600 mm.

MR_{DES} (MPa): Design subgrade resilient modulus based on the pavement deflection by the geophone 1,200 mm offset from the loading and further estimated as per AASHTO Guide for Design.

SN_{eff}: Effective Structure Number of all pavement layers above the subgrade as per AASHTO' 1993.

10.2 Pavement Sub-Surface Conditions

Mississauga Road from North of Financial Drive to 300 m North of Queen Street West was assessed by two (2) methods. In-situ structure number ("SN") and in-situ Granular Base Equivalency ("GBE") were estimated from the borehole data using the equivalency factors for various material types, as shown in Table 10.2.

Table 10.2: Typical Structural Layer Coefficient

Material Type	Typical AASHTO-Ontario Structural Layer Coefficient (SLC), ai (1)		Granular base Equivalency Factors (2)
Rehabilitation	**Drainage**	**Structural**	
Existing HL Existing Granular Base Existing Granular Sub-base Existing Granular Base/Sub-base	 Acceptable **1.0** Questionable 0.9 Inadequate 0.8 to 0.5	 0.14 to 0.28 0.10 to 0.14 0.05 to 0.09	1.25 0.75 0.50 0.625
Pulverization CIR RAP/Granular A blended stabilized with Expanded Asphalt Mix (EAM)	1.0 1.0 1.0	0.10 to 0.14 0.28 to 0.38 0.20 to 0.25	1.0 1.6 – 1.8 1.0

Notes:
(1) MTO Report MI-183 -. MTO Report MI-183 "Adaptation and Verification of AASHTO Pavement Design Parameters for Ontario Conditions" - Table 4-5.
(2) MTO Pavement Design Rehabilitation Manual 1990 – Table 3.5.

The soil profile at the borehole locations (typically to a depth of 1.5 m) is summarized in Table 10.3. Additional information is provided in the Borehole Log Data. Table 10.3 displays the total average pavement structural thickness of the existing asphaltic concrete pavement, granular base and sub-base, as well as the average existing structure number 'SN' and 'GBE' before rehabilitation.

All boreholes were open and dry upon completion to their respective vertical limits of investigation. It should be noted that the groundwater table could fluctuate seasonally and in response to weather events. Typically, all soils recovered from the boreholes were moist and occasionally wet.

Table 10.3: Summary of Boreholes and Soil Stratigraphy of Mississauga Road and Widening Area

Number of Boreholes		Thickness (mm)			GBE	SN	Predominant Subgrade Soils to a depth of 1.5 m
		Tps	HMA	Base/Sub-base	(mm)		
6 BHs (#s 1, 10, 13, 22, 25, 28)	MDL	-	130-220 mm Av. 175 mm	590-1,370 mm Av. 955 mm	569-1,063 mm Av. 817 mm	116-212 mm Av. 164 mm	Si(y) Sa, Concrete Sa, 50 mm CR Gr(y) Sa Tr Si, Sa & Gr Si(y) Sa & Gr Si(y), Gr(y) Sa Tr Cl
6 BHs (#s 6, 7, 16, 18, 19, 40)	EP		90-200 mm Av. 135 mm	150-1,400 mm Av. 950 mm	269-1,000 mm Av. 766 mm	57-196 mm Av. 152 mm	50 mm CR, Si(y) Sa Tr Gr Sa & Gr, Sa, Tr Si and Gr Si(y) Sa, Some Cl
14 BHs (#s 2, 4, 9, 11, 14, 21, 23, 26, 30, 31, 33, 35, 38, 42)	MSH/ SHR	0-200 mm Av. 85 mm	0-100 mm Av. 35 mm	0-1,400 mm Av. 450 mm	-	-	Si(y) Sa & Gr, Tr Cob Si(y) Sa Tr Gr & Cob Si(y) Sa, Gr(y) Sa some Si 19 mm CR, Sa & Gr Tr Si, Cl W plastic & Asph Si(y) Sa Tr Cob, Si(y) Sa, Some Org, Tr Gr Sa, Some Cob, Tr Gr Sa, Tr Gr & Cl
14 BHs (#s 3, 5, 8, 12, 15, 17, 20, 24, 27, 29, 32, 36, 39, 41)	TOS	0-300 mm Av. 145 mm	Asph encountered in BHs 12 & 17 80 mm, 100 mm	0-1,250 mm Av. 415 mm	-	-	Si(y) Cl some Sa & Gr Tr Cob Si(y) Sa / Sa(y) Si Si(y) Sa Tr Gr & Cob Si(y) Sa to Sa Si(y) Sa Tr Gr & Cob Si(y) Cl / Cl(y) Si Tr Sa & Gr Si(y) Sa Tr Cl & Gr Si(y) Cl/Cl(y) Si some Sa Tr Gr Sa Some Gr, Tr Cob Si(y) Sa & Gr Some Cob Si(y) Sa & Gr

Notes: BHs description as per OPSD 100.060
HMA = Hot mix asphalt; BH = Borehole; MDL = Mid-Driving Lane; EP = Edge of Pavement;
MSH = Mid Shoulder SHR = Shoulder Rounding TOS = Toe of Slope.

10.3 Existing and Forecasted Traffic Data

Mississauga Road is an existing 4-lane road classified as arterial road. The traffic data, represented in average annual daily traffic (AADT) and percentage of commercial vehicles (%) were extracted from Paradigm Transportation Solutions Limited Report titled, "Mississauga Road Class EA Study Transportation and Traffic Analysis Report", February 2017.

These traffic data were used to calculate the projected traffic for an additional 20-year period as presented in Table 10.4. The traffic loading represented in equivalent single axle loads (ESALs) was calculated cumulatively over 20 years as described in the Ministry of Transportation Report "Procedures for Estimating Traffic Loads for Pavement Design, 1995".

Table 10.4 – Traffic Data and Equivalent Single Axle Loads (ESALs)

Location	Two Way AADT		Growth Rate[2] (%)	Commercial Vehicles (%)	Design ESALs @ 20 Years	Traffic Category
	2015	2021[1]				
Queen St. to Embleton Rd	31,210	33,130	1%	3%	7,420,387 [3]	'D'
Embleton Rd to Lionhead Golf Club Rd	25,730	27,313		7%	14,274,184	"D'
Lionhead Golf Club Rd to Financial Dr.	26,340	27,960		7%	14,612,316[3] ~15X10^6	'D'

Notes:
(1) Anticipated construction year is 2021.
(2) Growth rate assumed to be 1%.
(3) Selected ESALs for the design.

10.4 Flexible Structural Pavement Design for Widening

After reviewing the field data and laboratory test results, the minimum pavement structural design for widening is presented in Tables 10.5a and 10.5b, as determined in accordance with the 1993 American Association of State Highway and Transportation Officials ('AASHTO') Guide for the Design of Pavement Structures using the Darwin Software Program.

The AASHTO Pavement Design is considered to be a function of estimated future traffic in both directions (ESALs), reliability (R) which is a function of road classification, overall standard deviation (S_o), resilient modulus (M_r), as well as initial and terminal serviceability (P_o, P_t). From these parameters, the structure number (SN) is calculated. The SN is defined in the AASHTO Guide as a number (in mm) which provides a measure of the pavement strength and thickness needed to avoid overstressing the subgrade.

The following design parameters were chosen to calculate the required structure number (SN) for the design of the flexible pavement using the AASHTO method, as described in the Ministry

of Transportation Materials Information Report MI-183 *"Adaptation and Verification of AASHTO Pavement Design Parameters for Ontario Conditions".*

- ESALs ~ 15.0 X10^6
- Initial serviceability, P_i = 4.5;
- Terminal serviceability, P_t = 2.5;
- Reliability level, R = 90 percent;
- Overall standard of deviation, S_o = 0.49;
- Subgrade Resilient Modulus, M_r (kPa) M_r = 35,000

Table 10.5a – Pavement Structure Analysis for Widening of Mississauga Road

Material Description	AASHTO'93 for 20 Yrs ESALs ~ 15.0 X10^6	Peel Region Roadway Design Standards
Hot Mix Asphalt Concrete	**195 mm Traffic Category 'D'**	Match existing or 150 mm
- HL 1 or SP12.5FC2	40 mm (PGAC 64-28)	HL1 - 50mm
- HL 8 (HS) /HDBC or SP19.0 mm	50 mm + 50 mm +55 mm (PGAC 64-28)	HL8HS /HDBC – 100 mm
Granular Base 'A'/Crusher Run Limestone	150 mm	150 mm Crusher Run Limestone 'A'
Granular Sub-base 'B' Type II/Crusher Run Limestone	350 mm	450 mm Crusher Run Limestone 'B'
Design Structure Number (DSN) mm	146 mm	-
Selected Structure Number (SSN) mm	152 mm (ok)	-
Total Pavement Thickness (mm)	**695 mm**	**750 mm**

Notes:

(1) Pavement structure should be built over approved subgrade.

(2) Granular A and B Type II: Compaction as per OPSS Form 1010 (100% Standard Proctor Maximum Dry Density - SPMDD).

(3) The granular thicknesses of the widening given in the table is a minimum thickness and should be increased, as required, to match the adjacent existing pavement granular thickness to promote positive lateral drainage (refer to the Borehole Log Data). In addition, the thicknesses can be increased depending on grading requirements.

The AASHTO pavement structural design was compared to the adopted since it is tailored to the site specifics regarding traffic loading and field conditions. However, the granular thickness in the design was increased to 450 mm to comply with the current Peel Region Roadway Design Standards.

Table 10.5b summarizes the hot mix type, lift thickness, and PGAC type making up the recommended asphalt thickness in Table 10.5a, as well as the traffic category, in accordance with OPSS 1151.

Table 10.5b – Flexible Pavement Design and Criteria

Lanes				Shoulder			
HMA		PGAC	Traffic Category	HMA		PGAC	Traffic Category
Type	Thickness (mm)			Type	Thickness (mm)		
SP 12.5 FC2	40 mm	64-28	D	SP 12.5	40 mm	64-28	D
SP 19.0 mm	50 mm	64-28	D	SP 12.5	50 mm	64-28	D
SP 19.0 mm	50 mm	64-28	D				
SP 19.0 mm	55 mm	64-28	D				
Total	195 mm			**Total**	90 mm		
Gran A	150 mm						
Gran B	450 mm						
Total Pavement Thickness (mm)	**795 mm**						

The shoulders will consist of 90 mm of hot mix, underlain by sufficient granular to match the base of granular below the adjacent driving lane to provide positive lateral drainage.

10.4.1 Widening

Pavement recommendations for widening are provided in both Tables 10.5a, and 10.5b, including hot mix type, lift thickness and PGAC type. For widening, full depth excavation is recommended, commencing from the existing edge of pavement. The design granular sub-base depth should be increased to match the existing subgrade to provide positive lateral drainage, if necessary. Where lateral drainage of the existing subgrade cannot be accommodated, installation of subdrain has to be considered.

Subgrade preparation should follow the recommendation in Section 10.6.2. The excavated granular materials from the shoulder can be re-used as fill material, provided it is not contaminated. New Granular B sub-base should be added, re-graded, and compacted, followed by new Granular A base material.

10.4.2 Intersection Improvements of Mississauga Road with Sideroads

Full depth excavation commencing from the existing edge of pavement will be required to accommodate the recommended widening design thickness of Mississauga Road, as detailed in

Tables 10.5a, and 10.5b. Sub-base can vary in thickness to match the adjacent existing pavement granular in order to promote positive lateral drainage.

The existing granular fill material from the shoulder may be stockpiled and re-used as granular sub-base provided that it is not contaminated.

10.5 Rehabilitation of Existing Pavement

Given that roadway will be widened and the existing pavement condition is rated as “Good” to “Fairly Good” condition, it is recommended that the existing surface course be milled and resurfaced to a depth of 40 mm commencing from the centerline of the roadway to the outside edge of pavement on the side of the roadway that is to be widened.

10.6 General Construction Comments for Pavement

10.6.1 Recommended Rehabilitation Strategy

For the existing pavement, mill 40 mm and overlay 40 mm is recommended (without grade raise).

10.6.2 Subgrade Preparation

The long-term performance of pavement structure is highly dependent on the subgrade support conditions. To prepare the subgrade for road widening, the existing topsoil and vegetation should be stripped and the area should be graded according to OPSS 206 (Construction Specification for Grading).

Fill, if required for site grading in the widening areas, should be placed as compacted fill to provide competent subgrade. The fill should be placed in lifts and each lift should be uniformly compacted as in OPSS 501 (Construction Specification for Compacting).

Subgrade preparation should not be done in the winter. Drainage layers and/or subdrains should be designed and installed to prevent any water accumulation under pavement surface at all times. The final subgrade surface should be sloped at least 3 % to drain towards the subdrain system or drainage ditches.

The subsoils at this site are generally fine grained which are considered frost susceptible. These soils will become weakened when subject to traffic and when wet. If site work is carried out during periods of wet weather, the subgrade will be easily disturbed. Under inclement weather conditions, an adequate granular working surface would be required to minimize disturbance and protect the integrity of the subgrade soils.

Construction traffic over exposed subgrade should be minimised and temporary construction hauling routes should be established. If these routes coincide with future paved areas, adequately reinforced haul roads (increased thickness of granular base, geosynthetics, etc.) should be constructed to reduce disturbance to the subgrade soils. These provisions are particularly important if the construction is scheduled during wet and cold seasons.

10.6.3 Drainage

For new construction or rehabilitation, adequate drainage should be provided both laterally and longitudinally along the length of the road section. Where a rural cross-section is proposed, the sub-base granular should extend across the full width of the roadway and should daylight in the ditches. If drainage through granular soils underneath pavement is considered not sufficient, subdrains should be installed. However, if installed, the subdrains should be placed parallel to the road edges, at the subgrade level and connected to the catch basins as shown on Subdrain Pipe – Connection and Outlet – OPSD 216.021.

Continuity of drainage through the granular road base and sub-base layers should be maintained between the existing and new pavement structures. In this regard, the granular thickness for new pavement structure may have to be adjusted to match the granular fill encountered under the existing pavement, but should not be less the depth recommended herein.

A minimum slope of 2 % or Region's standards should be maintained across the paved sections (finished road surface) for proper surface drainage. New pavement should slope towards gutter/ditch.

10.6.4 Hot Mixes and PGAC Type

The following hot mixes should be used on roadways: HL 8(HS) or HDBC or SP19.0 mm binder course and HL 1 or SP12.5 FC2 surface course mix, to provide the roadway with high durability. Material Specifications for Superpave hot mix asphalt should be as per OPSS 1151 (Material Specification for Superpave and Stone Mastic Asphalt Mixtures).

Typically, performance graded asphalt cement PGAC 58-28 would be specified for the Region of Southwest Ontario. However, performance graded asphalt cement of PGAC 64-28 is recommended for Superpave surface course and binder courses. This PGAC should satisfy the requirements of MP1 of SHRP Specifications for Superpave. It should be noted that PGAC is engineered asphalt cement with additives such as polymers or modifiers so as to accommodate a wide range of pavement temperatures. When PGAC is used, it is recommended that the steel-wheel rollers are thinly coated with light application of non-petroleum based, wetting agent (soap solution) to reduce sticking of the mix to the compaction equipment.

Transition Treatments at Limits of Paving: At the limits of the project, a butt joint with the existing pavement is recommended. The butt joint between successive lifts of hot mix should be staggered at a distance of not less than 5 m, in accordance with OPSS 313 (Construction Specification for Hot Mixt Asphalt – End Result). It should be ensured that no joint location corresponds with a joint location in any other layer.

10.6.5 In-Situ Compaction for Hot Mix

In all areas, asphaltic concrete should be compacted as per OPSS 310 (Construction Specification for Hot Mix Asphalt – End Result) - Table 10. It should be noted that the granular base and sub-base materials should be compacted as OPSS 310 (Construction Specification for Hot Mixt Asphalt)–Table 10.

Field Quality Assurance: Plate samples of loose hot mix should be obtained for each paving day, and extraction/gradation and full hot mix compliance testing should be carried out on these samples. The finished surface should be true to required and cross-section within 6 mm from required elevations and thickness. The surface should show no depressions or bumps exceeding 3 mm under a 3.0 m long straight edge, placed parallel to the road centre line as per OPSS 310 (Construction Specification for Hot Mixt Asphalt – End Result).

10.6.6 Asphalt Removal and Recycled Materials

The milled/reclaimed asphalt may be recycled and blended with granular sub-base materials to be used on the shoulders during the new construction for widening. The maximum amounts (%) of reclaimed asphalt pavement to be incorporated in the pavement are included in the OPS.MUNI 1010 (Material Specification for Aggregates – Base, Sub-base, Select Subgrade, and Backfill Material). RAP containing steel slag aggregates are not used as per OPSS MUNI 1010 (Material Specification for Aggregates – Base, Sub-base, Select Subgrade, and Backfill Material).

10.6.7 Stripping and Sub-Excavation

Stripping of organic matter and topsoil (ranging in thickness from 0 to 300 mm) is required within the widening limits. In addition, any unsuitable soft or saturated material should be sub-excavated and replaced with competent materials.

10.6.8 Sidewalk Construction

The sidewalks would be constructed on the new embankment (granular base) in the fill area and on the existing fill or natural soil (subgrade) in the cut areas. Construction of sidewalk should be in accordance with OPSD 310.010 (Concrete Sidewalk) and/or OPSD 310.020 (Concrete Sidewalk Adjacent to Curb and Gutter), unless otherwise stated in the Region Standards and/or contract specifications. The fill subgrade/granular base should be inspected prior to placement

of the sidewalk. Soft areas in the subgrade, if any, should be re-compacted (if applicable) or replaced and compacted. OPSS 501 (Construction Specification for Compacting) and/or the Region's Standards should be followed for compaction requirements. Quality control and quality assurance should be implemented according to the Region's Standards.

11.0 GENERAL CONSIDERATION FOR DESIGN AND CONSTRUCTION

11.1 Site Preparation

Site preparation should generally include stripping of topsoil, excavation to subgrade, proof-rolling, repairing soft spots, if encountered, and backfilling, if necessary with engineered fill in order to support the proposed structures.

11.2 Engineered Fill

Engineered fill, where required, may be used to backfill excavated areas, backfill behind retaining walls / abutments, replace soft/incompetent soils, and/or raise grades. Engineered fill for embankment and backfill of excavated areas should be placed after stripping any soils containing excessive organic matters, the existing fill soils and otherwise unsuitable soils.

Engineered fill should be prepared according to the Region' standards / contract specifications,. General guideline for preparation of engineered fill is described below:

- Engineered fill should extend a minimum of 1.0 m beyond the perimeter of the structure footprint to be supported, where applicable.
- Topsoil, organic matter, and other compressible, weak and deleterious materials should be stripped and or sub-excavated and replaced with compactable approved soil.
- The fill material should be placed and compacted as per OPSS 501 (Construction Specification for Compacting) and/or applicable Region standards.
- For a certifiable engineered fill, full-time geotechnical inspection and quality control are necessary.
- Fill material should not be frozen during backfill and compaction.
- Water content of the fill should be within 2 % of the optimum value for compaction.

11.3 Excavation and Dewatering

Temporary excavations should be carried out in accordance with the Ontario Health and Safety Regulations for Construction Projects. Based on the soil conditions encountered in the boreholes, the soils to be excavated can be classified as follows:

Existing fill soils	Type 3
Loose to compact silty sand / sandy silt / sand	Type 3
Dense to very dense silty sand / sandy silt / sand	Type 2
Dense to very dense sandy gravel / gravelly sand / sand and gravel	Type 2
Very dense silty sand / sandy silt till	Type 2
Hard silty clay / clayey silt till, weathered shale	Type 2

A bank slope of 1H:1V is required for excavations in Type 2 and Type 3 soils in accordance with the Ontario Health and Safety Regulations. For Type 2 soils, a 1.2 m high vertical cut at the bottom of excavation may generally be constructed. However, a 1.2 m high vertical cut under the groundwater table may not be stable and flatter slopes may be required. Also, near the ground surface, occasional 3H:1V slopes may be required due to possible loose/soft surficial soils. All excavations should be inspected and the exposed soil types should be confirmed by a geotechnical engineer.

For all cut slopes, the stability should be frequently monitored by a geotechnical engineer. If the cut slopes are subject to erosion (e.g., due to rainfall, high groundwater flow, etc.), slope stabilization measures (e.g., covering the slope/trench faces with plastic sheets, excavating flatter slope, etc.) should be implemented.

Stockpiles of excavated materials should be kept at least a horizontal distance equal to the depth of excavation from the top edge of the excavation or slope to prevent slope instability, subject to confirmation by a geotechnical engineer.

The terms describing the consistency (very stiff or hard) give an indication of the effort needed for excavation. Hard natural soils encountered in the boreholes, along with weathered shale, may require additional excavation effort/equipment (e.g., impact hammer, excavation with rippers, etc.). Such a possibility should be considered by the Contractor and construction contract.

Groundwater in excavations may be present and dewatering may be required for underground utility installation. Dewatering (where required) could be carried out, in general, by a system of sumps and pumps or gravity drainage. High water flow rates may be encountered during the course of the installation in sandy / gravelly soils and the dewatering effort could require an increased number of sumps and pumps. More information regarding the dewatering and hydrogeological condition of the site is provided in the hydrogeological report submitted under a separate cover.

OPSS 517 (Construction Specification for Dewatering of Pipeline, Utility and Associates Structure Excavation) should be followed to keep the excavations free of water during installation of underground utilities.

Excavating and backfilling should be carried in accordance with OPSS 902 (Construction Specification for Excavating and Backfilling - Structures).

If open cut cannot be carried out, a shoring system may be used to limit the extent of excavations, subject to engineering design and approval. Temporary protection systems, if required, should follow OPSS 539 (Construction Specification for Temporary Protection System).

Where there is insufficient space for open cut excavations, shoring or a trench box will be required. The shoring analysis and design should be carried out in accordance with the Canadian Foundation Engineering Manual, latest Edition. Soil parameter provided in Section 9.0 may be used for design of temporary shoring system.

It is recommended that qualified geotechnical personnel be present during the excavations to review the condition of excavations.

11.4 Soil Reuse and Backfill

The soils removed by excavation would consist of sand and gravel fill, silty sand fill and natural sand and gravel, sand, silty sand or silty clay / clayey silt till. The excavated soil may be used as backfill, if it is clean and without organic matter and approved by geotechnical engineer.

The water contents of the fill soils at the time of backfilling and compaction should be at or near optimum (normally ± 2% of optimum water content). The excavated soils may require reconditioning (e.g., drying) prior to reuse. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc., should not be used for backfilling. The backfill should be placed in maximum 300 mm thick layers and each layer should be compacted to at least 95 % Standard Proctor Maximum Dry Density (SPMDD). When compacting, care should be taken to prevent damage to the pipes / manholes / catch basins. Backfilling and compacting should be carried out in accordance with OPSS 401 (Construction Specification for Trenching, Backfilling and Compacting) and OPSS 501 (Compacting).

Backfill materials behind the bridge, or behind the proposed retaining walls should consist of non-frost susceptible, free-draining granular materials in accordance with OPSS 1010 – (Material Specification for Aggregates – Base, Sub-base, Select Subgrade, and Backfill Material) (i.e., Granular ‘A’ or Granular ‘B’).

Free-draining backfill materials and drain pipes and weep holes, etc. should be provided to prevent hydrostatic pressure build-up behind structures.

11.5 Soil Corrosivity

Two (2) soil samples from Boreholes BH 13 and BH B3 were tested to assess the corrosive potential of soil with respect to steel and concrete by determination of pH, soluble chloride, soluble sulphate, electrical conductivity and resistivity. The soil corrosivity analysis was carried out by AGAT Laboratories.

The corrosivity analysis results are summarized in Table 11.1. The complete laboratory test results and the Certificates of Analyses are included in Appendix C.

Table 11.1 –Soil Corrosivity Test Results

Sample ID	Resistivity (ohm-cm)	Chloride (µg/g)	Electrical Conductivity (mS/cm)	pH	Sulphate (µg/g)	Redox Potential (mV)
BH 13, SS 4	1140	338	0.694	9.92	20	129
BH B3, SS 6	346	1730	2.89	9.03	70	153

Compared to the values in the available literature (i.e., J.D. Palmer, "Soil Resistivity Measurement and Analysis", Materials Performance, Volume 13, 1974), the above-mentioned values of the soil resistivity should be considered as "severe to very severe" for exposed metallic structures.

The measured water-soluble sulphate in soil were 20 µg/g and 70 µg/g. In accordance with Table 3 of the Canadian Standards Association (CSA) Series CSA A23.1-09, soil with the sulphate content ratio less than 0.1% (i.e., 1,000 ppm or µg/g) is not considered aggressive to concrete. Therefore, in accordance with Table 6 of the CSA Series A23.1-09, Type GU Portland cement may be used for concrete.

Soil corrosivity should be assessed by a corrosivity expert, if necessary.

12.0 LIMITED SOIL CHEMICAL ANALYSES

12.1 Soil Sampling

The environmental component of the subsurface investigation included the following activities:

- Conducting the soil sampling activities in accordance with Ontario Ministry of Environment and Climate Change (MOECC) documents entitled "*Guide for Completing Phase Two Environmental Site Assessments under Ontario Regulation 153/04"* (March 2016), *"Protocol for Analytical Methods Used in the Assessment of Properties Under Part XV.1 of the Environmental Protection Act*" (June 2011) and Ontario Regulation 153/04;

- Soil samples were submitted for laboratory analysis of petroleum hydrocarbons (PHC) F1-F4, volatile organic compounds (VOCs), metals and inorganics and organochlorine pesticides (OCPs) to assist in determining appropriate soil disposal options, if required, during construction;
- Submission of one (1) soil sample for Ontario Regulation 347 as amended by Ontario Regulation 558/00 (O. Reg. 347) Toxicity Characteristic Leaching Procedure (TCLP) for volatile organic compounds (VOCs), ignitibility and metals and inorganics to determine landfill acceptability of soil/granular fill originating from the Site;
- Comparison of the laboratory analytical results to soil standards presented in the MOECC document entitled "*Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*," dated April 15, 2011 and O. Reg. 347, as amended by O. Reg. 558/00, Schedule 4 Leachate Quality Criteria provided in the MOECC document entitled "*Registration Guidance Manual For Generators of Liquid Industrial and Hazardous Waste*," October 2000 (the "Schedule 4 Criteria").

12.1.1 Site Condition Standards

Soil results are compared to the MOECC Table 1 soil standards for Residential/ Parkland/ Institutional/ Industrial/ Commercial/ Community Property Use (Table 1 SCS) and Table 3 soil standards for Industrial / Commercial / Community Property Use (Table 3 SCS) presented in the MOECC document "*Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*", dated April 15, 2011.

12.1.2 Sample Analysis Rationale

A total of fifteen (15) soil samples were collected for geotechnical purposes and submitted for analysis of metals and inorganics as shown in Table 12.1. Four (4) samples were submitted for analysis of PHC F1 to F4, VOCs and OCP.

Table 12.1 – Collected Soil Samples

Borehole ID	Sample ID	Sample Depth (m)	Chemical Analysis
BH 2	BH 2 / AS2	0.15 – 0.6	PHC F1 to F4, VOCs
BH 3	BH 3, 1.0m-1.5m	1.0 – 1.5	Metals and Inorganics, OCP
BH 6	BH 6 / AS3	0.7 – 1.0	PHC F1 to F4, VOCs, Metals and Inorganics
BH 8	BH 8 / AS2	0.7	Metals and Inorganics, OCP
BH 11	BH 11 / AS3	0.6 – 1.5	Metals and Inorganics
BH 13	BH 13 / AS2	0.76 – 1.2	Metals and Inorganics
BH 20	BH 20 / AS2	0.4 – 1.0	Metals and Inorganics, OCP
BH 23	BH 23 / SS3	0.76 – 1.2	Metals and Inorganics
BH 26	BH 26 / SS3	1.0 – 1.6	Metals and Inorganics
BH 29	BH 29 / AS2	0.35 – 0.70	Metals and Inorganics
BH 31	BH 31 / SS2	0.35 – 0.75	Metals and Inorganics
BH 36	BH 36 / AS1	0.25- 0.45	Metals and Inorganics
BH 39	BH 39, 600 mm - 1.5 m	0.6 – 1.5	Metals and Inorganics
BH 42	BH 42, 450 mm - 1.0 m	0.45 – 1.0	Metals and Inorganics
BH B5	BH B-5, 2.0 ft - 4.0 ft	0.6 – 1.2	PHC F1 to F4, VOCs, Metals and Inorganics
BH B6	BH B6 / SS1	0.3 – 0.6	Metals and Inorganics, OCP
	BH B6 / SS2	0.9 – 1.4	PHC F1 to F4, VOCs

12.1.3 Sampling, Inspection and Preservation Procedures

Samples were collected using a stainless steel sampling tool. Disposable nitrile gloves were used and replaced between the handling of successive samples.

Remaining soil samples were obtained for laboratory analysis and field screening, where applicable, using a drill rig equipped with split spoon sampling capabilities. The drillers obtained the split spoon sample by auguring to the specified depth, hammering the spoon about 0.6 m into the soil and removing the spoon. Select samples were also taken from auger cuttings. The split spoon samples were inspected for visual and/or olfactory evidence of environmental impacts. Disposable nitrile gloves were used and replaced between the handling of successive samples.

Soil samples deemed to be representative of the Site conditions were collected and placed in laboratory-supplied glass jars equipped with Teflon seals and submitted for PHC F2-F4, OCP

and/or metals & inorganics. Samples submitted for analysis of VOCs and PHC F1 were collected using dedicated laboratory supplied syringes and preserved in the field using 40 mL vials containing 10 mL of methanol. The samples were selected on the basis of visual/olfactory evidence of impacts, field screening results, or from the vicinity of the apparent water table. All samples were stored in coolers, on ice, immediately after collection and during transport to the laboratory.

Using nitrile gloves, the remaining sample, where applicable, was transferred from the split spoon sampler into clean (i.e., unused) resealable bags. Prior to measurement of soil headspace vapours, the bags were allowed to reach ambient temperature. Soil vapours in collected soil samples were measured with a RKI Eagle 2 portable gas meter. The RKI Eagle 2 was calibrated at the commencement of the field sampling programs using isobutylene reference gas and hexane reference gas. The duplicate soil sample fractions were screened for both combustible organic vapour (COV) and total organic vapour (TOV) concentrations using the sample headspace method to facilitate sample selections for laboratory analysis and to provide an assessment of the vertical contaminant distributions at each borehole location, if applicable.

Representative soil samples collected during the investigation were submitted to AGAT Laboratories of Mississauga, Ontario, for PHC F1-F4, VOCs, OCPs and metals and inorganics analysis. AGAT is accredited by the Standards Council of Canada (“SCC”) and the Canadian Association for Laboratory Accreditation (CALA) in accordance with ISO/IEC 17025:2005 – “General Requirements for the Competence of Testing and Calibration Laboratories” for the tested parameters set out in the Soil, Ground Water and Sediment Standards.

It should be noted that a Phase I ESA for the project area has not been conducted by or provided to Amec Foster Wheeler and therefore historical land use has not been confirmed.

12.2 Environmental Test Results And Considerations

12.2.1 Chemical Results

No evidence (i.e. visual/olfactory) of environmental impacts were observed in any of the soil samples collected from the project area. Field screening measurements of combustible and total organic gas vapours undertaken with the Gastector or RKI Eagle 2 are provided on the soil analytical tables. The readings ranged from non-detectable to 35 parts per million (ppm) for COV and 5 ppm for TOV. Soil vapour readings were used in the selection of soil samples for analysis.

A total of fifteen (15) soil samples were collected for geotechnical purposes and submitted for analysis of metals and inorganics. Four (4) samples were submitted for analysis of PHC F1 to F4, VOCs and OCP. Samples were submitted from depths between surface and 1.5 m based

on measured gas vapours (where available), proximity to the inferred water table, presence of fill material and depth of construction works.

The soil/crushed rock samples collected or reviewed as part of this assessment that exceeded the **Table 1 SCS** are as follows:

- BH B6 / SS2 exceeded for PHC F4 at a depth of 0.9 to 1.4 m.
- BH 3, 1.0m-1.5m exceeded for sodium adsorption ratio (SAR) at a depth of 1.0 to 1.5 m.
- BH 8/AS2 exceeded for SAR at a depth of 0.7 to 1.0 m.
- BH 11/AS3 exceeded for SAR at a depth of 0.6 to 1.5 m.
- BH 13/AS2 exceeded for SAR and electrical conductivity (EC) at a depth of 0.76 to 1.2 m.
- BH 20/AS2 exceeded for SAR at a depth of 0.4 to 1.0 m.
- BH 23/SS3 exceeded for SAR at a depth of 0.76 to 1.2 m.
- BH 26/SS3 exceeded for SAR and EC at a depth of 1.0 to 1.6 m.
- BH 29/AS2 exceeded for SAR and EC at a depth of 0.35 to 0.70 m.
- BH 31/SS2 exceeded for SAR and EC at a depth of 0.35 to 0.75 m.
- BH 36/AS1 exceeded for SAR at a depth of 0.25 to 0.45 m.
- BH B-5, 2.0 ft-4.0 ft exceeded for SAR and EC at a depth of 0.6 to 1.2 m.
- BH B6/SS1 exceeded for SAR at a depth of 0.3 to 0.6 m.

The remaining soil samples met the Table 1 SCS for PHC F1 to F4, VOCs, OCP and metals and inorganics.

The soil/crushed rock samples collected or reviewed as part of this assessment that exceeded the **Table 3 SCS** are as follows:

- BH 13/AS2 exceeded for SAR and EC at a depth of 0.76 to 1.2 m.
- Samples BH 23/SS3, BH 29/AS2 and BH 31/SS2 were above the pH range of 5 to 9 for surface soil to be able to apply Table 3 SCS under O. Reg. 153/04. The elevated pH is not considered to be hazardous for disposal at a licensed landfill.

The remaining soil samples met the Table 3 SCS for PHC F1 to F4, VOCs, OCPs and metals and inorganics. Due to the application of road salts for control of snow and ice on roads, it is common to find elevated concentrations of EC and SAR and therefore these parameters would be exempt under O. Reg.153/04 (O. Reg. 153/04 s. 48(3)).

The reported leachate concentrations were compared to the Schedule 4 Criteria. The reported concentrations of metals & inorganics and VOCs, were below the Schedule 4 Leachate Quality

Criteria and it was noted as non-flammable; therefore, the soil would be classified as non-hazardous for disposal at an approved landfill.

If soil is required to be removed from the site it should be disposed at a licensed landfill or equivalent receiving facility.

Analytical results are summarized in Tables 1 to 4 along with the laboratory certificates of analysis and provided in Appendix C. The results of the O. Reg. 347 TCLP analysis and associated laboratory certificate of analysis are provided in Appendix D.

12.2.2 Laboratory Quality Control

The "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act", 01 July 2011 (the "2011 Analytical Protocol") provides requirements for sample handling and storage requirements, reporting requirements, analytical methods and QA/QC procedures for analytical parameters.

A low bias might be present in cyanide, chromium VI and mercury sample results as the samples were analyzed past hold times. These parameters are not considered to be potential contaminants of concern and therefore the low bias is not considered to significantly affect the outcome of this assessment. Remaining samples/sample extracts were analyzed within their applicable hold times using approved analytical methods.

The reporting limits were met for all samples and tested parameters. No tested parameter was present in a detectable concentration in any laboratory Method Blank and all laboratory surrogates, reference materials and replicate samples are considered acceptable.

13.0 RECOMMENDATIONS FOR ADDITIONAL INVESTIGATION FOR DETAIL DESIGN

This geotechnical investigation was completed for Schedule 'C' Class Environmental Assessment. Additional investigation, including boreholes and / or analysis, may be required for detail design, once the design details are available. The following additional investigation / analysis should be carried out, for detail design:

- field investigation, including additional boreholes, for any additional structures not identified during this investigation; and
- slope stability analysis for:
  - retaining walls / abutment slopes, during detail design;
  - high embankments (height greater than or equal to 4.5 m); and
  - permanent cut slopes.

14.0 CLOSURE

The sub-surface information and recommendations contained in this report should be used solely for the purpose of geotechnical assessment of the project.

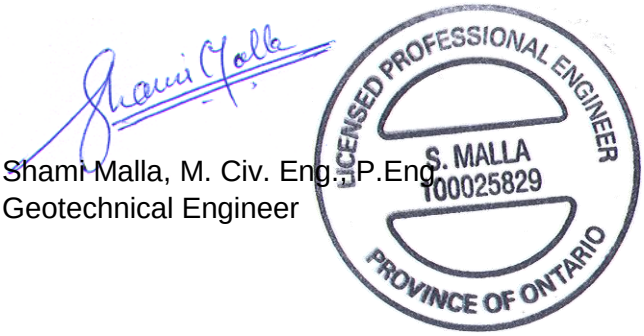
Additional borehole investigation and analyses may be required to fulfill the final design requirements.

The Report Limitations are an integral part of this report.

This report was prepared by Shami Malla, M.Civ.Eng., Hoda Seddik, M.A.Sc, P.Eng and Tracey Schranz, B.E.S., and reviewed by Jeff Carson, P.Eng. and Prapote Boonsinsuk, Ph.D., P.Eng.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure,
a Division of Amec Foster Wheeler Americas Limited



Shami Malla, M. Civ. Eng., P.Eng.
Geotechnical Engineer

Tracey Schranz, B.E.S.
Environmental Site Assessor

Hoda Seddik, M.A.Sc., P.Eng.
Consulting Engineer
Senior Associate Pavement Engineer

DRAFT

Amec Foster Wheeler Environment & Infrastructure,
a Division of Amec Foster Wheeler Americas Limited

REPORT LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the test holes.

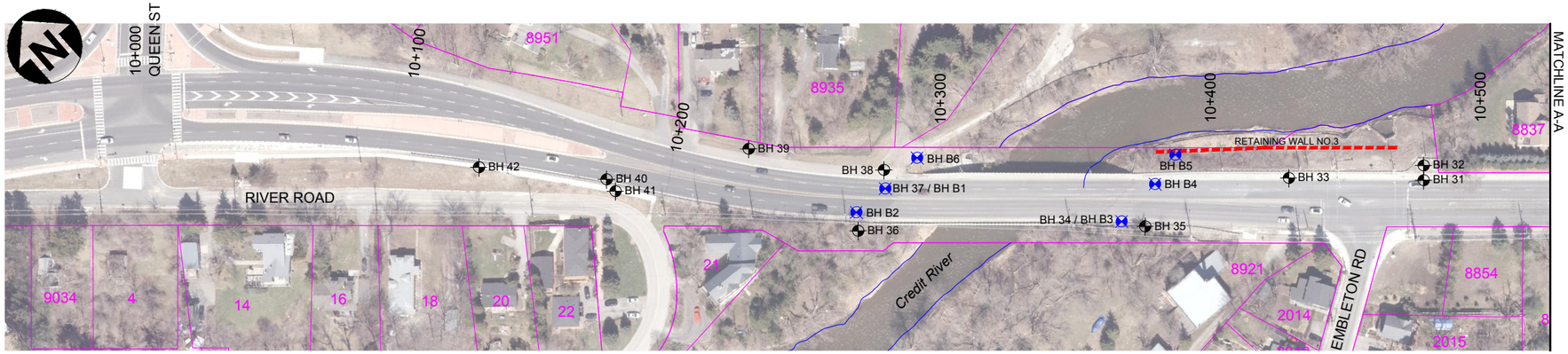
The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited be retained during the final design stage to verify that the design is consistent with Amec Foster Wheeler Environment & Infrastructure's recommendations, and that assumptions made in Amec Foster Wheeler Environment & Infrastructure, are valid.

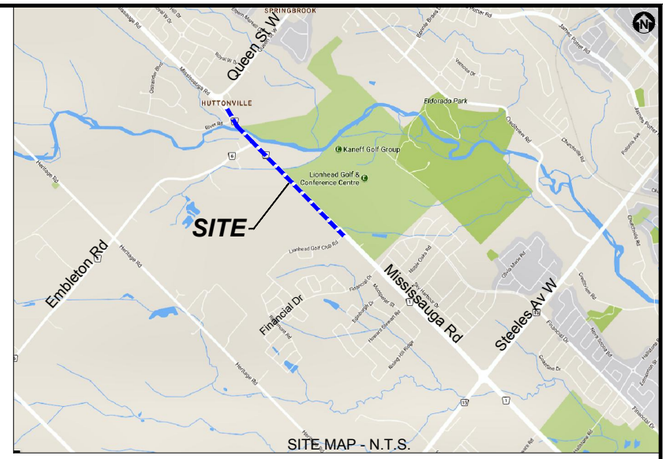
The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

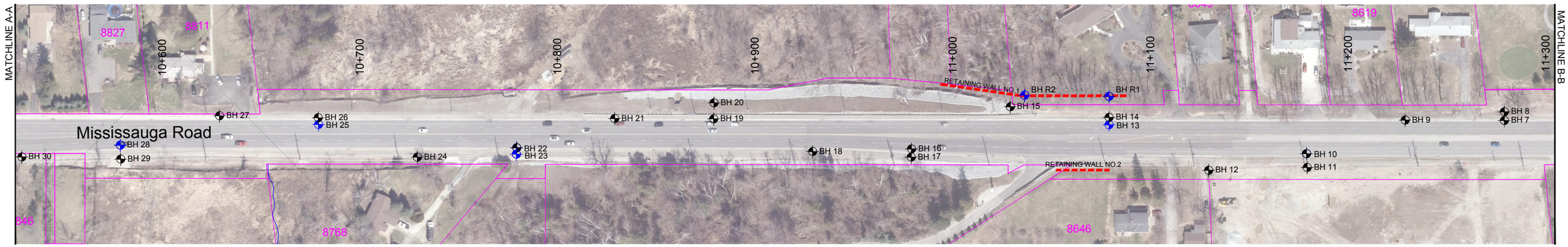
The elevations mentioned in this report were obtained for the purpose the geotechnical investigation and reporting and should not be used for any accurate measurement.

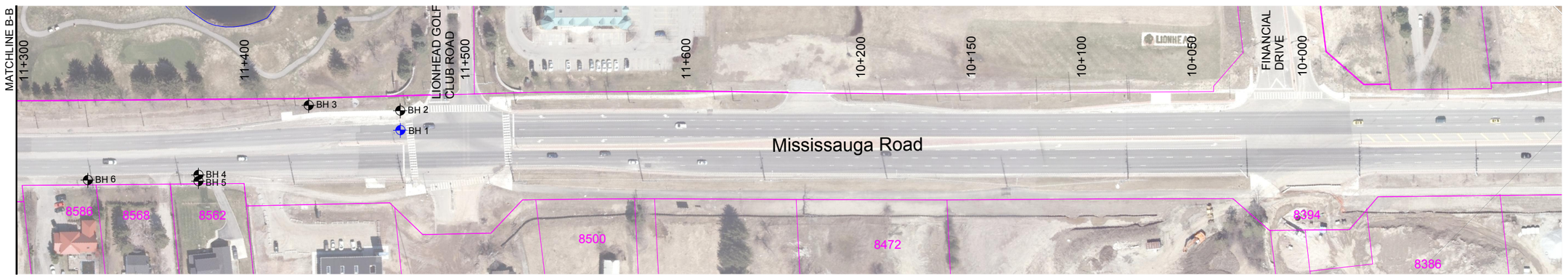
Any use of a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Amec Foster Wheeler Environment & Infrastructure, accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

FIGURE









LEGEND

- BOREHOLE LOCATION (pavement)
- BOREHOLE LOCATION (geotechnical)
- BOREHOLE LOCATION (bridge)
- FUTURE RETAINING WALL

0 25 50 75 100m

APPROXIMATE SCALE

CLIENT LOGO

Region of Peel
Working for you

CLIENT:

THE REGIONAL MUNICIPALITY OF PEEL

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited
104 Crockford Boulevard, Scarborough, Ontario, M1R 3C3

DWN BY:	KW
CHK'D BY:	PB
DATUM:	-
PROJECTION:	-
SCALE:	AS SHOWN

TITLE

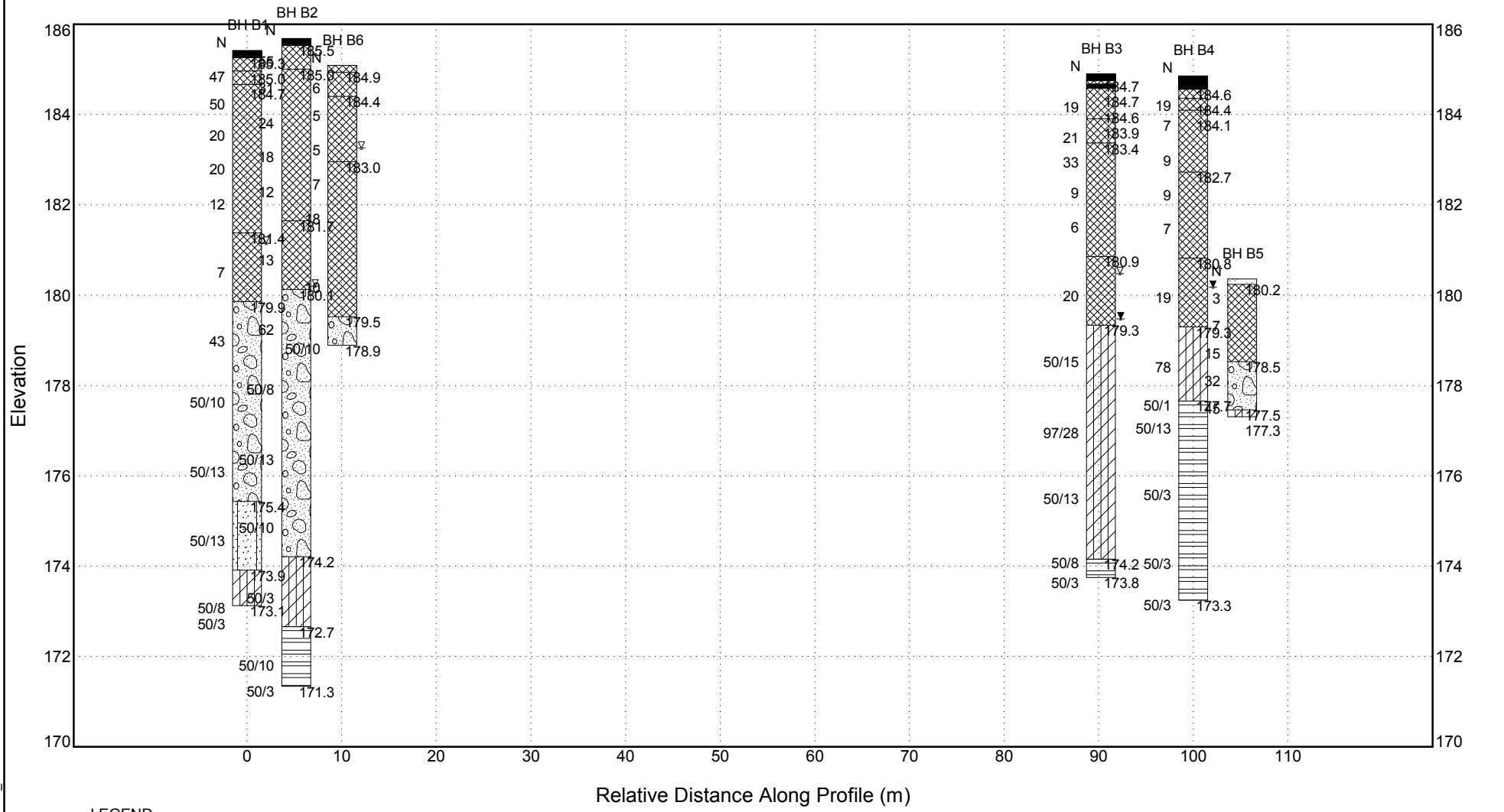
SITE AND BOREHOLE LOCATION PLAN

PROJECT

GEOTECHNICAL INVESTIGATION AND PAVEMENT DESIGN REPORT
SCHEDULE 'C' CLASS ENVIRONMENTAL ASSESSMENT
PROPOSED WIDENING OF MISSISSAUGA ROAD
FROM NORTH OF FINANCIAL DRIVE TO QUEEN STREET WEST (LOCATION 1)
CITY OF BRAMPTON, ONTARIO

DATE:	NOVEMBER 2017
PROJECT NO:	TP115085
CONTRACT NO:	-
REV. NO.:	-
FIGURE No.	1

Z:\Projects\2015\TP – Burlington\TP115085 – Mississauga Rd. Bypass\Workplan Kent\TP115085 – Rev_Site and Borehole Location Plan_Fig1.dwg – BH Plan – Nov. 20, 2017 1:12pm – kent.wong



SUBSURFACE FENCE DIAGRAM

Soil Profile along Huttonville Bridge

Geotechnical Investigation and Pavement Design

Mississauga Road

JOB NO.	DATE	Figure
TP115085	November 2017	2

FENCE FOR TP115085 TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC.SIVA 2008.GDT 20/11/17

RECORD OF BOREHOLES

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and Depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the *Modified Unified Soil Classification System*.

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows *(Ref. Canadian Foundation Engineering Manual)*:

Compactness of Cohesionless Soils	SPT N-Value
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	Undrained Shear Strength kPa	Undrained Shear Strength psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very stiff	100 to 200	2000 to 4000
Hard	Over 200	Over 4000

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

This column is used to describe non-standard situations or notes of interest.

Amec Foster Wheeler Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

amec foster wheeler

MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS

*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357 prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1 March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		W_L > 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 30%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < W_L < 50%	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		W_L > 50%	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SLITS & CLAYS BELOW "A" LINE	W_L < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		W_L > 50%	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGH ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SOIL COMPONENTS

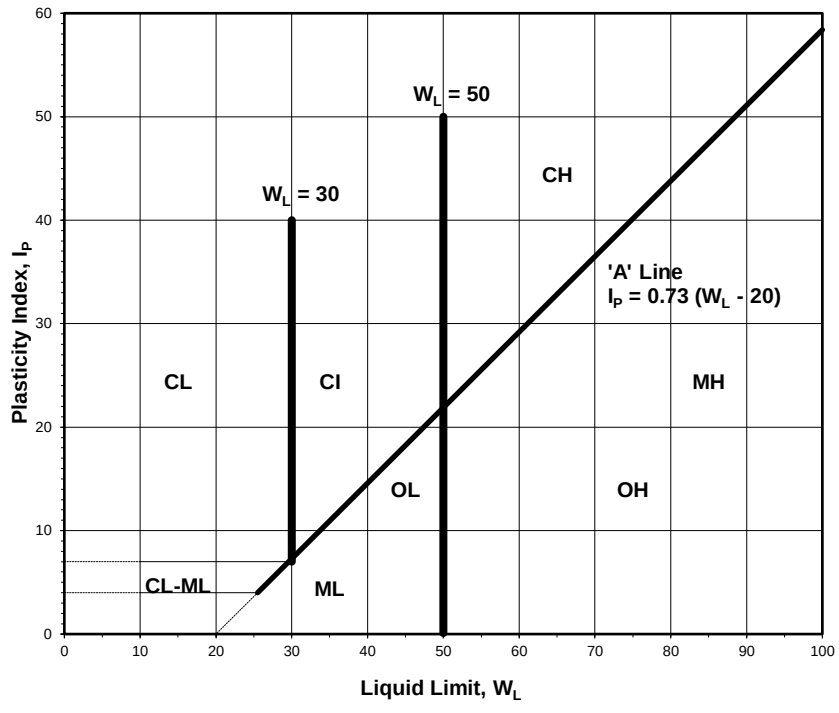
FRACTION	U.S STANDARD SIEVE SIZE		
GRAVEL	COARSE	PASSING	RETAINED
		76 mm	19 mm
	FINE	19 mm	4.75 mm
SAND	COARSE	4.75 mm	2.00 mm
	MEDIUM	2.00 mm	425 µm
	FINE	425 µm	75 µm
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm	

DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
PERCENT	DESCRIPTOR
35-50	AND
20-35	Y/EY
10-20	SOME
1-10	TRACE

OVERSIZED MATERIAL

ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm	NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS > 0.76 CUBIC METRE IN VOLUME

Plasticity Chart for Soil Passing 425 Micron Sieve



Amec Foster Wheeler Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Note 1: Soils are classified and described according to their engineering properties and behaviour.

Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual.

ABBREVIATIONS FOR BORING AND TEST DATA

Accep	Acceptable	Gry	Grey	Psty	Polystyrene
Agg	Aggregate	H	Heavy	Poss	Possible
Amor	Amorphous	Hi	Highly	PST	Prime and Surface Treated
Asph	Asphalt	HP	High Plasticity	Quant	Quantity
BR	Bedrock	HM	Hot Mix	Reinf	Reinforced
Blk	Black	Lt	Light	RSS	Remoulded Shear Strength
Bl	Blue	Liq	Liquid	RF	Rock Fill
BH	Borehole	W_L	Liquid Limit	Sa	Sand
Bld (y)	Boulder (y)	Lo	Loam	Sat	Saturated
Blds	Boulders	L	Loose	SH	Shale
BU	Break Up	Mrl	Marl	St	Sensitivity
Br	Brown	Matl	Material	SSM	Select Subgrade Material
CF	Channel Face	Max	Maximum	Sh Rk	Shot Rock
Cl	Clay	MDD	Maximum Dry Density	Si (y)	Silt (y)
Co	Coarse	MWD	Maximum Wet Density	Sl (y)	Slight (ly)
Cob	Cobbles	Med	Medium	SP	Slight Plasticity
Comp	Compact	MP	Medium Plasticity	Stn (y)	Stoney
Conc	Concrete	Mod	Moderate	D_R	Relative Density
Contam	Contaminated	Mott	Mottled	Stks	Streaks
Cord	Corduroy	Mul	Mulch	Surf	Surface
Cr	Crushed	NFP	No Further Progress	Temp	Temperature
Dk	Dark	NFP (Blds)	No Further Progress (Boulders)	TH	Test Hole
Decomp	Decomposed	Num	Numerous	TP	Test Pit
D	Dense	OCC	Occasional	Tps	Topsoil
E	Earth	Wopt	Optimum Moisture Content	Tr	Trace
Fib	Fibrous	Ora	Orange	USS	Undisturbed Shear Strength
w	Field Moisture Content	Org	Organic	Unreinf	Unreinforced
F	Fine	Org M	Organic Matter	Varv	Varved
Fr Wat	Free Water	Ob	Overburden	VF	Very Fine
FB	Frost Boil	Pavt	Pavement	WT	Water Table
FH	Frost Heave	Pedo	Pedological	Weath	Weathered
Gran	Granular	Pen Mac	Penetration Macadam	W	With
Gr	Gravel (ly)	Wp	Plastic Limit	Wd (y)	Wood (y)
Grn	Green	Ip	Plasticity Index	Yel	Yellow

SUSCEPTIBILITY TO FROST HEAVING

HSFH – High
MSFH – Medium
LSFH – Low

ONTARIO PROVINCIAL STANDARD DRAWING

Date | 1986 07 18 | Rev

ABBREVIATIONS

GEOTECHNICAL

Date _ _ _ _ _ _

OPSD – 100.06

RECORD OF BOREHOLE No. BH 1

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, MDL on Mississauga Road
Drilling Method: 150 mm Solid Stem Augering
Drilling Machine: Truck Mounted Drill
Date Started: 13 Jun 17 Date Completed: 13 Jun 17

Logged by: JF Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

Geodetic Ground Surface Elevation: 204.2 m

Depth (m)	Description	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
0.0	about 190mm ASPHALT	204.0				
0.2	Sand and Gravel (19mm Crusher Run) FILL moist	203.7	AS	1		
0.5	Sand and Gravel (50mm Crusher Run) FILL moist	203.5				
0.7	brown Sand and Gravel FILL moist		SS	2	100	29
1.4	dark brown Sandy Silt FILL trace clay with organics, trace wood chips moist	202.8	SS	3	78	22
2.1	brown SAND some silt compact wet	202.1	SS	4	67	14
			SS	5	56	10
3.5	End of Borehole	200.7				

Field Testing: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Lab Testing: Soil Vapour Reading — COV (LEL), TOV (LEL) 2 4 6 8; COV (ppm), TOV (ppm) 100 200 300 400; W_P W W_L; Plastic Liquid; 20 40 60 80

Instrumentation Installation: 630

Comments & Grain Size Distribution (%): Borehole located on NBL, on lane 2, about 6.2 m from CL.

GR SA SI CL

Groundwater depth during drilling on 13/06/2017 at a depth of: 2.4 m.

Cave in depth after removal of augers: 2.4 m.

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Scale: 1 : 53

RECORD OF BOREHOLE No. BH 13

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Design**
Project Location: **Mississauga Road**

Drilling Location: **NBL, MDL on Mississauga Road**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Truck Mounted Drill**
Date Started: **13 Jun 17** Date Completed: **13 Jun 17**

Logged by: **JF** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 17/10/17**

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 201.8 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT □ PPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading □ COV (LEL) ■ TOV (LEL) 2 4 6 8 △ COV (ppm) ▲ TOV (ppm) 100 200 300 400 W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	about 180 mm ASPHALT	201.6										Borehole located on NBL, on lane 2.
	Sand and Gravel (19mm Crusher Run) FILL moist	0.2 201.3	AS	1								
	Sand and Gravel (50mm Crusher Run) FILL moist	0.5 200.9										
	brown **SAND** trace to some silt, trace gravel compact moist	0.9	SS	2	100	21	1	201				
			SS	3	100	21	2	200				
			SS	4	100	14		199				
			SS	5	100	11	3					
		198.3										
	End of Borehole	3.5										

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH 23

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, Sidewalk, on Mississauga Road
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Truck Mounted Drill
Date Started: 15 Jun 17 Date Completed: 15 Jun 17

Logged by: DU Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

amec foster wheeler

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 183.6 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	Penetration Testing: SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading: COV (LEL), TOV (LEL) 2 4 6 8; COV (ppm), TOV (ppm) 100 200 300 400; W_P W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR SA SI CL
	about 100 mm ASPHALT	183.5 0.1										Borehole located on sidewalk.
	brown Gravelly Sand FILL some silt to silty moist	183.3 0.3	AS	1								
	brown Sand and Gravel FILL some silt to silty moist	183.0 0.6	AS	2				183				
	Sand and Gravel (19mm Crusher Run) FILL moist	182.4 1.2	SS	3	100	65	1					
	brown Sand and Gravel FILL some silt, trace cobbles moist		SS	4	44	25	2	182				
	brown / reddish brown SILTY SAND / SANDY SILT / SAND trace to some clay, trace gravel with organics loose wet	181.5 2.1	SS	5	83	9		181				
	greyish brown SAND AND GRAVEL some silt, trace cobbles and boulders dense wet	180.6 3.0	SS	6	67	34	3					
							4	180				
			SS	7	58	36	5	179				
	End of Borehole	178.4 5.2										

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

▽ Groundwater depth during drilling on 15/06/2017 at a depth of: 2.3 m.

◪ Cave in depth after removal of augers: 2.3 m.

RECORD OF BOREHOLE No. BH 25

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, MDL on Mississauga Road
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Truck Mounted Drill
Date Started: 14 Jun 17 Date Completed: 14 Jun 17

Logged by: DU Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

Depth (m)	Description	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
	Geodetic Ground Surface Elevation: 183.4 m					
	about 130 mm ASPHALT	183.2				
	Sand and Gravel (19mm Crusher Run) FILL	0.1	AS	1		
	moist	183.0				
	Sand and Gravel (50mm Crusher Run) FILL	0.4	SS	2	83	50 / 150mm
	moist	182.7				
	brown	0.7				
	Gravelly Sand FILL		SS	3	78	27
	some silt					
	moist					
1		182.0				
	brown	1.4				
	Sand and Gravel FILL		SS	4	89	24
	some silt					
	moist					
2		181.2				
	brown	2.1				
	Sand FILL		SS	5	78	14
	some silt, trace to some gravel					
	wet					
3		180.5				
	brown	2.9				
	SANDY GRAVEL		SS	6	89	31
	some silt					
	dense					
	wet	179.8				
	End of Borehole	3.5				

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* Intact/Remould; Nilcon Vane* Intact/Remould; * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Soil Vapour Reading — COV (LEL), TOV (LEL) 2 4 6 8; COV (ppm), TOV (ppm) 100 200 300 400; W_P W W_L; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole located on NBL, on lane 2, about 5.0 m east of CL.

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Groundwater depth during drilling on 14/06/2017 at a depth of: 2.1 m.

Cave in depth after removal of augers: 2.4 m.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH 28

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, MDL on Mississauga Road
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Truck Mounted Drill
Date Started: 15 Jun 17 Date Completed: 15 Jun 17

Logged by: DU Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

Depth (m)	Description	Elevation (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Field Testing	Lab Testing	Instrumentation / Installation
	Geodetic Ground Surface Elevation: 183.0 m								
0	about 200 mm ASPHALT	182.8							
0.2	dark brown Sand and Gravel FILL some silt moist	182.7	AS	1					
0.3			AS	2					
0.6		182.4	AS	3					
0.9	light brown Gravelly Sand FILL moist	182.1	SS	4	89	67			
	Sand and Gravel (19mm Crusher Run) FILL moist								
	reddish brown Sand and Gravel / Gravelly Sand FILL some silt, trace cobbles moist to wet		SS	5	67	27			
			SS	6	27	1			
2.9	greyish brown SILTY SAND / SANDY SILT TILL trace clay, some gravel to gravelly, cobbles and boulders very dense moist	180.1	SS	7	58	54			
			SS	8	47	70 / 280mm	70 / 280 mm		
5.0	End of Borehole	178.0							

Penetration Testing: SPT, PPT, DCPT
MTO Vane*: Intact, Remould
Nilcon Vane*: Intact, Remould
* Undrained Shear Strength (kPa): 20, 40, 60, 80

Soil Vapour Reading: COV (LEL), TOV (LEL) 2, 4, 6, 8; COV (ppm), TOV (ppm) 100, 200, 300, 400
W_P, W, W_L: Plastic, Liquid 20, 40, 60, 80

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Borehole located on SBL, on lane 2, about 5.0 m west of CL. Borehole moved from shoulder to lane 2.

Hard augering.

Groundwater depth during drilling on 15/06/2017 at a depth of: 2.4 m.

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B1

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, MDL on Mississauga Road
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Truck Mounted Drill
Date Started: 16 Jun 17 Date Completed: 16 Jun 17

Logged by: KK Compiled by: DU Reviewed by: SM Revision No.: 0, 27/10/17

Geodetic Ground Surface Elevation: 185.4 m

DESCRIPTION	Elevation (m)	Depth (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Undrained Shear Strength (kPa)	Soil Vapour Reading (ppm)	Plastic / Liquid
about 160 mm ASPHALT	185.3	0							
brown Sand and Gravel FILL moist	185.0	0.2	SS	1	58	47		4	
brown Gravelly Sand FILL trace cobbles moist	184.7	0.5	SS	2	42	50		6	
grey / brown Silty Sand FILL trace to some clay and gravel moist to wet		0.7	SS	3	83	20		11	
			SS	4	89	20		9	
			SS	5	89	12		11	
brown Silty Clay / Clayey Silt FILL trace gravel, with sand pockets	181.4	4.0	SS	6	89	7		13	
brown / reddish brown GRAVELLY SAND trace clay, some silt, trace cobbles dense to very dense wet	179.9	5.6	SS	7	100	43		11	
			SS	8	100	50 / 100mm	50 @ 100 mm	15	
			SS	9	100	50 / 130mm	50 @ 130 mm	11	
	175.4	10							

Penetration Testing: SPT, PPT, DCPT
MTO Vane*: Intact, Remould
Nilcon Vane*: Intact, Remould
* Undrained Shear Strength (kPa)
Soil Vapour Reading: COV (LEL), TOV (LEL), COV (ppm), TOV (ppm)
W_P, W, W_L: Plastic, Liquid

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located on NBL, on lane 2, about 6.5 m from CL.

GR	SA	SI	CL
32	50	15	3

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Groundwater depth during drilling on 17/06/2017 at a depth of: 4.3 m.

Cave in depth after removal of augers: 5.2 m.

Scale: 1 : 53

Continued on Next Page

RECORD OF BOREHOLE No. BH B1

Project Number: **TP115085** Project Name: **Geotechnical Investigation and Pavement Design**

Project Location: **Mississauga Road**

amec foster wheeler

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading: □ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400; W_P W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	brown / brownish grey **SILTY SAND** trace clay, some gravel, trace cobbles very dense	10.0						175							
			SS	10	100	50 / 130mm			50 / 130 mm	11		14	53	25	8
							11								
		173.9						174							
	greyish brown **SILTY CLAY / CLAYEY SILT TILL** some sand to sandy, trace gravel hard	11.5													
							12								
		173.1	SS	11	100	50 / 80mm			50 / 80 mm	12					
	End of Borehole due to Auger Refusal	12.3	SS	12	100	50 / 30mm			50 / 30 mm	14					

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B2

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: SBL, MDL on Mississauga Road
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Truck Mounted Drill
Date Started: 16 Jun 17 Date Completed: 16 Jun 17

Logged by: KK/DU Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

amec foster wheeler

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 185.7 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Field Testing	Lab Testing	Instrumentation	Comments & Grain Size Distribution (%) GR SA SI CL
	about 155 mm ASPHALT	185.5									
	brown **Sand and Gravel FILL** trace clay and silt moist	185.0	0.2	SS	1	89	55				Borehole located on SBL, on lane 2, about 5.3 m from CL.
	greyish brown / brown **Sand FILL** trace clay, trace to some silt, trace gravel moist		0.7	SS	2	78	31				
			1	SS	3	56	24				
			2	SS	4	100	18				
			3	SS	5	100	12				9 71 16 4
	reddish brown **Silty Clay / Clayey Silt FILL** trace gravel, with sand pockets	181.7	4.0								
			4	SS	6	94	13				
	brown / reddish brown **SAND AND GRAVEL** some silt, trace clay and cobbles very dense wet	180.1	5.6								
			6	SS	7	100	62				35 40 19 6
			7	SS	8	100	50 / 80mm	50 / 80 mm			Hard augering starting about 7.5 m depth.
			8	SS	9	60	50 / 130mm	50 / 130 mm			
			9								
			10								

Field Testing: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); * Undrained Shear Strength (kPa) 20 40 60 80

Lab Testing: Soil Vapour Reading — COV (LEL), TOV (LEL) 2 4 6 8; COV (ppm), TOV (ppm) 100 200 300 400; W_P W W_L Plastic Liquid 20 40 60 80

Groundwater depth during drilling on 16/06/2017 at a depth of: 5.5 m.

Cave in depth after removal of augers: 5.8 m.

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Scale: 1 : 53

Continued on Next Page

RECORD OF BOREHOLE No. BH B2

Project Number: **TP115085** Project Name: **Geotechnical Investigation and Pavement Design**

Project Location: **Mississauga Road**

amec foster wheeler

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT / PPT / DCPT); MTO Vane* (Intact / Remould); Nilcon Vane* (Intact / Remould); * Undrained Shear Strength (kPa)	LAB TESTING: Soil Vapour Reading COV (LEL) / TOV (LEL); COV (ppm) / TOV (ppm); W_P W W_L Plastic Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown / reddish brown **SAND AND GRAVEL** some silt, trace clay and cobbles very dense wet	SS	10	100	50 / 100mm	11	175	50 / 100 mm	8		
	174.2 reddish brown 11.5 **SILTY CLAY / CLAYEY SILT TILL** trace sand and gravel, with shale fragments hard	SS	11	100	50 / 30mm	12	174 173	50 / 30 mm	7		
	172.7 grey 13.0 **WEATHERED SHALE** hard	SS	12	100	50 / 100mm	13	172	50 / 100 mm	13		
	171.3 **End of Borehole due to Auger Refusal** 14.3	SS	13	100	50 / 30mm	14		50 / 30 mm	14		

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B3

Project Number: TP115085 | Drilling Location: SBL, MDL on Mississauga Road

Project Client: The Regional Municipality of Peel | Drilling Method: 150 mm Solid Stem Augers

Project Name: Geotechnical Investigation and Pavement Design | Drilling Machine: Truck Mounted Drill

Project Location: Mississauga Road | Date Started: 19 Jun 17 | Date Completed: 19 Jun 17

Logged by: JF | Compiled by: DU | Reviewed by: SM | Revision No.: 0, 17/10/17

amec foster wheeler

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 184.9 m)	Elevation	Thickness	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	Depth (m)	Elevation (m)	Field Testing	Lab Testing	Instrumentation Installation
	about 150 mm ASPHALT	184.7										
	brown Gravelly Sand FILL	184.2	0.5	AS	1							
	about 90 mm ASPHALT	184.0	0.3									
	Gravelly Sand FILL trace cobbles			SS	2	79	19					
		183.9						1	184			
	brown Silty Sand FILL with silty clay pockets moist		1.0	SS	3	100	21					
		183.4						2	183			
	brown Sand FILL trace clay, silt and gravel with silty clay pockets moist to wet		1.5	SS	4	83	33					
				SS	5	67	9					
				SS	6	56	6	3	182			
		180.9						4	181			
	brown Sandy Clayey Silt FILL trace gravel wet		4.0	SS	7	56	20					
		179.3						5	180			
	reddish brown SILTY CLAY / CLAYEY SILT TILL some sand to sandy, trace gravel, trace cobbles with limestone and shale fragments hard		5.6	SS	8	100	50 / 150mm	6	179			
				SS	9	106	97 / 280mm	7	178			
				SS	10	91	50 / 130mm	8	177			
								9	176			
								10	175			

Field Testing: Penetration Testing — ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80

Lab Testing: Soil Vapour Reading — □ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400; W_P W W_L; Plastic Liquid 20 40 60 80

Field Testing values: 50 / 150 mm; 50 / 130 mm; 97 / 280 mm

Lab Testing values: 5, 3, 11, 7, 9, 13, 15, 9, 11, 8

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located on SBL, on lane 2, about 5.3 m from CL.

GR	SA	SI	CL
6	39	43	12

Hard augering starting about 7.5 m depth.

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

▽ Groundwater depth during drilling on 19/06/2017 at a depth of: 4.4 m.

▼ Groundwater depth observed on 2/10/2017 at a depth of: 5.4 m.

■ Cave in depth after removal of augers: 9.1 m.

Scale: 1 : 53

Continued on Next Page

RECORD OF BOREHOLE No. BH B3

Project Number: **TP115085** Project Name: **Geotechnical Investigation and Pavement Design**

Project Location: **Mississauga Road**

amec foster wheeler

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (SPT, PPT, DCPT); MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); * Undrained Shear Strength (kPa)	LAB TESTING: Soil Vapour Reading (COV (LEL), TOV (LEL), COV (ppm), TOV (ppm)); W_P, W, W_L; Plastic, Liquid	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	reddish brown **SILTY CLAY / CLAYEY SILT TILL** some sand to sandy, trace gravel, trace cobbles with limestone and shale fragments hard										
	174.2	SS	11	100	50 / 80mm			50 / 80 mm	7		
	grey 10.7 **WEATHERED SHALE** hard					11	174				
	173.8	SS	12	100	50 / 30mm			50 / 30 mm			
	End of Borehole due to Auger Refusal 11.1										
	Monitoring Well Installation Details: (50 mm Diameter) Flush mount casing Installed Concrete: 0 - 0.3 m Sand: 0.3 - 0.9 m Bentonite: 0.9 - 5.5 m Sand Filter: 5.5 - 6.1 m Screen: 6.1 - 7.6 m Bentonite: 7.6 - 11.1 m Measured Groundwater Depth: on 21 September 2017: 4.9 m on 25 September 2017: 5.4 m on 2 October 2017: 5.4 m										

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B4

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, MDL on Mississauga Road
Drilling Method: 150 mm / 200 mm Solid Stem Augers / Hollow Stem Augers
Drilling Machine: Truck Mounted Drill
Date Started: 14 Jun 17 Date Completed: 16 Jun 17

Logged by: DU Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

amec foster wheeler

Geodetic Ground Surface Elevation: 184.9 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Undrained Shear Strength (kPa)	LAB TESTING: Soil Vapour Reading / Plasticity	INSTRUMENTATION INSTALLATION
	about 300 mm ASPHALT									
	184.6									
	dark brown Sand and Gravel FILL some silt moist 0.3 / 184.4 / 0.5 / 184.1 / 0.8	SS	1	100	19					
	reddish brown Gravelly Sand FILL some silt with silty clay pockets moist	SS	2	56	7	1	184			
	reddish brown Silty Sand FILL trace to some clay, trace to some gravel moist to wet	SS	3	89	9	2	183			
	182.7									
	reddish brown Sand FILL trace silt and gravel with clayey silt pockets moist 2.1	SS	4	89	9	3	182			
		SS	5	89	7					
	180.8					4	181			
	greyish brown Sandy Gravel FILL trace to some clay and silt with clayey silt pockets moist 4.0	SS	6	78	19	5	180			
	179.3									
	reddish brown SILTY CLAY / CLAYEY SILT TILL sandy, trace gravel with shale and limestone fragments hard 5.6	SS	7	61	78	6	179			
	177.7	SS	8	100	50 / 10mm	7	178	50 / 10 mm		
	reddish brown / grey WEATHERED SHALE with limestone fragments hard 7.2	SS	9	100	50 / 130mm	8	177	50 / 130 mm		
		SS	10	100	50 / 30mm	9	176	50 / 30 mm		
						10	175			

Penetration Testing: SPT, PPT, DCPT
MTO Vane*: Intact, Remould
Nilcon Vane*: Intact, Remould
* Undrained Shear Strength (kPa): 20, 40, 60, 80

Soil Vapour Reading: COV (LEL), TOV (LEL); COV (ppm), TOV (ppm)
W_P, W, W_L: Plastic, Liquid

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
3	32	49	16

Borehole located on NBL, on lane 2, about 6.5 m from CL. When reached about 7.2 m depth, borehole moved about 1 m towards south due to auger refusal.

Hard augering starting about 6.1 m depth.

On 14 June 2017, due to cave-ins, borehole was terminated at a depth of 7.2 m. On 16 June 2017 borehole was redrilled, at the same location, using Hollow Stem Augers.

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

No freestanding groundwater measured in open borehole on completion of drilling.

Groundwater depth observed on 2/10/2017 at a depth of: 4.7 m.

Scale: 1 : 53

Continued on Next Page

RECORD OF BOREHOLE No. BH B4

Project Number: **TP115085** Project Name: **Geotechnical Investigation and Pavement Design**

Project Location: **Mississauga Road**

amec foster wheeler

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (○ SPT □ PPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Soil Vapour Reading (□ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400); W_P W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	reddish brown / grey **WEATHERED SHALE** with limestone fragments hard	SS	11	100	50 / 30mm	11	174	50 / 30 mm	14		
	173.3 **End of Borehole due to Auger Refusal** 11.6	SS	12	100	50 / 30mm			50 / 30 mm	9		

Monitoring Well Installation Details:
(50 mm Diameter)

Flush mount casing Installed
Concrete: 0 - 0.3 m
Sand: 0.3 - 0.9 m
Bentonite: 0.9 - 5.5 m
Sand Filter: 5.5 - 10.0 m
Screen: 10.0 - 11.5 m

Measured Groundwater Depth:

on 21 September 2017: 4.6 m
on 25 September 2017: 5.3 m
on 2 October 2017: 4.7 m

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B5

Project Number: **TP115085**
Project Client: **The Regional Municipality of Peel**
Project Name: **Geotechnical Investigation and Pavement Design**
Project Location: **Mississauga Road**

Drilling Location: **SBL, EP on Mississauga Road**
Drilling Method: **100 mm Solid Stem Augers / Hand Drilling**
Drilling Machine: **Hand Drill**
Date Started: **19 Jun 17** Date Completed: **19 Jun 17**

Logged by: **JF** Compiled by: **DU** Reviewed by: **SM** Revision No.: **0, 17/10/17**

amec foster wheeler

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%)
	Geodetic Ground Surface Elevation: 180.4 m							Penetration Testing: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading: □ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400; W_P W W_L Plastic Liquid 20 40 60 80		GR SA SI CL
	about 120 mm TOPSOIL 180.2										
	brown 0.1 **Silty Sand FILL** trace clay, trace gravel and cobbles with rootlets and organics wet	SS	1	42	3		180				Borehole located at southwest corner of bridge at the toe of slope, about 10 m from CL and about 15 m from BH B3.
		SS	2	83	7	1					
	178.5	SS	3	33	15		179				Borehole was moved about 1 m to the north due to auger refusal.
	brown 1.8 **SAND AND GRAVEL** trace clay and silt, trace cobbles with organics dense moist	SS	4	42	32	2					
	177.5	SS	5	42	45		178				Borehole moved again due to auger refusal on cobbles/boulders.
	reddish brown 177.4 **SILTY CLAY / CLAYEY SILT TILL** 3.0 hard					3					
	End of Borehole due to Auger Refusal										

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

▽ No freestanding groundwater measured in open borehole on completion of drilling.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH B6

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, EP on Mississauga Road
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Truck Mounted Drill
Date Started: 14 Jun 17 Date Completed: 14 Jun 17

Logged by: DU Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

amec foster wheeler

LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 185.1 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	PenetrationTesting ○ SPT □ PPT ● DCPT MTO Vane* △ Intact ▲ Remould Nilcon Vane* ◇ Intact ◆ Remould * Undrained Shear Strength (kPa) 20 40 60 80	Soil Vapour Reading □ COV (LEL) ■ TOV (LEL) 2 4 6 8 △ COV (ppm) ▲ TOV (ppm) 100 200 300 400 W_P W W_L Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION		GR	SA	SI	CL
	Sand and Gravel (19mm Crusher Run) FILL moist	184.9 0.2					0	185				Borehole located at northeast corner of bridge, about 13.5 m east from CL.				
	dark brown **Clayey Silt FILL** some sand to sandy, trace gravel moist	184.4 0.7	SS	1	44	6				13					
	brown **Gravelly Sand FILL** some silt moist to wet		SS	2	33	5	1	184		7					
			SS	3	33	5				7					
	brown **Sandy Gravel FILL** trace silt wet	183.0 2.1	SS	4	44	7	2	183		8					
			SS	5	56	18	3	182		8					
							4	181							
			SS	6	67	10	5	180		6			68	25	(7)
	brown **SAND AND GRAVEL** trace silt very dense wet	179.5 5.6													
	End of Borehole	178.9 6.2	SS	7	100	50 / 100mm	6	179	50 / 100 mm	5					

Amec Foster Wheeler
Environment & Infrastructure

104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

▽ Groundwater depth during drilling on 14/06/2017 at a depth of: 1.8 m.

■ Cave in depth after removal of augers: 2.4 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying'Explanation of Borehole Log'.

Scale: 1 : 53

RECORD OF BOREHOLE No. BH R1

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, Top of Slope, on Mississauga
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Track Mounted Drill
Date Started: 13 Jun 17 Date Completed: 13 Jun 17

Logged by: SN/DU Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 204.3 m)	Elev.	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
	about 150 mm TOPSOIL	204.1	0.0				
	brown / reddish brown Silty Sand FILL trace clay, trace gravel with organics and rootlets moist	202.1	2.1	SS	1	75	5
				SS	2	100	2
				SS	3	89	3
	brown / light brown SAND trace clay and silt, trace gravel compact to loose moist			SS	4	100	12
				SS	5	100	14
	------- wet			SS	6	100	18
				SS	7	100	15
		196.2	8.1	SS	8	100	6
	End of Borehole						

FIELD TESTING: Penetration Testing (○ SPT □ PPT ● DCPT); MTO Vane* (△ Intact ▲ Remould); Nilcon Vane* (◇ Intact ◆ Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Soil Vapour Reading (□ COV (LEL) ■ TOV (LEL) 2 4 6 8; △ COV (ppm) ▲ TOV (ppm) 100 200 300 400); W_P W W_L; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located on top of slope.

GR	SA	SI	CL
0	94	4	2

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

▽ Groundwater depth during drilling on 13/06/2017 at a depth of: 6.1 m.

■ Cave in depth after removal of augers: 1.5 m.

RECORD OF BOREHOLE No. BH R2

Project Number: TP115085
Project Client: The Regional Municipality of Peel
Project Name: Geotechnical Investigation and Pavement Design
Project Location: Mississauga Road

Drilling Location: NBL, Top of Slope, on Mississauga
Drilling Method: 150 mm Solid Stem Augers
Drilling Machine: Track Mounted Drill
Date Started: 13 Jun 17 Date Completed: 13 Jun 17

Logged by: SN Compiled by: DU Reviewed by: SM Revision No.: 0, 17/10/17

amec foster wheeler

Lithology Plot	DESCRIPTION (Geodetic Ground Surface Elevation: 204.3 m)	Elevation	Depth	Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)
	about 150 mm TOPSOIL	204.0					
	brown Silty Sand FILL moist	0.3		SS	1	100	4
				SS	2	100	5
	brown SAND trace silt, trace gravel loose to compact moist	202.9 1.4		SS	3	100	12
				SS	4	67	16
				SS	5	67	9
				SS	6	67	17
	brown SILTY SAND compact wet	198.7 5.6		SS	7	100	18
	brown SILT trace clay and gravel, some sand compact wet	197.2 7.1		SS	8	100	15
	End of Borehole	196.2 8.1					

FIELD TESTING: Penetration Testing — SPT, PPT, DCPT; MTO Vane* (Intact, Remould); Nilcon Vane* (Intact, Remould); * Undrained Shear Strength (kPa) 20 40 60 80

LAB TESTING: Soil Vapour Reading — COV (LEL), TOV (LEL) 2 4 6 8; COV (ppm), TOV (ppm) 100 200 300 400; W_P W W_L; Plastic Liquid 20 40 60 80

INSTRUMENTATION INSTALLATION

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

Borehole located on top of slope.

GR	SA	SI	CL
2	12	78	8

Amec Foster Wheeler
Environment & Infrastructure
104 Crockford Boulevard
Scarborough, Ontario, M1R 3C3
Canada
Tel. No.: (416) 751-6565
amecfw.com

Groundwater depth during drilling on 13/06/2017 at a depth of: 6.1 m.

Cave in depth after removal of augers: 0.6 m.

BOREHOLE LOG DATA

BH# 2-NBL:			**Sta (10+400)**		
SHR			**NAD'83 Coordinates: 597591 4832386**		
0	-	150	Top Soil		
150	-	600	Br Si(y) Sa Tr Gr	Moist	(Fill)
600	-	1.5m	Br Si(y) Sa & Gr, Tr Cob	Moist	(Fill)
BH# 3-NBL:			**Sta (10+450)**		
TOS			**NAD'83 Coordinates: 597564 4832412**		
0	-	160	Tps		
160	-	660	Sa & Gr, some Cob, Si & Cl	Moist	(Fill)
660	-	1.5m	Br Si(y) Cl some Sa & Gr Tr Cob	Moist	(Fill)
BH# 4-SBL:			**Sta (10+500)**		
MSH			**NAD'83 Coordinates: 597455 4832501**		
0	-	100	Asph	Moist	(Fill)
100	-	400	Br Si(y) Sa, Tr Gr	Moist	(Fill)
400	-	860	19mm & 50mm Cr	Moist	(Fill)
860	-	1.5m	Br Si(y) Sa Tr Gr	Moist to W	(Fill)
BH# 5-SBL:			**Sta (10+500)**		
TOS			**NAD'83 Coordinates: 597454 4832502**		
0	-	300	Tps		
300	-	660	Br Si(y) F Sa Tr Gr	Moist	(Fill)
660	-	1.5m	Br Si(y) F Sa to Sa(y) Si	Moist to W	(Native)
BH# 6-SBL:			**Sta (10+550)**		
EP			**NAD'83 Coordinates: 597423 4832537**		
0	-	90	Asph		
90	-	300	Dk Br Si(y) Sa Tr Gr	Moist	(Fill)
300	-	700	19mm CR	Moist	(Fill)
700	-	1.5m	50mm CR	Moist	(Fill)

And > 40%.
Adjective (Si(y), Sa(y) 30-40%
With 20-30%
Some 10-20%
Trace 1-10%

BOREHOLE LOG DATA

BH# 7-NBL:			**Sta (10+600)**		
EP			**NAD'83 Coordinates: 597316 4832640**		
0	-	140	Asph		
140	-	300	Si(y) Sa & Gr	Moist	(Fill)
300	-	450	19mm CR	Moist	(Fill)
450	-	750	Si(y) Sa & Gr, Tr Cob	Moist	(Fill)
750	-	1.5m	Br Si(y) Sa, Tr Gr	Moist	(Fill)
BH# 8-NBL:			**Sta (10+600)**		
TOS			**NAD'83 Coordinates: 597319 4832640**		
0	-	150	Tps		
150	-	700	Br Si(y) Sa, Tr Gr	Moist	(Fill)
700	-	1.5m	Reddish Br Si(y) Sa, Tr Gr & Cob	Moist	(Native)
BH# 9-NBL:			**Sta (10+650)**		
SHR			**NAD'83 Coordinates: 597289 4832669**		
0	-	200	Tps		
200	-	680	Si(y) Sa Tr Gr	Moist	(Fill)
680	-	1.5m	Br Si(y) Sa Tr Gr	Moist	(Fill)
BH# 10-SBL2:			**Sta (10+700)**		
MDL			**NAD'83 Coordinates: 597130 4832826**		
0	-	180	Asph		
180	-	800	19mm CR	Moist	(Fill)
800	-	1.0m	50mm CR	Moist	(Fill)
	-	1.0m	NFP (refusal)		
BH# 11-SBL:			**Sta (10+700)**		
SHR			**NAD'83 Coordinates: 597166 4832785**		
0	-	200	Tps		
200	-	600	Br Si(y) Sa, Tr Gr	Moist	(Fill)
600	-	1.5m	Br Si(y) Sa, Tr Gr & Cob	Moist	(Fill)

And > 40%.
Adjective (Si(y), Sa(y) 30-40%
With 20-30%
Some 10-20%
Trace 1-10%

BOREHOLE LOG DATA

BH# 12-SBL:			**Sta (10+750)**		
TOS			**NAD'83 Coordinates: 597174 4832791**		
0	-	80	Ashpalt		
80	-	450	Si(y) Sa Tr Gr	Moist	(Fill)
450	-	1.0m	Br Si(y) F Sa	Moist	(Native)
1.0m	-	1.5m	Br Si(y) F Sa to Med Sa	Moist	(Native)
BH# 14-NBL:			**Sta (10+800)**		
SHR			**NAD'83 Coordinates: 597042 4832912**		
0	-	200	Tps		
200	-	1.2m	Br Si(y) Cl/Cl Si	DTPL	(Native)
1.2m	-	1.5m	Br Si(y) Sa	Moist	(Native)
BH# 15-NBL:			**Sta (10+850)**		
TOS			**NAD'83 Coordinates: 596990 4832967**		
0	-	200	Tps		
200	-	550	Br Si(y) Sa	Moist	(Fill)
550	-	1.5	F Sa	Moist	(Native)
BH# 16-SBL:			**Sta (10+900)**		
EP			**NAD'83 Coordinates: 596881 4833067**		
0	-	190	Asph		
190	-	450	19mm CR	Moist	(Fill)
450	-	750	50mm CR	Moist	(Fill)
750	-	1.5m	Br Si(y) Sa Tr Gr	Moist	(Fill)
BH# 17-NBL:			**Sta (10+900)**		
TOS			**NAD'83 Coordinates: 596886 4833070**		
0	-	100	Asph		
100	-	350	Br Si(y) Sa & Gr	Moist	(Fill)
350	-	660	19mm CR	Moist	(Fill)
660	-	1.5m	Br Si(y) Sa Tr Gr	Moist	(Fill)

And > 40%.
Adjective (Si(y), Sa(y) 30-40%
With 20-30%
Some 10-20%
Trace 1-10%

BOREHOLE LOG DATA

BH# 18-SBL:			**Sta (10+950)**		
SHR			**NAD'83 Coordinates: 596846 4833106**		
0	-	100	Asph		
100	-	300	Br Sa & Gr	Moist	(Fill)
300	-	600	19mm CR	Moist	(Fill)
600	-	1.2m	50mm CR	Moist	(Fill)
1.2m	-	1.5m	Br Sa & Gr	Moist	(Fill)
BH# 19-NBL:			**Sta (11+000)**		
EP			**NAD'83 Coordinates: 596810 4833143**		
0	-	100	Asph		
100	-	300	Br Gr(y) Sa, Tr Si	Moist	(Fill)
300	-	800	Lt Br 19mm & 50mm CR	Moist	(Fill)
800	-	1.5m	Br Sa, Tr Si & Gr	Moist	(Fill)
BH# 20-NBL:			**Sta (11+000)**		
TOS			**NAD'83 Coordinates: 596806 4833143**		
0	-	100	Tps		
100	-	400	Sa & Gr Tr Cob some Si	Moist	(Fill)
400	-	980	Gr(y) Sa some Si	Moist	(Fill)
980		1.5m	Si(y) Sa Tr Gr some Cob	Moist	(Fill)
BH# 21-NBL:			**Sta (11+050)**		
SHR			**NAD'83 Coordinates: 596757 4833206**		
0	-	100	Asph		
100	-	430	Sa & Gr	Moist	(Fill)
430	-	1.0m	Br Cl(y) Si/Si(y) Cl, some Sa, Tr Gr	Moist	(Fill)
1.0m		1.5m	Br Gr(y) Sa, some Si	Moist	(Fill)
BH# 22-SBL:			**Sta (11+100)**		
MDL			**NAD'83 Coordinates: 597087 4832845**		
0	-	220	Asph		
220	-	450	Gr(y) Sa	Moist	(Fill)
450	-	700	Gr(y) Sa Tr Cob & 50 mm CR	Moist	(Fill)
700		1.0m	50 mm CR	Moist	(Fill)

And > 40%.
Adjective (Si(y), Sa(y) 30-40%
With 20-30%
Some 10-20%
Trace 1-10%

BOREHOLE LOG DATA

CB# 24-SBL:			**Sta (11+150)**		
SHR			**NAD'83 Coordinates: 596746 4833212**		
0	-	300	Top Soil		
300	-	500	Br Si(y) Sa, Tr Gr	Moist	(Fill)
500	-	800	19mm CR	Moist	(Fill)
800		1.2m	50mm CR	Moist	(Fill)
1.2m	-	1.5m	Br Si(y) Sa, Tr Gr & Cob	Moist	(Fill)
BH# 26-NBL:			**Sta (11+200)**		
SHR			**NAD'83 Coordinates: 596725 4833205**		
0	-	100	Asph		
100	-	500	Dk Br Sa(y) Si, Tr Cl & Gr	Moist	(Fill)
500	-	1.0m	Dk Br Gr(y) Sa	Moist	(Fill)
1.0m		1.5m	Br Sa & Gr Tr Si, Cl, plastic & Asph	Moist	(Fill)
BH# 27-NBL:			**Sta (11+250)**		
TOS			**NAD'83 Coordinates: 596768 4833155**		
0	-	200	Tps		
200	-	650	Br Si(y) Sa Tr Gr	Moist	(Fill)
650	-	1.5m	Dk Br/Gry Si(y) Cl/Cl(y) Si, Tr Sa & Gr	Moist	(Fill)
BH# 29-SBL:			**Sta (11+300)**		
TOS			**NAD'83 Coordinates: 596792 4833139**		
0	-	350	Br Sa & Gr	Moist	(Fill)
350	-	750	Br Sa & Gr to Sa(y) Gr	Moist	(Fill)
750	-	1.25m	Lt Br Gr(y) Sa	Moist	(Fill)
1.25m		1.5m	Br Si(y) Sa Tr Cl & Gr		
BH# 30-SBL:			**Sta (11+350)**		
SHR			**NAD'83 Coordinates: 17 T 596903 4833017**		
0	-	100	Asph		
100	-	300	Sa & Gr	Moist	(Fill)
300	-	700	Sa & Gr some Cob	Moist	(Fill)
700		1.0 m	Dk Br Si(y) Sa & Gr	Moist	(Fill)
1.0 m		1.5 m	Dk Br Si(y) F Sa Tr Cob	wet	(Fill)

And > 40%.
Adjective (Si(y), Sa(y) 30-40%
With 20-30%
Some 10-20%
Trace 1-10%

BOREHOLE LOG DATA

BH# 31-NBL:			**Sta (11+400)**		
MSH			**NAD'83 Coordinates: 596949 483298**		
0	-	350	Sa & Gr	Moist	(Fill)
350	-	750	Si(y) Sa some Gr	Moist	(Fill)
750	-	1.5m	Gry Si(y) Sa Tr Gr	Moist	(Fill)
BH# 32-NBL:			**Sta (11+400)**		
TOS			**NAD'83 Coordinates: 596942 4832985**		
0	-	250	Sa & Gr	Moist	(Fill)
250	-	680	Dk Br Si(y) Sa & Gr some Cl	Moist	(Fill)
680	-	1.5m	Br Si(y) Cl/Cl(y) Si some Sa Tr Gr	Moist	(Fill)
BH# 33-NBL:			**Sta (11+450)**		
SHR			**NAD'83 Coordinates: 597052 4832869**		
0	-	100	Tps		
100	-	300	Br Sa(y) Si, Tr rootlets	Moist	(Fill)
300	-	750	Br Sa, Tr Si	Moist	(Fill)
750		1.5m	Dk Br Si(y) Sa, some Org, Tr Gr	Moist	(Fill)
BH# 35-SBL			**Sta (11+500)**		
SHR			**NAD'83 Coordinates: 597085 4832842**		
0	-	200	Tps		
200	-	600	Sa, Tr Gr & rootlets	Moist	(Fill)
600	-	1.5m	Sa, some Cob, Tr Gr	Moist	(Fill)
BH# 36-SBL:			**Sta (11+550)**		
TOS			**NAD'83 Coordinates: 597225 4832709**		
0	-	250	Tps		
250	-	450	Si(y) Sa, Tr rootlets	Moist	(Fill)
450	-	800	Sa, Tr Gr	Moist	(Fill)
800		1.5m	Sa, some Gr, Tr Cob	Moist	(Fill)

And > 40%.
Adjective (Si(y), Sa(y) 30-40%
With 20-30%
Some 10-20%
Trace 1-10%

BOREHOLE LOG DATA

BH# 38-WBL:			**Sta (9+100)**		
EP			**NAD'83 Coordinates: 597087 4832845N**		
0	-	200	Asph		
200	-	300	Sa & Gr	Moist	(Fill)
300	-	500	Gr(y) Sa	Moist	(Fill)
500		800	Sa Tr to some Gr	Moist	(Fill)
800	-	1.4 m	Sa & Gr	Moist	
1.4 m	-	2.1 m	Sa Tr Gr & Cl	Moist	
BH# 39-NBL			**Sta (11+650)**		
TOS			**NAD'83 Coordinates: 597335 4832588**		
0	-	200	Tps		
200	-	600	Sa & Gr, some Cob	Moist	(Fill)
600	-	1.5m	Br Si(y) Sa & Gr, some Cob	Moist	(Fill)
BH# 40-SBL:			**Sta (11+700)**		
EP			**NAD'83 Coordinates: 597376 4832552**		
0	-	200	Asph		
200	-	410	Br Sa & Gr	Moist	(Fill)
410	-	750	Gr(y) Sa some Cob	Moist	(Fill)
750		1.2m	19mm & 50mm CR	Moist	(Fill)
1.2m	-	1.5m	Dk Gry Si(y) Sa, some Cl	Moist	(Fill)
BH# 41-SBL:			**Sta (11+700)**		
TOS			**NAD'83 Coordinates: 597372 4832550**		
0	-	150	Tps	Moist	(Fill)
150	-	800	Si(y) Sa & Gr	Moist	(Fill)
800	-	1.3m	Si(y) Sa, Tr Gr & Cob	Moist	(Fill)
	-	1.3m	NFP (refusal)		
BH# 42-SBL:			**Sta (11+750)**		
SHR			**NAD'83 Coordinates: 597471 4832455**		
0	-	150	Tps		
150	-	450	Sa & Gr	Moist	(Fill)
450	-	1.0m	Si(y) Sa & Gr, some Cob	Moist	(Fill)
	-	1.0m	NFP (refusal)		

And > 40%.
Adjective (Si(y), Sa(y) 30-40%
With 20-30%
Some 10-20%
Trace 1-10%

APPENDIX A
SITE PHOTOGRAPHS
FALLING WEIGHT DEFLECTOMETER ANALYSIS

APPENDIX A- PAVEMENT CONDITION SURVEY

PROJECT NO. TP115085

PROJECT Geotechnical Investigation and Pavement Design Report

LOCATION Proposed Widening of Mississauga Road
from North of Financial Drive to Queen St W
City of Brampton, Ontario

ENCLOSURE 1

PHOTOGRAPH	1

Mississauga Rd

Good Condition

PHOTOGRAPH	2

Mississauga Rd

Good Condition

APPENDIX A- PAVEMENT CONDITION SURVEY

PROJECT NO. TP115085

PROJECT Geotechnical Investigation and Pavement Design Report

LOCATION Proposed Widening of Mississauga Road
from North of Financial Drive to Queen St W
City of Brampton, Ontario

ENCLOSURE 2

PHOTOGRAPH	3

Mississauga Rd
Good Condition

PHOTOGRAPH	4

Mississauga Rd
Good Condition

APPENDIX A- PAVEMENT CONDITION SURVEY

PROJECT NO. TP115085

PROJECT LOCATION Geotechnical Investigation and Pavement Design Report
Proposed Widening of Mississauga Road
from North of Financial Drive to Queen St W
City of Brampton, Ontario

ENCLOSURE 3

PHOTOGRAPH	5

Mississauga Rd

Good to Fairly Good Condition

NBL north of Bridge
(apprach Slab)

Lane 1 Longitudinal Cracking
Lane 2 Loss of Aggregates
Distortion

PHOTOGRAPH	6

Mississauga Rd

Good to Fairly Good Condition

AMEC Foster Wheeler

Falling Weight Deflectometer Testing and Analysis – Mississauga Road – 300 m North of Financial Drive to Queen Street

Submit to:

Ms. Hoda Seddik
104 Crockford Blvd.
Scarborough, ONT
M1R 3C3

Project Number
BRM-00601643-F0

Prepared By:

Kelvin Liu, B Eng.
Eric C.Y. Chan, P Eng.

Exp Services Inc.
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada

Date Submitted
September 1, 2017

1. Introduction

AMEC Foster Wheeler (AMECFW) retained **Exp** Services Inc. (exp) to undertake Falling Weight Deflectometer (FWD) testing for Mississauga Road from 300 m North of Financial Drive to approximately 300 m North of Queen Street West, Brampton, Ontario.

The project employed the use of **Exp**'s Heavy Weight Deflectometer (HWD) to perform field testing at approximately 50 meters intervals in each travelled lanes and directions. The HWD testing machine is fully adaptable to the conventional FWD machine, which the HWD is capable of generating greater dynamic loads up to 210 kN when necessary (i.e. to simulate heavy aircraft such as Boeing 747). In this project, part of the weight was removed such that the dynamic load is applied in the range of 30kN~75kN, and normalized to 40kN for conventional asphalt pavement testing.

The pavement structure of various sections were provided by AMECFW and used for data analysis purposes. The data analysis protocol adopted for this project included the backcalculation of the in-situ subgrade resilient modules, pavement structure number and normalized deflection analysis that can be used to estimate pavement structural adequacy.

2. Scope

On July 13, 2017, **exp** undertook FWD testing on the subject pavement sections in order to estimate the in-situ structural capacity of the pavements. The objective of this testing is to provide the necessary information for AMECFW to ascertain the existing pavement structure adequacy. Compilation of data collected from the field investigation and the backcalculation results are presented in this report for information purposes.

To achieve this objective, **exp** has performed the following works:

1. In-Situ FWD testing with 50m interval staggered within each pavement sections in all lanes and travelled directions;
2. Ambient and Asphalt Surface temperature measurements;
3. Deflection Normalization to 21^{o}C and Deflection Area Basin analysis;
4. Subgrade Resilient Modules analysis; and,
5. Structural Number estimation conforms to 1993 ASSHTO Pavement Design Guide.

3. Test Section

The subject pavement sections are in the City of Brampton within the Regional Municipality of Peel. All pavement sections are located on Mississauga Road from 300 m North of Financial Drive to approximately 300 m North of Queen Street West. It should be noted that at the time of testing, there were construction activities North of Queen Street. Therefore, testing was not conducted from Queen Street West to the North limit. Testing sections are summarized below:

- Section 1: Mississauga Road Northbound Lane 1 (~300 m North of Financial Drive to Queen Street).
- Section 2: Mississauga Road Northbound Lane 2 (~300 m North of Financial Drive to Queen Street).
- Section 3: Mississauga Road Southbound Lane 1 (From Queen Street to ~300 m North of Financial Drive).
- Section 4: Mississauga Road Southbound Lane 2 (From Queen Street to ~300 m North of Financial Drive).

Based upon the pavement layer thicknesses provided by AMECFW, it was determined that the subject pavement sections are composed of layers of hot mix asphalt layers, on top of granular layers (base and subbase). This pavement structure information was used for estimating the structure number and resilient modules of the subgrade layer.

4. Field Works

4.1 FWD Testing Protocol

The FWD machine operated by exp Services Inc. was used to apply a dynamic load on the pavement varying from 30 kN to 75 kN (four (4) drops per location). The Strategic Highways Research Program (SHRP) specifies the locations of the sensors, and the minimum number of loading drops that are to be applied to a pavement section, so that the standard deviation and variance in the backcalculated results can be ascertained. The sensor spacing was set as per standard protocols as 0 mm, 200 mm, 300 mm, 450 mm, 600 mm, 900 mm, 1200 mm, 1500 mm and 1800 mm (which are in accordance with the SHRP specifications).

The FWD applies an impact load to the pavement surface, and measures the surface deformation (called deflection basin), using nine geophones. This data is recorded by the data acquisition system, and then used to backcalculate the material properties of individual layers, if the thicknesses are known. This process can also be performed vice-versa in order to determine the layer thicknesses, if the material properties are known (laboratory mechanical tests).

It is also important to determine the surface, sub-surface and ambient air temperatures at the time of the testing, because it is critical for adjusting the backcalculated moduli of hot-mix asphalt (HMA), which has high thermal susceptibility. For the project specified testing plan, the ambient air temperatures and the pavement surface temperatures were detected on site using the thermal gun attached to the data acquisition system. These temperatures were further used to calculate the asphalt layer temperature with last 24 hours mean temperature by Bell equation.

Once the FWD data for various roads was obtained, a normalized deflection and deflection ratio coupled with the area of deflection basin analysis. This phase of testing yielded thickness information of various layers that were used to estimate the Structural number of the pavement structure.

4.2 Normalization of Deflection Data

The data collected from the pavement sections using the FWD is stored in ASCII file format. Normalization of the FWD data to 40 kN applied load at 21 °C temperature was performed to estimate the structural capacity of the existing pavement. The deflection basin profile and individual deflections approximate the existing condition of the pavement that is being tested using the FWD machine. The criteria that are widely used in the industry and employed in this study are as follows:

1. d_o: Centre Plate Deflection (Primarily measures the subgrade strength and the pavement stiffness) – Maximum 0.5 mm;
2. d_o/d_{200}: Ratio of Centre Plate Deflection to Sensor Deflection at 200 mm from the Centre Plate (subgrade strength verses other structural strengths) – Maximum 1.4 mm;
3. *Normalized Area*: Area of the Deflection Basin (overall ability of the pavement to effectively distribute vehicular loading) – Minimum 600 mm.

4.3 Backcalculation of Composite Modules, Subgrade Resilient Modules and Effective Structural Number

Once the deflection profile was available for each drop, the backcalculated pavement composite modules was estimated using the following equation as detailed by MTO and derived from the National Cooperative Highway Research Program (NCHRP) Study was used for the calculation of composite moduli of the tested pavement [(1)].

$$E_o = \frac{f \times (1 - \nu^2) \times \sigma_o \times a}{d_0}$$

where:

E_o = Composite modulus of the entire pavement system beneath the load plate
f = Factor for stress distribution (using 2)
v = Poisson's ratio

σ_o = (Peak) pressure of FWD impact load under the load plate
a = Radius of FWD load plate
d_o = (Peak) center FWD deflection reading

The relation of Poisson's ratio as a function of temperature for hot mix asphalt used in this analysis is shown in the following Figure 1:

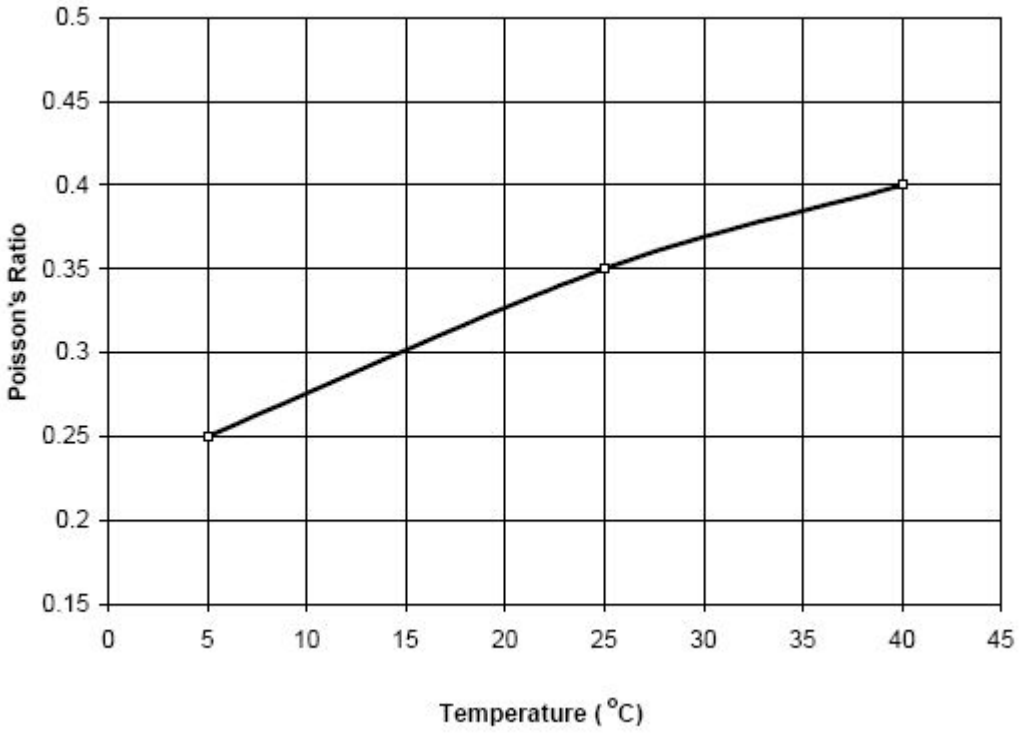


Figure 1: Poisson's Ratio and Temperature Relationship for Hot Mix Asphalt

The subgrade resilient moduli are also determined based on the pavement deflection recorded by the geophone 1200 mm offset from the loading. The design subgrade resilient moduli are further estimated by the procedure described in the AASHTO Guide for Design of Pavement Structures as below:

$$Mr = C\ (0.24P\ /d_r * r)$$

Where:

Mr = Subgrade modulus, in psi;
P = Applied load, in pounds;
d_r = Deflection measured at a radial distance r, in inches;
r = Radial distance at which the deflection is measured, in inches; and
C = Correction factor for design (0.25 was employed).

The design values of the subgrade resilient modules were calculated based on a 0.25 correction factor for reference purpose (AASHTO suggests the correction factor not greater than 0.33). The average subgrade resilient moduli are summarized in Tables A1 through A4 of Appendix A.

The existing pavement structure number was calculated based on the 1993 AASHTO Pavement design guide as follow:

$$SNeff = 0.0045 * D * Ep^{(1/3)}$$

Where D= Total thickness of all pavement layers of existing pavement above the subgrade (inch)
Ep= Effective combined modulus of all pavement layers above the subgrade (psi)

4.3.1 Pavement Structural Parameters Analysis

The details of the normalized deflection analysis, estimated subgrade resilient modules and effective structural numbers for all pavement sections are attached to Appendix A of this report and are summarized in Table 1 below.

Table 1: Backcalculation Summary as per AASHTO 1993 Pavement Design Protocol – Mississauga Road from 300 m North of Financial Drive to Queen Street West

Road Sections	Normalized d_0 (mm)	Normalized d_0/d_{200}	Normalized Area (mm)	M_{RDES} (MPa)	Sn_{eff} (mm)
Mississauga Road NBL1 (300 m North of Financial Drive to Queen Street West)	0.158	1.28	512	78.0	207.4
Mississauga Road NBL2 (300 m North of Financial Drive to Queen Street West)	0.187	1.26	516	72.2	196.1
Mississauga Road SBL1 (300 m North of Financial Drive to Queen Street West)	0.161	1.29	515	73.5	222.7
Mississauga Road SBL2 (300 m North of Financial Drive to Queen Street West)	0.179	1.27	519	67.9	215.2

Based on the estimated normalized deflection and backcalculated resilient modulus data, the pavement sections deflects reasonably according to their current pavement type and thicknesses. However, the pavement structures in all of the tested section shows issues in terms of effectively distributes the vehicular loading (Normalized area less than 600mm). This is typical for old asphalt layer which the load transfer capability is relatively lower then newer asphalt. Older pavements are typically more brittle and have a higher potential for various types of cracking to develop.

The subgrade resilient modulus was found to range from 50.8 MPa to 106.6 MPa and the effective structure numbers are ranged from 185 to 239 mm, based on the calculations from each of the FWD test locations. It should be noted that the calculated resilient modulus has not been subject for seasonal reduction factor, and the effective structural number calculation is based on a deflection-total

pavement thickness calculations. Given the relatively high values of resilient modulus and structural number, the designer should be cautioned when determining the proper rehabilitation strategy.

5. Conclusion

AMECFW has retained **exp** Services Inc. to undertake structural evaluation of the subject pavements within the Region of Peel. The project employed the use of **Exp**'s Heavy Weight Deflectometer (FWD) to perform field-testing at approximately 50 meters intervals staggered in all travelled lanes and direction, and to evaluate the current structural capacity of the pavement sections.

The data analysis protocol adopted for this project included estimation of in-situ subgrade resilient moduli and structural numbers of the pavement structure. Normalized deflection analysis is also presented in this report to ascertain the load bearing capacity of the subject roadway.

We trust this submission is satisfactory for your purposes, and should there be any questions, please don't hesitate to contact the undersigned.

Yours truly,

Exp services Inc.

Kelvin Liu, B. Eng.
Pavement and Materials

Eric Chan, P. Eng.
Senior Engineer, Pavement and Materials

6. References

1. "Manual for FWD Testing in the Long-Term Pavement Performance Program," SHRP-P-661, PCS Law Engineering and Braun Intertec Pavement, Inc. National Research Council, Washington, DC, 1993.
2. Pierce, L. M., "Development of a Computer Program for the Determination of the Area Value and Subgrade Resilient Modulus Using Dynatest FWD," Report/Software by Washington State Department of Transportation, May 1999.
3. Anderson, P. D., "Cost-Effective Structural Rehabilitation of Pavements Using NDT Deflection Methods," 1989.
4. Zhang, Z., Claros, G., Manuel, L., and Damnjanovic, I.," Development of Structural Condition Index to Support Pavement Maintenance and Rehabilitation Decisions at Network Level," Transportation Research Record No. 1827, pp. 10 – 17, 200

Appendix A – Deflection Normalization Data Subgrade Resilient Modules & Existing Structural Numbers

Table A1: Normalized Deflection, Deflection Ratio, Area Analysis and Subgrade Modules – Mississauga Road Northbound Lane 1 (~300 m North of Financial Drive to Queen Street West).

Route: City of Brampton Section: Mississauga Road NBL1 (300 m North of Financial Drive to Queen Street West)							
Station	**Latitude**	**Longitude**	**Normalized d_0 (mm)**	**Normalized d_0/d_{200}**	**Normalized Area**	**M_{RDES} (Mpa)**	**$S_{n\ eff}$ (mm)**
Station = 10.525	43.63867003	-79.79119835	0.137	1.29	535	67	217
Station = 10.725	43.63990498	-79.79295336	0.160	1.24	558	58	206
Station = 10.925	43.64123497	-79.79464499	0.163	1.30	470	91	205
Station = 11.125	43.64247169	-79.79636834	0.174	1.34	469	76	200
Station = 11.325	43.64374002	-79.79810003	0.142	1.29	490	97	214
Station = 11.515	43.64494832	-79.79972000	0.168	1.25	536	77	203
Station = 11.725	43.64640331	-79.80133832	0.159	1.23	523	80	207
Mean			0.158	1.28	511.5	78.0	207.4
Standard Deviation			0.013	0.04	35.0	13.3	6.0
C.O.V (%)			8.4	3.04	6.8	17.0	2.9
Maximum			0.174	1.34	557.7	97.0	217
Minimum			0.137	1.23	469.2	57.8	200

Table A2: Normalized Deflection, Deflection Ratio, Area Analysis and Subgrade Modules - Mississauga Road Northbound Lane 2 (~300 m North of Financial Drive to Queen Street West).

Route: City of Brampton Section: Mississauga Road NBL2 (300 m North of Financial Drive to Queen Street West)							
Station	**Latitude**	**Longitude**	**Normalized d_0 (mm)**	**Normalized d_0/d_{200}**	**Normalized Area**	**M_{RDES} (Mpa)**	**$S_{n\ eff}$ (mm)**
Station = 10.425	43.63804499	-79.79031334	0.176	1.26	525	64	200
Station = 10.625	43.63932501	-79.79209836	0.164	1.24	542	63	204
Station = 10.825	43.64060497	-79.79379501	0.145	1.25	529	77	213
Station = 11.025	43.64188836	-79.79547666	0.185	1.28	497	74	196
Station = 11.025	43.64190000	-79.79546165	0.180	1.25	509	72	198
Station = 11.225	43.64317334	-79.79716167	0.211	1.26	508	65	188
Station = 11.405	43.64432170	-79.79873002	0.179	1.25	509	84	199
Station = 11.445	43.64455668	-79.79907335	0.190	1.28	505	65	194
Station = 11.625	43.64569836	-79.80061499	0.191	1.23	548	60	194
Station = 11.825	43.64720001	-79.80198332	0.221	1.30	476	107	185
Station = 11.865	43.64745000	-79.80231667	0.218	1.24	530	64	186
Mean			0.187	1.26	516.4	72.2	196.1
Standard Deviation			0.023	0.02	20.9	13.4	8.3
C.O.V (%)			12.3	1.61	4.1	18.5	4.2
Maximum			0.221	1.30	548.1	106.6	213
Minimum			0.145	1.23	476.5	60.2	185

Table A3: Normalized Deflection, Deflection Ratio, Area Analysis and Subgrade Modules - Mississauga Road Southbound Lane 1 (Queen Street West to ~300 m North of Financial Drive).

Route: City of Brampton Section: Mississauga Road SBL1 (Queen Street West to 300 m North of Financial Drive)							
Station	**Latitude**	**Longitude**	**Normalized d_0 (mm)**	**Normalized d_0/d_{200}**	**Normalized Area**	**M_{RDES} (Mpa)**	**$S_{n\ eff}$ (mm)**
Station = 11.850	43.64720167	-79.80231997	0.208	1.23	518	81	203
Station = 11.675	43.64594669	-79.80105337	0.181	1.30	502	78	213
Station = 11.475	43.64464499	-79.79939499	0.129	1.29	513	92	239
Station = 11.275	43.64339333	-79.79762999	0.167	1.30	522	60	219
Station = 11.075	43.64211000	-79.79592501	0.159	1.27	541	51	222
Station = 10.875	43.64081834	-79.79424667	0.128	1.26	539	86	239
Station = 10.675	43.63951499	-79.79251836	0.155	1.38	488	67	224
Station = 10.475	43.63826669	-79.79079336	0.159	1.31	498	73	222
Mean			0.161	1.29	515.3	73.5	222.7
Standard Deviation			0.026	0.04	18.9	13.7	12.0
C.O.V (%)			16.3	3.36	3.7	18.6	5.4
Maximum			0.208	1.38	540.9	91.5	239
Minimum			0.128	1.23	488.5	50.8	203

Table A3: Normalized Deflection, Deflection Ratio, Area Analysis and Subgrade Modules - Mississauga Road Southbound Lane 2 (Queen Street West to ~300 m North of Financial Drive).

Route: City of Brampton Section: Mississauga Road SBL2 (Queen Street West to 300 m North of Financial Drive)							
Station	**Latitude**	**Longitude**	**Normalized d_0 (mm)**	**Normalized d_0/d_{200}**	**Normalized Area**	**M_{RDES} (Mpa)**	**$S_{n\ eff}$ (mm)**
Station = 11.775	43.64668001	-79.80174497	0.250	1.24	521	58	191
Station = 11.525	43.64496498	-79.79981168	0.193	1.18	585	52	208
Station = 11.375	43.64399166	-79.79856497	0.156	1.23	531	75	224
Station = 11.175	43.64273001	-79.79680335	0.172	1.26	543	59	216
Station = 10.975	43.64145997	-79.79508667	0.138	1.36	483	81	233
Station = 10.775	43.64016501	-79.79339670	0.162	1.31	488	76	221
Station = 10.575	43.63885835	-79.79170170	0.179	1.32	480	74	213
Mean			0.179	1.27	518.7	67.9	215.2
Standard Deviation			0.036	0.06	38.5	11.4	13.3
C.O.V (%)			20.2	4.79	7.4	16.8	6.2
Maximum			0.250	1.36	585.3	81.3	233
Minimum			0.138	1.18	479.5	51.6	191

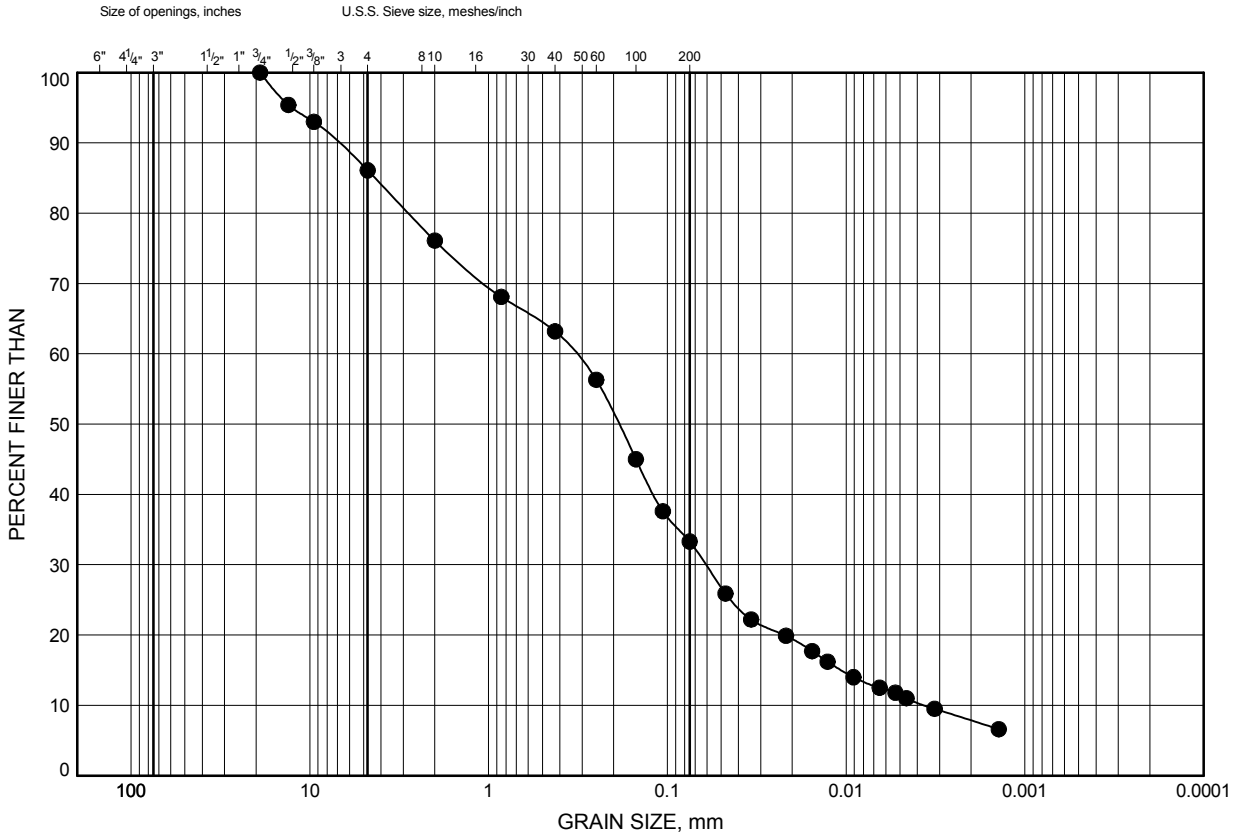
APPENDIX B
SOIL LABORATORY TEST RESULTS

Geotechnical Investigation and Pavement Analysis

GRAIN SIZE DISTRIBUTION

Silty Sand

FIGURE No. B1



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	BH B1	SS 10	10.7	174.8

Date September 2017

Project TP115085

Prep'd WA

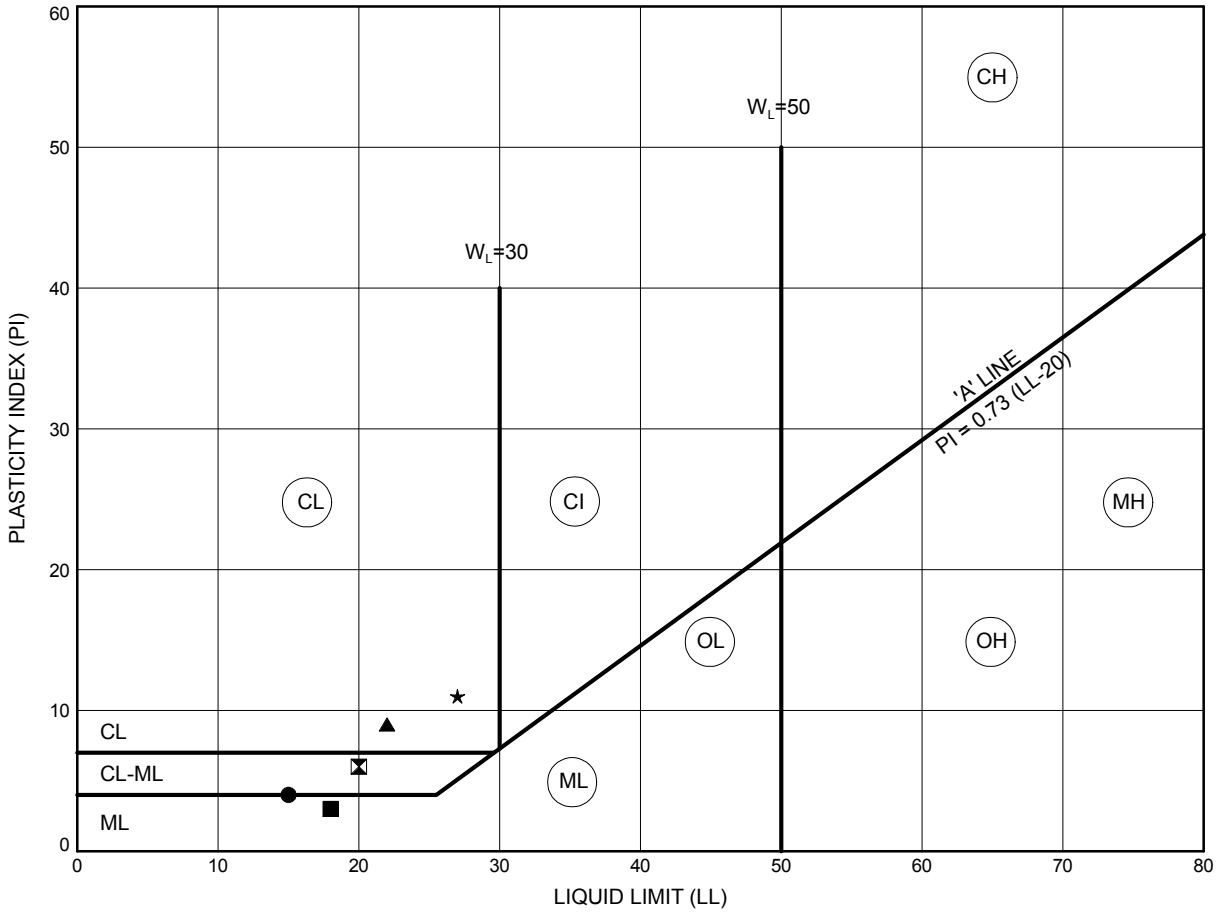
Chkd. SB

AMECFW GRADATION CURVE TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC SCARBOROUGH LOG 2009.GDT 25/09/17

Geotechnical Investigation and Pavement Design

ATTERBERG LIMIT TEST RESULTS

FIGURE No. B2



SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)	LL	PL	PI
●	BH B1	SS 10	10.7	174.8	15	11	4
⊠	BH B2	SS 7	6.1	179.6	20	14	6
▲	BH B3	SS 8	6.1	178.8	22	13	9
★	BH B4	SS 7	6.1	178.8	27	16	11
■	BH R2	SS 8	7.6	196.6	18	15	3

Date October 2017

Project TP115085

Prep'd Saiful

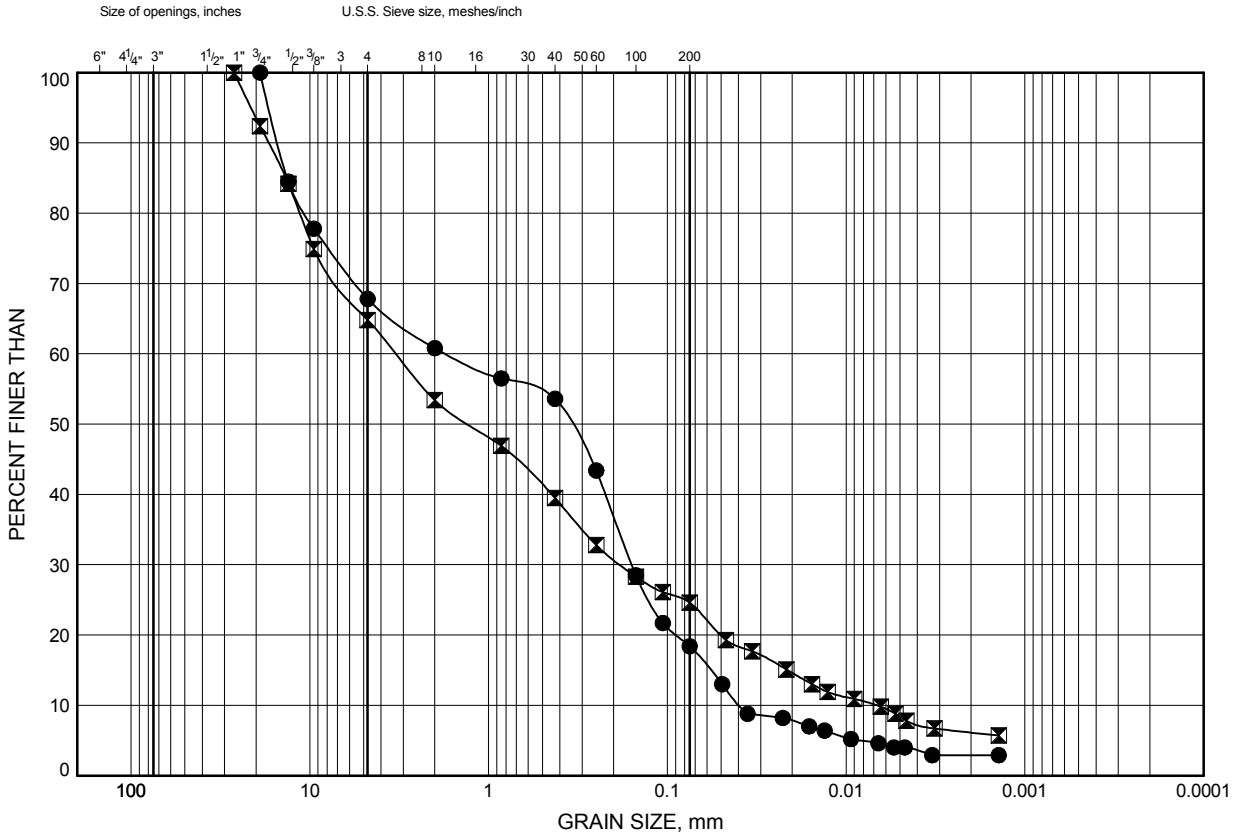
Chkd. SB

AMECFW ATTERBERG LIMITS TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC SCARBOROUGH LOG 2009.GDT 06/10/17

Geotechnical Investigation and Pavement Analysis

GRAIN SIZE DISTRIBUTION
Gravelly Sand / Sand and Gravel

FIGURE No. B3



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	BH B1	SS 7	6.1	179.3
⊠	BH B2	SS 7	6.1	179.6

Date September 2017

Project TP115085

Prep'd WA

Chkd. SB

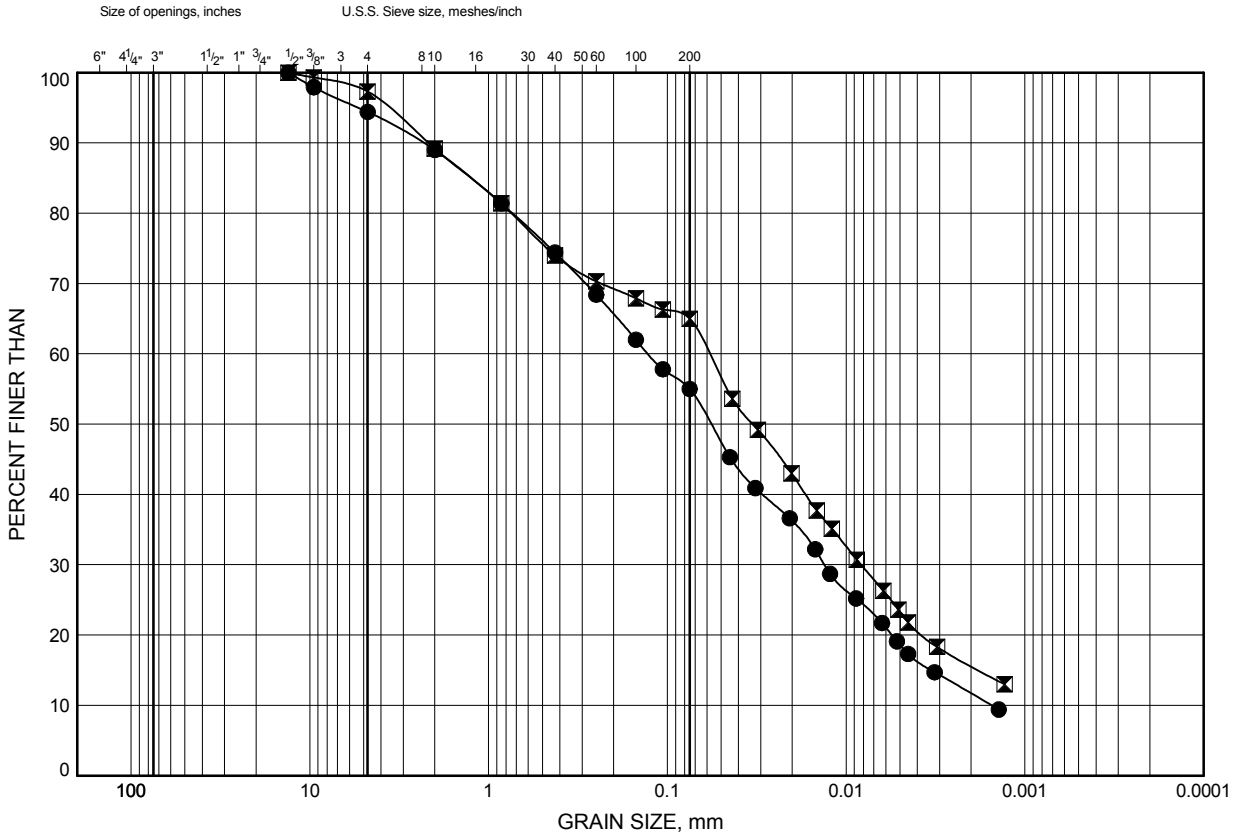
AMECFW GRADATION CURVE TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC SCARBOROUGH LOG 2009.GDT 25/09/17

Geotechnical Investigation and Pavement Analysis

GRAIN SIZE DISTRIBUTION

Silty Clay / Clayey Silt Till

FIGURE No. B4



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	BH B3	SS 8	6.1	178.8
⊠	BH B4	SS 7	6.1	178.8

Date September 2017

Project TP115085

Prep'd WA

Chkd. SB

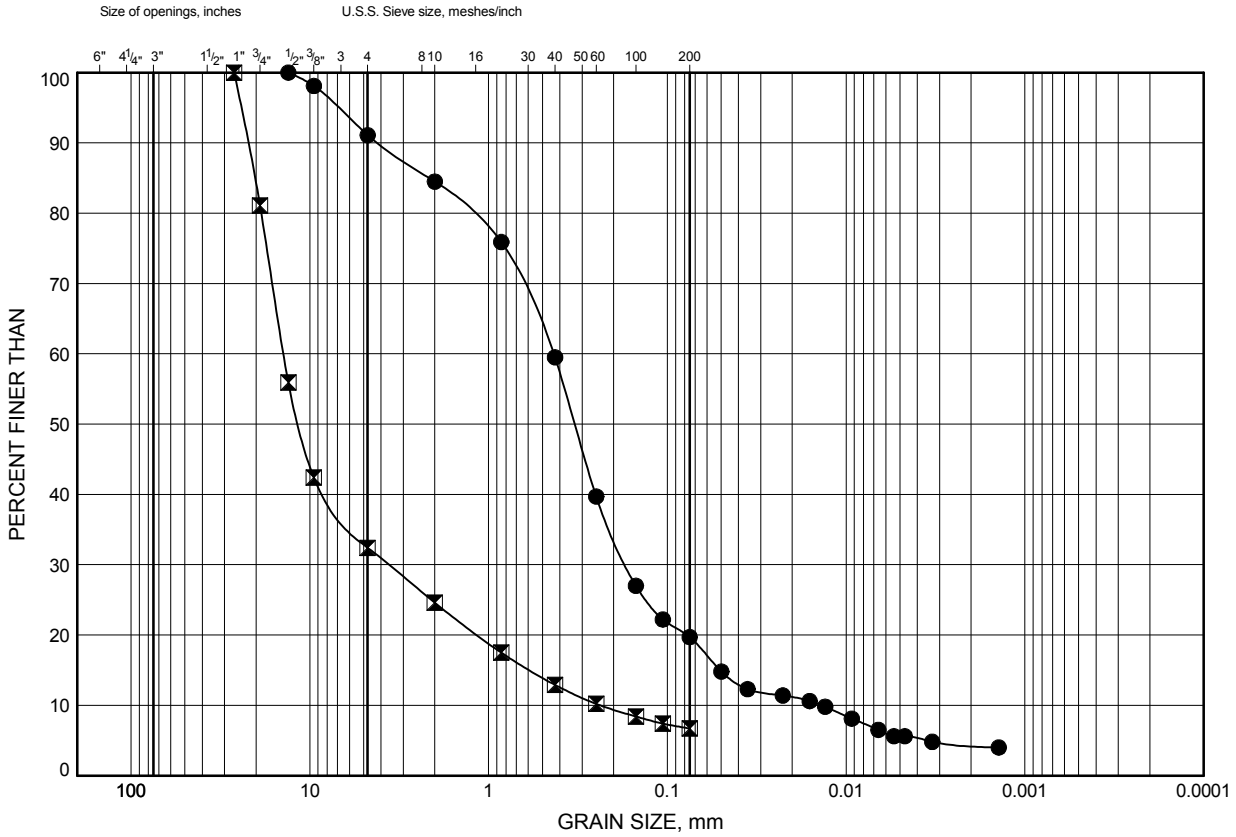
AMECFW GRADATION CURVE TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC SCARBOROUGH LOG 2009.GDT 25/09/17

Geotechnical Investigation and Pavement Analysis

GRAIN SIZE DISTRIBUTION

Sand / Sandy Gravel Fill

FIGURE No. B5



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	BH B2	SS 5	3.0	182.6
⊠	BH B6	SS 6	4.6	180.5

Date September 2017

Project TP115085

Prep'd WA

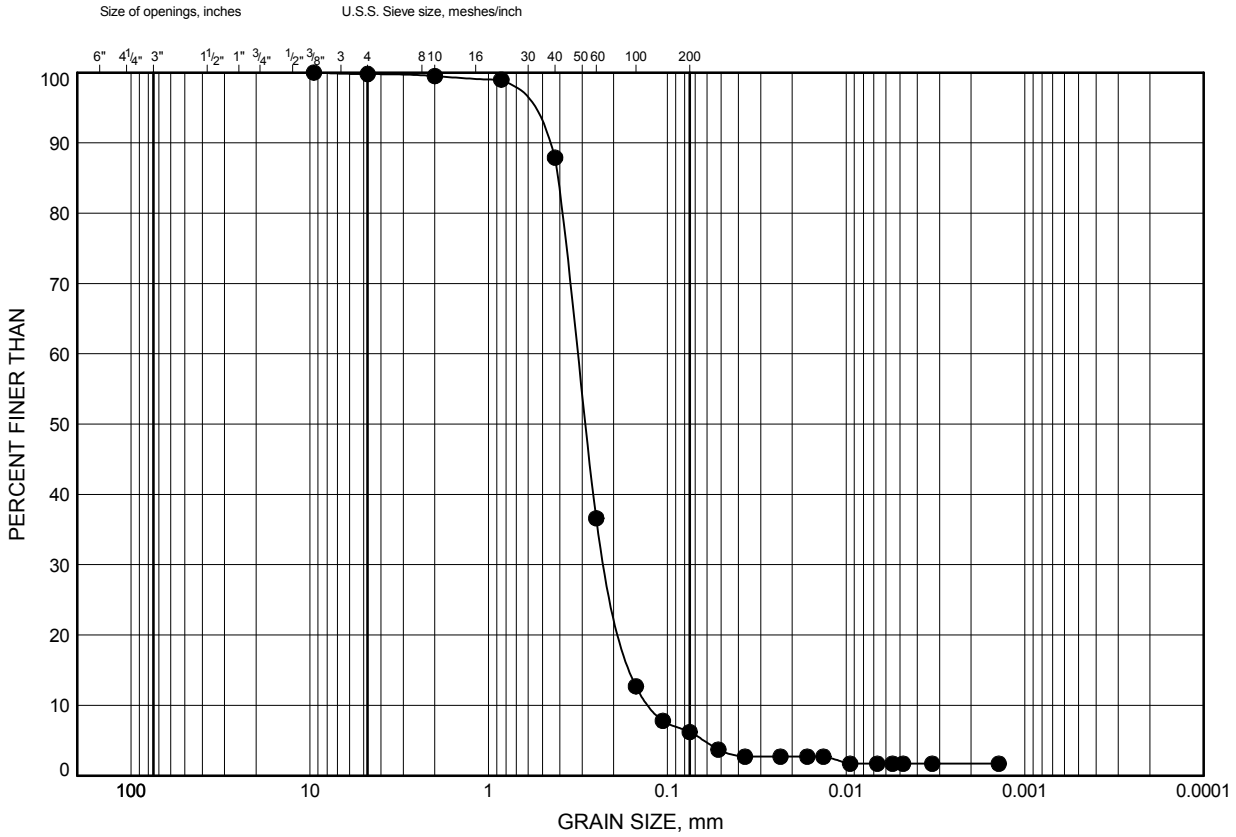
Chkd. SB

AMECFW GRADATION CURVE TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC SCARBOROUGH LOG 2009.GDT 25/09/17

Geotechnical Investigation and Pavement Analysis

GRAIN SIZE DISTRIBUTION
Sand

FIGURE No. B6



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	BH R1	SS 8	7.6	196.6

Date September 2017

Project TP115085

Prep'd WA

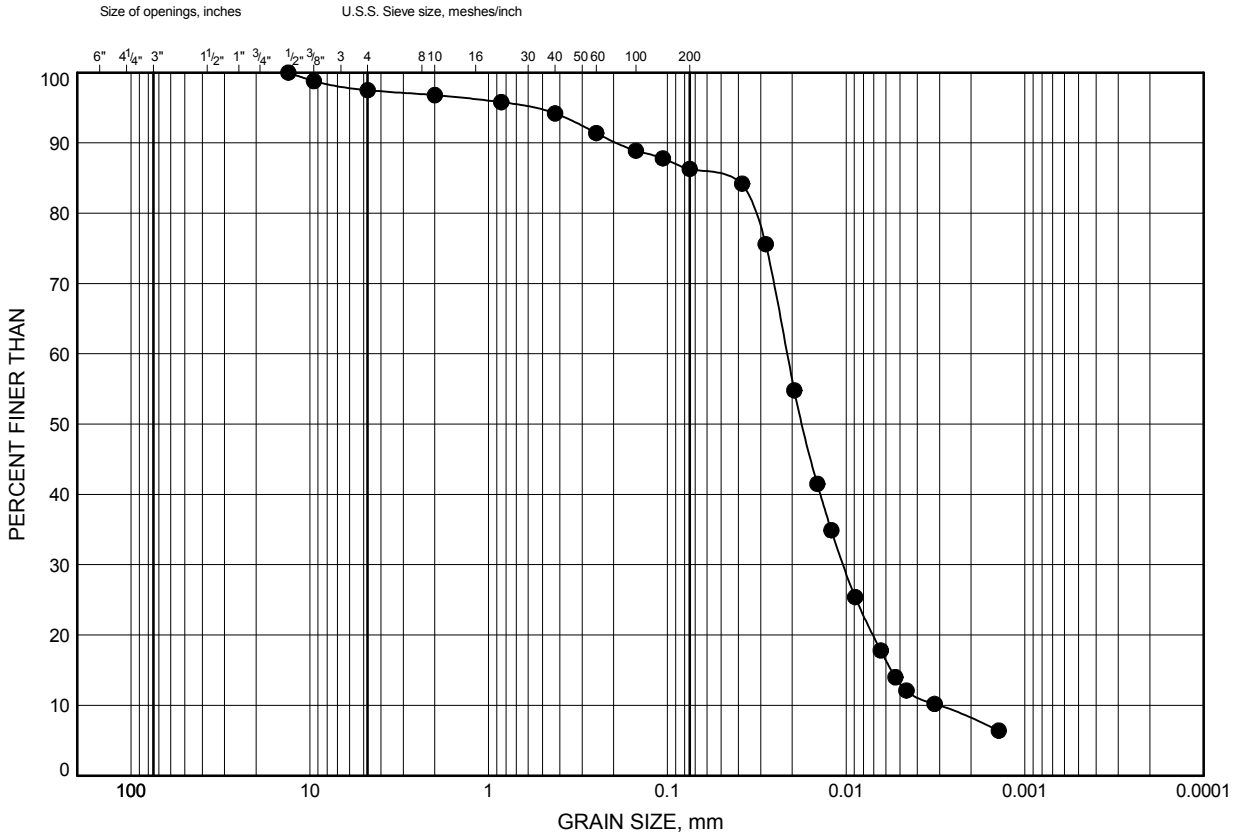
Chkd. SB

AMECFW GRADATION CURVE TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC SCARBOROUGH LOG 2009.GDT 25/09/17

Geotechnical Investigation and Pavement Analysis

GRAIN SIZE DISTRIBUTION
Silt

FIGURE No. B7



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

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	ELEVATION (m)
●	BH R2	SS 8	7.6	196.6

Date September 2017

Project TP115085

Prep'd WA

Chkd. SB

AMECFW GRADATION CURVE TP115085 MISSISSAUGA RD_BOREHOLE LOGS.GPJ AMEC SCARBOROUGH LOG 2009.GDT 25/09/17

APPENDIX C
SOIL CHEMICAL ANALYSIS AND CERTIFICATES OF ANALYSIS

AGAT Laboratories

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

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
104 CROCKFORD BLVD
SCARBOROUGH, ON M1R3C3
(416) 751-6565

ATTENTION TO: Shami Malla

PROJECT: Mississauga Road

AGAT WORK ORDER: 17T229179

SOIL ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Jun 29, 2017

PAGES (INCLUDING COVER): 17

VERSION*: 1

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

NOTES

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

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-06-16

DATE REPORTED: 2017-06-29

		SAMPLE DESCRIPTION:		BH 6 / AS3	BH8 / AS2	BH11 / AS3	BH23 / SS3	BH26 / SS3	BH31 / SS2	BH B6 / SS1
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-06-13	2017-06-13	2017-06-13	2017-06-15	2017-06-14	2017-06-14	2017-06-14
Parameter	**Unit**	**G / S**	**RDL**	**8499242**	**8499249**	**8499254**	**8499260**	**8499281**	**8499287**	**8499295**
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	5	3	4	5	5	4	5
Barium	µg/g	220	2	12	30	37	19	62	42	31
Beryllium	µg/g	2.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	µg/g	36	5	7	<5	6	6	5	5	6
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.16	0.28	0.32	0.25	0.36	0.30	0.16
Cadmium	µg/g	1.2	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	70	2	3	9	9	4	10	9	7
Cobalt	µg/g	21	0.5	1.7	3.8	4.9	1.8	5.0	4.6	3.4
Copper	µg/g	92	1	5	12	16	6	26	21	15
Lead	µg/g	120	1	32	8	9	24	26	13	14
Molybdenum	µg/g	2	0.5	0.7	<0.5	<0.5	0.9	<0.5	<0.5	0.8
Nickel	µg/g	82	1	3	8	10	5	9	8	7
Selenium	µg/g	1.5	0.4	<0.4	<0.4	<0.4	<0.4	0.4	<0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	µg/g	86	1	4	15	14	9	16	14	15
Zinc	µg/g	290	5	82	30	34	86	65	48	54
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.270	0.350	0.440	0.570	**0.610**	**0.890**	0.300
Sodium Adsorption Ratio	NA	2.4	NA	1.45	**6.38**	**4.16**	**2.95**	**9.62**	**4.24**	**6.71**
pH, 2:1 CaCl2 Extraction	pH Units		NA	8.08	7.36	7.57	11.1	7.83	11.3	8.18

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8499242-8499295 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Iris Verástegui

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2017-06-16

DATE REPORTED: 2017-06-29

		SAMPLE DESCRIPTION:		BH8 / AS2	BH B6 / SS1
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2017-06-13	2017-06-14
Parameter	**Unit**	**G / S**	**RDL**	**8499249**	**8499295**
Hexachloroethane	µg/g	0.01	0.01	<0.01	<0.01
Gamma-Hexachlorocyclohexane	µg/g	0.01	0.005	<0.005	<0.005
Heptachlor	µg/g	0.05	0.005	<0.005	<0.005
Aldrin	µg/g	0.05	0.005	<0.005	<0.005
Heptachlor Epoxide	µg/g	0.05	0.005	<0.005	<0.005
Endosulfan	µg/g	0.04	0.005	<0.005	<0.005
Chlordane	µg/g	0.05	0.007	<0.007	<0.007
DDE	µg/g	0.05	0.007	<0.007	<0.007
DDD	µg/g	0.05	0.007	<0.007	<0.007
DDT	µg/g	1.4	0.007	<0.007	<0.007
Dieldrin	µg/g	0.05	0.005	<0.005	<0.005
Endrin	µg/g	0.04	0.005	<0.005	<0.005
Methoxychlor	µg/g	0.05	0.005	<0.005	<0.005
Hexachlorobenzene	µg/g	0.01	0.005	<0.005	<0.005
Hexachlorobutadiene	µg/g	0.01	0.01	<0.01	<0.01
Moisture Content	%		0.1	19.4	8.6
Surrogate	**Unit**	**Acceptable Limits**			
TCMX	%	50-140		76	74
Decachlorobiphenyl	%	60-130		98	82

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8499249-8499295 Results are based on the dry weight of the soil.
Note: DDT applies to the total of op'DDT and pp'DDT, DDD applies to the total of op'DDD and pp'DDD and DDE applies to the total of op'DDE and pp'DDE. Endosulfan applies to the total of Endosulfan I and Endosulfan II.
Chlordane applies to the total of Alpha-Chlordane and Gamma-Chlordane.

Certified By: N Popowich

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)

DATE RECEIVED: 2017-06-16

DATE REPORTED: 2017-06-29

		SAMPLE DESCRIPTION:		BH2 / AS2	BH 6 / AS3	BH B6 / SS2
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2017-06-13	2017-06-13	2017-06-14
Parameter	**Unit**	**G / S**	**RDL**	**8499239**	**8499242**	**8499296**
F1 (C6 to C10)	µg/g	25	5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	5	<5	<5	<5
F2 (C10 to C16)	µg/g	10	10	<10	<10	<10
F3 (C16 to C34)	µg/g	240	50	<50	<50	210
F4 (C34 to C50)	µg/g	120	50	<50	51	**320**
Gravimetric Heavy Hydrocarbons	µg/g	120	50	NA	NA	NA
Moisture Content	%		0.1	17.4	6.5	7.6
Surrogate	**Unit**	**Acceptable Limits**				
Terphenyl	%	60-140		76	69	60

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8499239-8499296 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Certified By: N Popowich

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

O. Reg. 153(511) - VOCs (Soil)

DATE RECEIVED: 2017-06-16

DATE REPORTED: 2017-06-29

		SAMPLE DESCRIPTION:		BH2 / AS2	BH 6 / AS3	BH B6 / SS2
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2017-06-13	2017-06-13	2017-06-14
Parameter	Unit	G / S	RDL	8499239	8499242	8499296
Dichlorodifluoromethane	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Vinyl Chloride	ug/g	0.02	0.02	<0.02	<0.02	<0.02
Bromomethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Trichlorofluoromethane	ug/g	0.25	0.05	<0.05	<0.05	<0.05
Acetone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
1,1-Dichloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methylene Chloride	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Trans- 1,2-Dichloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methyl tert-butyl Ether	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1-Dichloroethane	ug/g	0.05	0.02	<0.02	<0.02	<0.02
Methyl Ethyl Ketone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
Cis- 1,2-Dichloroethylene	ug/g	0.05	0.02	<0.02	<0.02	<0.02
Chloroform	ug/g	0.05	0.04	<0.04	<0.04	<0.04
1,2-Dichloroethane	ug/g	0.05	0.03	<0.03	<0.03	<0.03
1,1,1-Trichloroethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Carbon Tetrachloride	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Benzene	ug/g	0.02	0.02	<0.02	<0.02	<0.02
1,2-Dichloropropane	ug/g	0.05	0.03	<0.03	<0.03	<0.03
Trichloroethylene	ug/g	0.05	0.03	<0.03	<0.03	<0.03
Bromodichloromethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Methyl Isobutyl Ketone	ug/g	0.5	0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Toluene	ug/g	0.2	0.02	<0.02	<0.02	<0.02
Dibromochloromethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Ethylene Dibromide	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Tetrachloroethylene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1,1,2-Tetrachloroethane	ug/g	0.05	0.04	<0.04	<0.04	<0.04
Chlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Ethylbenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
m & p-Xylene	ug/g		0.05	<0.05	<0.05	<0.05

Certified By: N Popnikolof

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

O. Reg. 153(511) - VOCs (Soil)

DATE RECEIVED: 2017-06-16

DATE REPORTED: 2017-06-29

		SAMPLE DESCRIPTION:		BH2 / AS2	BH 6 / AS3	BH B6 / SS2
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2017-06-13	2017-06-13	2017-06-14
Parameter	**Unit**	**G / S**	**RDL**	**8499239**	**8499242**	**8499296**
Bromoform	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Styrene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,1,2,2-Tetrachloroethane	ug/g	0.05	0.05	<0.05	<0.05	<0.05
o-Xylene	ug/g		0.05	<0.05	<0.05	<0.05
1,3-Dichlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,4-Dichlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,2-Dichlorobenzene	ug/g	0.05	0.05	<0.05	<0.05	<0.05
Xylene Mixture	ug/g	0.05	0.05	<0.05	<0.05	<0.05
1,3-Dichloropropene	µg/g	0.05	0.04	<0.04	<0.04	<0.04
n-Hexane	µg/g	0.05	0.05	<0.05	<0.05	<0.05
Surrogate	**Unit**	**Acceptable Limits**				
Toluene-d8	% Recovery	50-140		89	90	91
4-Bromofluorobenzene	% Recovery	50-140		86	84	85

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8499239-8499296 The sample was analysed using the high level technique. The sample was extracted using methanol, a small amount of the methanol extract was diluted in water and the purge & trap GC/MS analysis was performed. Results are based on the dry weight of the soil.

Certified By: N Popowich

AGAT Laboratories

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

Guideline Violation

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8499249	BH8 / AS2	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	6.38
8499254	BH11 / AS3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	4.16
8499260	BH23 / SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	2.95
8499281	BH26 / SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	mS/cm	0.57	0.610
8499281	BH26 / SS3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	9.62
8499287	BH31 / SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	mS/cm	0.57	0.890
8499287	BH31 / SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	4.24
8499295	BH B6 / SS1	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	6.71
8499296	BH B6 / SS2	ON T1 S RPI/ICC	O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)	F4 (C34 to C50)	µg/g	120	320

AGAT Laboratories

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

Soil Analysis

RPT Date: Jun 29, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8499295	8499295	<0.8	<0.8	NA	< 0.8	102%	70%	130%	109%	80%	120%	73%	70%	130%
Arsenic	8499295	8499295	5	5	0.0%	< 1	114%	70%	130%	112%	80%	120%	94%	70%	130%
Barium	8499295	8499295	31	32	3.2%	< 2	106%	70%	130%	112%	80%	120%	99%	70%	130%
Beryllium	8499295	8499295	<0.5	<0.5	NA	< 0.5	79%	70%	130%	108%	80%	120%	74%	70%	130%
Boron	8499295	8499295	6	6	NA	< 5	109%	70%	130%	104%	80%	120%	74%	70%	130%
Boron (Hot Water Soluble)	8499295	8499295	0.16	0.16	NA	< 0.10	109%	60%	140%	101%	70%	130%	92%	60%	140%
Cadmium	8499295	8499295	<0.5	<0.5	NA	< 0.5	93%	70%	130%	108%	80%	120%	91%	70%	130%
Chromium	8499295	8499295	7	7	NA	< 2	77%	70%	130%	107%	80%	120%	81%	70%	130%
Cobalt	8499295	8499295	3.4	3.5	2.9%	< 0.5	89%	70%	130%	118%	80%	120%	86%	70%	130%
Copper	8499295	8499295	15	16	6.5%	< 1	78%	70%	130%	105%	80%	120%	72%	70%	130%
Lead	8499295	8499295	14	13	7.4%	< 1	102%	70%	130%	111%	80%	120%	85%	70%	130%
Molybdenum	8499295	8499295	0.8	0.8	NA	< 0.5	94%	70%	130%	113%	80%	120%	94%	70%	130%
Nickel	8499295	8499295	7	8	13.3%	< 1	85%	70%	130%	112%	80%	120%	78%	70%	130%
Selenium	8499295	8499295	<0.4	<0.4	NA	< 0.4	125%	70%	130%	109%	80%	120%	93%	70%	130%
Silver	8499295	8499295	<0.2	<0.2	NA	< 0.2	98%	70%	130%	117%	80%	120%	89%	70%	130%
Thallium	8499295	8499295	<0.4	<0.4	NA	< 0.4	116%	70%	130%	113%	80%	120%	93%	70%	130%
Uranium	8499295	8499295	<0.5	<0.5	NA	< 0.5	94%	70%	130%	114%	80%	120%	99%	70%	130%
Vanadium	8499295	8499295	15	15	0.0%	< 1	78%	70%	130%	102%	80%	120%	79%	70%	130%
Zinc	8499295	8499295	54	51	5.7%	< 5	102%	70%	130%	114%	80%	120%	97%	70%	130%
Chromium VI	8499315		<0.2	<0.2	NA	< 0.2	92%	70%	130%	103%	80%	120%	102%	70%	130%
Cyanide	8496633		<0.040	<0.040	NA	< 0.040	90%	70%	130%	106%	80%	120%	101%	70%	130%
Mercury	8499295	8499295	<0.10	<0.10	NA	< 0.10	100%	70%	130%	101%	80%	120%	87%	70%	130%
Electrical Conductivity	8499295	8499295	0.300	0.300	0.0%	< 0.005	95%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8499295	8499295	6.71	6.19	8.1%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8499254	8499254	7.57	7.61	0.5%	NA	101%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: 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.

Certified By: Iris Verástegui

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

Trace Organics Analysis

RPT Date: Jun 29, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - VOCs (Soil)															
Dichlorodifluoromethane	8499916		< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	79%	50%	140%	75%	50%	140%
Vinyl Chloride	8499916		< 0.02	< 0.02	NA	< 0.02	72%	50%	140%	81%	50%	140%	80%	50%	140%
Bromomethane	8499916		< 0.05	< 0.05	NA	< 0.05	85%	50%	140%	87%	50%	140%	86%	50%	140%
Trichlorofluoromethane	8499916		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	78%	50%	140%	71%	50%	140%
Acetone	8499916		< 0.50	< 0.50	NA	< 0.50	89%	50%	140%	90%	50%	140%	89%	50%	140%
1,1-Dichloroethylene	8499916		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	92%	60%	130%	97%	50%	140%
Methylene Chloride	8499916		< 0.05	< 0.05	NA	< 0.05	102%	50%	140%	101%	60%	130%	99%	50%	140%
Trans- 1,2-Dichloroethylene	8499916		< 0.05	< 0.05	NA	< 0.05	101%	50%	140%	95%	60%	130%	99%	50%	140%
Methyl tert-butyl Ether	8499916		< 0.05	< 0.05	NA	< 0.05	90%	50%	140%	93%	60%	130%	99%	50%	140%
1,1-Dichloroethane	8499916		< 0.02	< 0.02	NA	< 0.02	92%	50%	140%	99%	60%	130%	99%	50%	140%
Methyl Ethyl Ketone	8499916		< 0.50	< 0.50	NA	< 0.50	83%	50%	140%	92%	50%	140%	96%	50%	140%
Cis- 1,2-Dichloroethylene	8499916		< 0.02	< 0.02	NA	< 0.02	95%	50%	140%	101%	60%	130%	97%	50%	140%
Chloroform	8499916		< 0.04	< 0.04	NA	< 0.04	95%	50%	140%	97%	60%	130%	93%	50%	140%
1,2-Dichloroethane	8499916		< 0.03	< 0.03	NA	< 0.03	90%	50%	140%	92%	60%	130%	87%	50%	140%
1,1,1-Trichloroethane	8499916		< 0.05	< 0.05	NA	< 0.05	100%	50%	140%	100%	60%	130%	93%	50%	140%
Carbon Tetrachloride	8499916		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	95%	60%	130%	98%	50%	140%
Benzene	8499916		< 0.02	< 0.02	NA	< 0.02	96%	50%	140%	93%	60%	130%	88%	50%	140%
1,2-Dichloropropane	8499916		< 0.03	< 0.03	NA	< 0.03	87%	50%	140%	91%	60%	130%	97%	50%	140%
Trichloroethylene	8499916		< 0.03	< 0.03	NA	< 0.03	97%	50%	140%	101%	60%	130%	91%	50%	140%
Bromodichloromethane	8499916		< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	88%	60%	130%	84%	50%	140%
Methyl Isobutyl Ketone	8499916		< 0.50	< 0.50	NA	< 0.50	90%	50%	140%	98%	50%	140%	94%	50%	140%
1,1,2-Trichloroethane	8499916		< 0.04	< 0.04	NA	< 0.04	87%	50%	140%	91%	60%	130%	89%	50%	140%
Toluene	8499916		< 0.02	< 0.02	NA	< 0.02	97%	50%	140%	94%	60%	130%	86%	50%	140%
Dibromochloromethane	8499916		< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	100%	60%	130%	79%	50%	140%
Ethylene Dibromide	8499916		< 0.04	< 0.04	NA	< 0.04	92%	50%	140%	97%	60%	130%	100%	50%	140%
Tetrachloroethylene	8499916		< 0.05	< 0.05	NA	< 0.05	100%	50%	140%	91%	60%	130%	82%	50%	140%
1,1,1,2-Tetrachloroethane	8499916		< 0.04	< 0.04	NA	< 0.04	85%	50%	140%	86%	60%	130%	99%	50%	140%
Chlorobenzene	8499916		< 0.05	< 0.05	NA	< 0.05	86%	50%	140%	87%	60%	130%	81%	50%	140%
Ethylbenzene	8499916		< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	98%	60%	130%	85%	50%	140%
m & p-Xylene	8499916		< 0.05	< 0.05	NA	< 0.05	65%	50%	140%	86%	60%	130%	73%	50%	140%
Bromoform	8499916		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	88%	60%	130%	66%	50%	140%
Styrene	8499916		< 0.05	< 0.05	NA	< 0.05	90%	50%	140%	91%	60%	130%	95%	50%	140%
1,1,2,2-Tetrachloroethane	8499916		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	95%	60%	130%	86%	50%	140%
o-Xylene	8499916		< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	95%	60%	130%	86%	50%	140%
1,3-Dichlorobenzene	8499916		< 0.05	< 0.05	NA	< 0.05	90%	50%	140%	92%	60%	130%	86%	50%	140%
1,4-Dichlorobenzene	8499916		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	94%	60%	130%	87%	50%	140%
1,2-Dichlorobenzene	8499916		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	95%	60%	130%	97%	50%	140%
1,3-Dichloropropene	8499916		< 0.04	< 0.04	NA	< 0.04	97%	50%	140%	94%	60%	130%	88%	50%	140%
n-Hexane	8499916		< 0.05	< 0.05	NA	< 0.05	83%	50%	140%	95%	60%	130%	97%	50%	140%

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

Trace Organics Analysis (Continued)

RPT Date: Jun 29, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)															
F1 (C6 to C10)	8495525		< 5	< 5	NA	< 5	73%	60%	130%	87%	85%	115%	74%	70%	130%
F2 (C10 to C16)	8497265		< 10	< 10	NA	< 10	108%	60%	130%	82%	80%	120%	73%	70%	130%
F3 (C16 to C34)	8497265		< 50	< 50	NA	< 50	109%	60%	130%	80%	80%	120%	76%	70%	130%
F4 (C34 to C50)	8497265		< 50	< 50	NA	< 50	96%	60%	130%	88%	80%	120%	72%	70%	130%
O. Reg. 153(511) - OC Pesticides (Soil)															
Hexachloroethane	8497444		< 0.01	< 0.01	NA	< 0.01	100%	50%	140%	58%	50%	140%	52%	50%	140%
Gamma-Hexachlorocyclohexane	8497444		< 0.005	< 0.005	NA	< 0.005	108%	50%	140%	80%	50%	140%	82%	50%	140%
Heptachlor	8497444		< 0.005	< 0.005	NA	< 0.005	107%	50%	140%	66%	50%	140%	86%	50%	140%
Aldrin	8497444		< 0.005	< 0.005	NA	< 0.005	109%	50%	140%	64%	50%	140%	86%	50%	140%
Heptachlor Epoxide	8497444		< 0.005	< 0.005	NA	< 0.005	110%	50%	140%	80%	50%	140%	94%	50%	140%
Endosulfan	8497444		< 0.005	< 0.005	NA	< 0.005	104%	50%	140%	77%	50%	140%	97%	50%	140%
Chlordane	8497444		< 0.007	< 0.007	NA	< 0.007	111%	50%	140%	84%	50%	140%	98%	50%	140%
DDE	8497444		< 0.007	< 0.007	NA	< 0.007	111%	50%	140%	69%	50%	140%	87%	50%	140%
DDD	8497444		< 0.007	< 0.007	NA	< 0.007	106%	50%	140%	87%	50%	140%	92%	50%	140%
DDT	8497444		< 0.007	< 0.007	NA	< 0.007	107%	50%	140%	74%	50%	140%	91%	50%	140%
Dieldrin	8497444		< 0.005	< 0.005	NA	< 0.005	108%	50%	140%	80%	50%	140%	94%	50%	140%
Endrin	8497444		< 0.005	< 0.005	NA	< 0.005	106%	50%	140%	78%	50%	140%	92%	50%	140%
Methoxychlor	8497444		< 0.005	< 0.005	NA	< 0.005	106%	50%	140%	82%	50%	140%	96%	50%	140%
Hexachlorobenzene	8497444		< 0.005	< 0.005	NA	< 0.005	109%	50%	140%	76%	50%	140%	82%	50%	140%
Hexachlorobutadiene	8497444		< 0.01	< 0.01	NA	< 0.01	112%	50%	140%	76%	50%	140%	50%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By: N Popnikolof

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P &T GC / FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P & T GC / FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	Balance
Moisture Content	VOL-91-5009	CCME Tier 1 Method, SW846 5035,8015	BALANCE
Terphenyl	VOL-91-5009	CCME Tier 1 Method	GC/FID
Dichlorodifluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromomethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Acetone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methylene Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trans- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl tert-butyl Ether	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Cis- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chloroform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Benzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromodichloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T229179

PROJECT: Mississauga Road

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:D.M.

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Toluene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Dibromochloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromoform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Styrene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
o-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Xylene Mixture	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
n-Hexane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

AGAT Laboratories

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

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 17T229179
Cooler Quantity:
Arrival Temperatures:
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Report Information:
Company: Amec Foster Wheeler
Contact:
Address:
Phone: Fax:
Reports to be sent to:
1. Email:
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)
☑ Regulation 153/04 — Table 1 (Indicate One) — ☑ Ind/Com ☑ Res/Park ☐ Agriculture — Soil Texture (Check One) ☐ Coarse ☐ Fine
☐ Sewer Use — ☐ Sanitary ☐ Storm — Region (Indicate One) — ☐ MISA
☑ Regulation 558 — ☐ CCME ☐ Prov. Water Quality Objectives (PWQO) ☐ Other (Indicate One)

Turnaround Time (TAT) Required:
Regular TAT ☐ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays
For 'Same Day' analysis, please contact your AGAT CPM

Project Information:
Project: Mississauga Food
Site Location:
Sampled By: D.U.
AGAT Quote #: PO: TP1150851-6L02
Please note: If quotation number is not provided, client will be billed full price for analysis.

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

Report Guideline on Certificate of Analysis ☐ Yes ☑ No

Invoice Information: Bill To Same: Yes ☐ No ☐
Company:
Contact:
Address:
Email:

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Metals and Inorganics (O. Reg 153)	Field Filtered - Metals, Hg, CrVI	O. Reg 153	Full Metals Scan	Regulation/Custom Metals	Volatiles	CCME Fractions 1 to 4	ABNs	PAHs	PCBs	Organochlorine Pesticides	TCLP	Sewer Use
BH2 / AS2	15 June	2		Soil	1x40, 1x120							✓	✓						
BH 6 / [illegible]		3			1x40 1x60, 1x250		✓					✓	✓						
BH 8 / AS2		2			1x250, 1x120		✓										✓		
BH 11 / AS3		1			1x250		✓												
BH 24 / SS2	15 June	1			1x250														
BH 25 / SS5	"	1			1x250		✓												
BH 25 / AS1	14 June	1			1x150														
BH 26 / SS3	"	2			1x40, 1x120		✓												
BH 31 / SS2	"	1			1x250		✓												
BH 301 / AS1	15 June	1			1x250														
BH 30 / SS4	"	2			1x120, 1x40														

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Steve Miller			[signature]	2017/11/14	12:00
[signature]	2017/11/13				

Page 1 of 2
No T 053669

AGAT Laboratories

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

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #:

Cooler Quantity:

Arrival Temperatures:

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: Amec Foster Wheeler
Contact: Sharni Malla
Address: 104 Crockford BLVD. Scarborough, ON M1R 3C3
Phone: 416-751-6565 Fax: 416-751-7592
Reports to be sent to:
1. Email: sharni.malla@amecfw.com
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One): ☐ Ind/Comm ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region (Indicate One): ☐ MISA

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

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):

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

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: Mississauga Rd.
Site Location:
Sampled By: D.H
AGAT Quote #: PO: TPIS085.1.6000
Please note: If quotation number is not provided, client will be billed full price for analysis.

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

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

Invoice Information: Bill To Same: Yes ☐ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N
BH B6 / SS1	14 June		2	Soil	2 x 250	
BH B6 / SS2	"		2	"	1 x 40 1 x 120	
BH B6 / SS3	"		1	"	1 x 120	

Field Filtered - Metals, Hg, CrVI

O. Reg 153: ☐ All Metals ☐ 153 Metals (incl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides)

ORPs: ☐ B-HWS ☐ O. ☐ CN ☐ Cr ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR

Metals and Inorganics Reg 153 ✓

Full Metals Scan

Regulation/Custom Metals

Nutrients: ☐ TP ☐ NH_4 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_2+NO_3

Volatiles: ✓ VOC ☐ BTEX ☐ THM

CCME Fractions 1 to 4 ✓

ABNs

PAHs

PCBs: ☐ Total ☐ Aroclors

Organochlorine Pesticides ✓

TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ Pest

Sewer Use

Relinquished By (Print Name and Sign)	Date	Time	Received By (Print Name and Sign)	Date	Time
Sharni Malla				2015/06/17	12:52

Page 2 of 2

No T 053670

AGAT Laboratories

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

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #:

Cooler Quantity: 1 cmp

Arrival Temperatures: 3.8 3.3 3.8 / 22.2 5.1 2.1

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: Amec Foster Wheeler

Contact:

Address:

Phone: Fax:

Reports to be sent to:

1. Email:

2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

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

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

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

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: Missisauga Road

Site Location:

Sampled By: D. U.

AGAT Quote #: PO: TPI15085-1-6000

Please note: If quotation number is not provided, client will be billed full price for analysis.

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

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

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company:

Contact:

Address:

Email:

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides))	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
BH2 / AS2	13 June	2		Soil	1x40, 1x120													
BH 6 / ~~SS1~~	"	3		"	1x40, 1x120, 1x250													
BH 8 / AS2	"	2		"	1x250, 1x120													
BH 11 / AS3	"	1		"	1x250													
BH 24 / SS2	15 June	1		"	1x250													
BH 23 / SS3	"	1		"	1x250													
BH 26 / AS1	14 June	1		"	1x150													
BH 26 / SS3	"	2		"	1x40, 1x120													
BH 31 / SS2	"	1		"	1x250													
BH 30 / AS1	15 June	1		"	1x250													
BH 30 / SS4	"	2		"	1x120, 1x40													

Hold for Test assignment

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Shami Malla			Ray	2017/06/16	12:50
Ray	2017/6/16	5:25			

Page 1 of 2

N°: T 053669

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

AGAT Laboratories

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

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #:

Cooler Quantity: yes

Arrival Temperatures: 3.5 | 3.8 | 3.9
2.2 | 2.5 | 2.9

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: Amec Foster Wheeler
Contact: Shami Malla
Address: 104 Crockford BLVD.
Scarborough, ON M1R 3C3
Phone: 416-751-6565 Fax: 416-751-7592
Reports to be sent to:
1. Email: shami.malla@ameefw.com
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table ____ *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region ____ *Indicate One*
☐ MISA

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

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

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

Turnaround Time (TAT) Required:

Regular TAT ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

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

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: Mississauga Rd.
Site Location:
Sampled By: D.U.
AGAT Quote #: PO: TP15085-1.6000
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (exc. Hydrides) ☐ Hydride Metals ☐ 153 Metals (incl. Hydrides))	O. Reg 153: ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use
BH BG1/SS1	14 June		2	Soil	2x250				Hold for Test assignment										
BH BG1/SS2	"		2	"	1x40, 1x120														
BH BG1/SS3	"		1	"	1x120														

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Shami Malla	2017/6/15	5:28	Ron	2017/6/16	12:52

Page 2 of 2

N°: T 053670

Document ID: DW-78-1511-014

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

Date Issued: February 22, 2017

AGAT Laboratories

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

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
104 CROCKFORD BLVD
SCARBOROUGH, ON M1R3C3
(416) 751-6565

ATTENTION TO: Shami Malla

PROJECT: Mississauga Rd

AGAT WORK ORDER: 17T230186

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Jul 19, 2017

PAGES (INCLUDING COVER): 16

VERSION*: 1

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

NOTES

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

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Ignitability in Soil

DATE RECEIVED: 2017-06-21 **DATE REPORTED: 2017-07-19**

				SAMPLE DESCRIPTION:	BH 3, 1.0m - 1.5m
				SAMPLE TYPE:	Soil
				DATE SAMPLED:	2017-06-19
Parameter	Unit	G / S	RDL	8556975	
Ignitability				N	

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

8556975 N = Non-Flammable Solid
Wet soil sample with pebbles.

Certified By: Amanjot Bhela

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-06-21

DATE REPORTED: 2017-07-19

				BH 3, 1.0m -	BH B-5, 2.0 ft -	BH 39, 600 mm -	BH42, 450 mm -
		SAMPLE DESCRIPTION:		1.5m	4.0 ft	1.5 m	1.0 m
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-06-19	2017-06-19	2017-06-19	2017-06-19
Parameter	Unit	G / S	RDL	8556975	8556979	8556981	8556982
Antimony	µg/g		0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g		1	4	4	5	5
Barium	µg/g		2	32	56	50	53
Beryllium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5
Boron	µg/g		5	<5	<5	<5	6
Boron (Hot Water Soluble)	µg/g		0.10	0.17	0.23	0.26	0.31
Cadmium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g		2	7	10	11	16
Cobalt	µg/g		0.5	3.6	4.5	5.8	8.4
Copper	µg/g		1	23	16	22	29
Lead	µg/g		1	23	14	25	14
Molybdenum	µg/g		0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/g		1	7	9	11	17
Selenium	µg/g		0.4	<0.4	<0.4	<0.4	<0.4
Silver	µg/g		0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g		0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	µg/g		1	11	11	16	21
Zinc	µg/g		5	41	48	61	68
Chromium VI	µg/g		0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g		0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g		0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm		0.005	0.177	0.903	0.187	0.529
Sodium Adsorption Ratio	NA		NA	3.62	11.8	1.66	0.925
pH, 2:1 CaCl2 Extraction	pH Units		NA	8.05	7.76	7.77	8.55

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

8556975-8556982 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. Please note that samples were analyzed past hold time for cyanide analysis.

Certified By: Amanjot Bhela

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2017-06-21 **DATE REPORTED: 2017-07-19**

				SAMPLE DESCRIPTION:	BH 3, 1.0m - 1.5m
				SAMPLE TYPE:	Soil
				DATE SAMPLED:	2017-06-19
Parameter	**Unit**	**G / S**	**RDL**		**8556975**
Hexachloroethane	µg/g		0.01		<0.01
Gamma-Hexachlorocyclohexane	µg/g		0.005		<0.005
Heptachlor	µg/g		0.005		<0.005
Aldrin	µg/g		0.005		<0.005
Heptachlor Epoxide	µg/g		0.005		<0.005
Endosulfan	µg/g		0.005		<0.005
Chlordane	µg/g		0.007		<0.007
DDE	µg/g		0.007		<0.007
DDD	µg/g		0.007		<0.007
DDT	µg/g		0.007		<0.007
Dieldrin	µg/g		0.005		<0.005
Endrin	µg/g		0.005		<0.005
Methoxychlor	µg/g		0.005		<0.005
Hexachlorobenzene	µg/g		0.005		<0.005
Hexachlorobutadiene	µg/g		0.01		<0.01
Moisture Content	%		0.1		11.1
Surrogate	**Unit**	**Acceptable Limits**			
TCMX	%	50-140			70
Decachlorobiphenyl	%	60-130			80

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

8556975 Results are based on the dry weight of the soil.
Note: DDT applies to the total of op'DDT and pp'DDT, DDD applies to the total of op'DDD and pp'DDD and DDE applies to the total of op'DDE and pp'DDE. Endosulfan applies to the total of Endosulfan I and Endosulfan II.
Chlordane applies to the total of Alpha-Chlordane and Gamma-Chlordane.

Certified By: N Popnikolof

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)

DATE RECEIVED: 2017-06-21 **DATE REPORTED: 2017-07-19**

				BH B-5, 2.0 ft -
		SAMPLE DESCRIPTION:		4.0 ft
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-06-19
Parameter	Unit	G / S	RDL	8556979
F1 (C6 to C10)	µg/g		5	<5
F1 (C6 to C10) minus BTEX	µg/g		5	<5
F2 (C10 to C16)	µg/g		10	<10
F3 (C16 to C34)	µg/g		50	56
F4 (C34 to C50)	µg/g		50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA
Moisture Content	%		0.1	18.4
Surrogate	**Unit**	**Acceptable Limits**		
Terphenyl	%	60-140		120

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

8556979 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Certified By: N Popowich

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

O. Reg. 153(511) - VOCs (Soil)

DATE RECEIVED: 2017-06-21 **DATE REPORTED: 2017-07-19**

				BH B-5, 2.0 ft -
		SAMPLE DESCRIPTION:		4.0 ft
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-06-19
Parameter	Unit	G / S	RDL	8556979
Dichlorodifluoromethane	µg/g		0.05	<0.05
Vinyl Chloride	ug/g		0.02	<0.02
Bromomethane	ug/g		0.05	<0.05
Trichlorofluoromethane	ug/g		0.05	<0.05
Acetone	ug/g		0.50	<0.50
1,1-Dichloroethylene	ug/g		0.05	<0.05
Methylene Chloride	ug/g		0.05	<0.05
Trans- 1,2-Dichloroethylene	ug/g		0.05	<0.05
Methyl tert-butyl Ether	ug/g		0.05	<0.05
1,1-Dichloroethane	ug/g		0.02	<0.02
Methyl Ethyl Ketone	ug/g		0.50	<0.50
Cis- 1,2-Dichloroethylene	ug/g		0.02	<0.02
Chloroform	ug/g		0.04	<0.04
1,2-Dichloroethane	ug/g		0.03	<0.03
1,1,1-Trichloroethane	ug/g		0.05	<0.05
Carbon Tetrachloride	ug/g		0.05	<0.05
Benzene	ug/g		0.02	<0.02
1,2-Dichloropropane	ug/g		0.03	<0.03
Trichloroethylene	ug/g		0.03	<0.03
Bromodichloromethane	ug/g		0.05	<0.05
Methyl Isobutyl Ketone	ug/g		0.50	<0.50
1,1,2-Trichloroethane	ug/g		0.04	<0.04
Toluene	ug/g		0.02	<0.02
Dibromochloromethane	ug/g		0.05	<0.05
Ethylene Dibromide	ug/g		0.04	<0.04
Tetrachloroethylene	ug/g		0.05	<0.05
1,1,1,2-Tetrachloroethane	ug/g		0.04	<0.04
Chlorobenzene	ug/g		0.05	<0.05
Ethylbenzene	ug/g		0.05	<0.05

Certified By: N Popowkolof

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

O. Reg. 153(511) - VOCs (Soil)

DATE RECEIVED: 2017-06-21 **DATE REPORTED: 2017-07-19**

				BH B-5, 2.0 ft -
		SAMPLE DESCRIPTION:		4.0 ft
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-06-19
Parameter	Unit	G / S	RDL	8556979
m & p-Xylene	ug/g		0.05	<0.05
Bromoform	ug/g		0.05	<0.05
Styrene	ug/g		0.05	<0.05
1,1,2,2-Tetrachloroethane	ug/g		0.05	<0.05
o-Xylene	ug/g		0.05	<0.05
1,3-Dichlorobenzene	ug/g		0.05	<0.05
1,4-Dichlorobenzene	ug/g		0.05	<0.05
1,2-Dichlorobenzene	ug/g		0.05	<0.05
Xylene Mixture	ug/g		0.05	<0.05
1,3-Dichloropropene	µg/g		0.04	<0.04
n-Hexane	µg/g		0.05	<0.05
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	50-140		88
4-Bromofluorobenzene	% Recovery	50-140		80

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

8556979 The sample was analysed using the high level technique. The sample was extracted using methanol, a small amount of the methanol extract was diluted in water and the purge & trap GC/MS analysis was performed. Results are based on the dry weight of the soil.

Certified By: N Popowkolof

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Soil Analysis

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8556975	8556975	<0.8	<0.8	NA	< 0.8	85%	70%	130%	102%	80%	120%	102%	70%	130%
Arsenic	8556975	8556975	4	4	NA	< 1	92%	70%	130%	99%	80%	120%	103%	70%	130%
Barium	8556975	8556975	32	32	0.0%	< 2	102%	70%	130%	104%	80%	120%	100%	70%	130%
Beryllium	8556975	8556975	<0.5	<0.5	NA	< 0.5	81%	70%	130%	103%	80%	120%	94%	70%	130%
Boron	8556975	8556975	<5	<5	NA	< 5	86%	70%	130%	106%	80%	120%	100%	70%	130%
Boron (Hot Water Soluble)	8556975	8556975	0.17	0.15	NA	< 0.10	84%	60%	140%	94%	70%	130%	97%	60%	140%
Cadmium	8556975	8556975	<0.5	<0.5	NA	< 0.5	102%	70%	130%	102%	80%	120%	105%	70%	130%
Chromium	8556975	8556975	7	8	NA	< 2	75%	70%	130%	105%	80%	120%	104%	70%	130%
Cobalt	8556975	8556975	3.6	3.7	2.7%	< 0.5	92%	70%	130%	106%	80%	120%	103%	70%	130%
Copper	8556975	8556975	23	24	4.3%	< 1	91%	70%	130%	110%	80%	120%	105%	70%	130%
Lead	8556975	8556975	23	24	4.3%	< 1	101%	70%	130%	105%	80%	120%	103%	70%	130%
Molybdenum	8556975	8556975	<0.5	<0.5	NA	< 0.5	88%	70%	130%	108%	80%	120%	107%	70%	130%
Nickel	8556975	8556975	7	7	0.0%	< 1	96%	70%	130%	112%	80%	120%	107%	70%	130%
Selenium	8556975	8556975	<0.4	<0.4	NA	< 0.4	82%	70%	130%	104%	80%	120%	109%	70%	130%
Silver	8556975	8556975	<0.2	<0.2	NA	< 0.2	82%	70%	130%	106%	80%	120%	110%	70%	130%
Thallium	8556975	8556975	<0.4	<0.4	NA	< 0.4	79%	70%	130%	104%	80%	120%	102%	70%	130%
Uranium	8556975	8556975	<0.5	<0.5	NA	< 0.5	88%	70%	130%	105%	80%	120%	100%	70%	130%
Vanadium	8556975	8556975	11	10	9.5%	< 1	89%	70%	130%	103%	80%	120%	105%	70%	130%
Zinc	8556975	8556975	41	41	0.0%	< 5	99%	70%	130%	112%	80%	120%	114%	70%	130%
Chromium VI	8558036		<0.2	<0.2	NA	< 0.2	93%	70%	130%	101%	80%	120%	98%	70%	130%
Cyanide	8552648		<0.040	<0.040	NA	< 0.040	92%	70%	130%	100%	80%	120%	102%	70%	130%
Mercury	8556975	8556975	<0.10	<0.10	NA	< 0.10	96%	70%	130%	95%	80%	120%	98%	70%	130%
Electrical Conductivity	8556975	8556975	0.177	0.184	3.9%	< 0.005	96%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8556975	8556975	3.62	3.70	2.2%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8556981	8556981	7.77	7.79	0.3%	NA	101%	80%	120%	NA			NA		
O. Reg. 558 Metals and Inorganics															
Arsenic Leachate	8553822		<0.010	<0.010	NA	< 0.010	99%	90%	110%	92%	80%	120%	103%	70%	130%
Barium Leachate	8553822		0.495	0.467	NA	< 0.100	103%	90%	110%	102%	80%	120%	98%	70%	130%
Boron Leachate	8553822		0.057	0.058	NA	< 0.050	98%	90%	110%	99%	80%	120%	88%	70%	130%
Cadmium Leachate	8553822		<0.010	<0.010	NA	< 0.010	102%	90%	110%	97%	80%	120%	115%	70%	130%
Chromium Leachate	8553822		<0.010	<0.010	NA	< 0.010	103%	90%	110%	102%	80%	120%	107%	70%	130%
Lead Leachate	8553822		0.012	0.012	NA	< 0.010	103%	90%	110%	98%	80%	120%	95%	70%	130%
Mercury Leachate	8553822		<0.01	<0.01	NA	< 0.01	100%	90%	110%	94%	80%	120%	92%	70%	130%
Selenium Leachate	8553822		<0.010	<0.010	NA	< 0.010	102%	90%	110%	100%	80%	120%	104%	70%	130%
Silver Leachate	8553822		<0.010	<0.010	NA	< 0.010	103%	90%	110%	96%	80%	120%	103%	70%	130%
Uranium Leachate	8553822		<0.050	<0.050	NA	< 0.050	101%	90%	110%	100%	80%	120%	98%	70%	130%
Fluoride Leachate	8553822		<0.05	<0.05	NA	< 0.05	101%	90%	110%	107%	90%	110%	101%	70%	130%
Cyanide Leachate	8553822		<0.05	<0.05	NA	< 0.05	92%	90%	110%	100%	90%	110%	100%	70%	130%
(Nitrate + Nitrite) as N Leachate	8553822		<0.70	<0.70	NA	< 0.70	101%	80%	120%	98%	80%	120%	96%	70%	130%

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Soil Analysis (Continued)

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: NA signifies Not Applicable.
Duplicate Qualifier: 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.

Certified By: Amanjot Bhela

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Trace Organics Analysis

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - VOCs (Soil)															
Dichlorodifluoromethane	8551744		< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	94%	50%	140%	87%	50%	140%
Vinyl Chloride	8551744		< 0.02	< 0.02	NA	< 0.02	93%	50%	140%	92%	50%	140%	89%	50%	140%
Bromomethane	8551744		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	90%	50%	140%	96%	50%	140%
Trichlorofluoromethane	8551744		< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	86%	50%	140%	89%	50%	140%
Acetone	8551744		< 0.50	< 0.50	NA	< 0.50	99%	50%	140%	95%	50%	140%	90%	50%	140%
1,1-Dichloroethylene	8551744		< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	95%	60%	130%	99%	50%	140%
Methylene Chloride	8551744		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	95%	60%	130%	97%	50%	140%
Trans- 1,2-Dichloroethylene	8551744		< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	97%	60%	130%	91%	50%	140%
Methyl tert-butyl Ether	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	94%	60%	130%	97%	50%	140%
1,1-Dichloroethane	8551744		< 0.02	< 0.02	NA	< 0.02	87%	50%	140%	97%	60%	130%	92%	50%	140%
Methyl Ethyl Ketone	8551744		< 0.50	< 0.50	NA	< 0.50	99%	50%	140%	96%	50%	140%	91%	50%	140%
Cis- 1,2-Dichloroethylene	8551744		< 0.02	< 0.02	NA	< 0.02	91%	50%	140%	96%	60%	130%	97%	50%	140%
Chloroform	8551744		< 0.04	< 0.04	NA	< 0.04	97%	50%	140%	94%	60%	130%	94%	50%	140%
1,2-Dichloroethane	8551744		< 0.03	< 0.03	NA	< 0.03	96%	50%	140%	93%	60%	130%	92%	50%	140%
1,1,1-Trichloroethane	8551744		< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	96%	60%	130%	99%	50%	140%
Carbon Tetrachloride	8551744		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	99%	60%	130%	98%	50%	140%
Benzene	8551744		< 0.02	< 0.02	NA	< 0.02	96%	50%	140%	87%	60%	130%	92%	50%	140%
1,2-Dichloropropane	8551744		< 0.03	< 0.03	NA	< 0.03	97%	50%	140%	95%	60%	130%	91%	50%	140%
Trichloroethylene	8551744		< 0.03	< 0.03	NA	< 0.03	88%	50%	140%	90%	60%	130%	91%	50%	140%
Bromodichloromethane	8551744		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	94%	60%	130%	93%	50%	140%
Methyl Isobutyl Ketone	8551744		< 0.50	< 0.50	NA	< 0.50	83%	50%	140%	95%	50%	140%	90%	50%	140%
1,1,2-Trichloroethane	8551744		< 0.04	< 0.04	NA	< 0.04	88%	50%	140%	97%	60%	130%	96%	50%	140%
Toluene	8551744		< 0.02	< 0.02	NA	< 0.02	91%	50%	140%	97%	60%	130%	97%	50%	140%
Dibromochloromethane	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	98%	60%	130%	94%	50%	140%
Ethylene Dibromide	8551744		< 0.04	< 0.04	NA	< 0.04	93%	50%	140%	97%	60%	130%	98%	50%	140%
Tetrachloroethylene	8551744		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	98%	60%	130%	100%	50%	140%
1,1,1,2-Tetrachloroethane	8551744		< 0.04	< 0.04	NA	< 0.04	97%	50%	140%	93%	60%	130%	90%	50%	140%
Chlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	97%	60%	130%	87%	50%	140%
Ethylbenzene	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	81%	60%	130%	83%	50%	140%
m & p-Xylene	8551744		< 0.05	< 0.05	NA	< 0.05	75%	50%	140%	72%	60%	130%	73%	50%	140%
Bromoform	8551744		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	94%	60%	130%	91%	50%	140%
Styrene	8551744		< 0.05	< 0.05	NA	< 0.05	85%	50%	140%	92%	60%	130%	89%	50%	140%
1,1,2,2-Tetrachloroethane	8551744		< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	96%	60%	130%	100%	50%	140%
o-Xylene	8551744		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	92%	60%	130%	87%	50%	140%
1,3-Dichlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	88%	60%	130%	99%	50%	140%
1,4-Dichlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	87%	60%	130%	95%	50%	140%
1,2-Dichlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	91%	50%	140%	82%	60%	130%	98%	50%	140%
1,3-Dichloropropene	8551744		< 0.04	< 0.04	NA	< 0.04	95%	50%	140%	90%	60%	130%	84%	50%	140%
n-Hexane	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	90%	60%	130%	90%	50%	140%

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Trace Organics Analysis (Continued)

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)															
F1 (C6 to C10)	8556979	8556979	< 5	< 5	NA	< 5	73%	60%	130%	85%	85%	115%	80%	70%	130%
F2 (C10 to C16)	8556979	8556979	< 10	< 10	NA	< 10	102%	60%	130%	97%	80%	120%	73%	70%	130%
F3 (C16 to C34)	8556979	8556979	56	54	NA	< 50	105%	60%	130%	99%	80%	120%	71%	70%	130%
F4 (C34 to C50)	8556979	8556979	< 50	< 50	NA	< 50	104%	60%	130%	95%	80%	120%	79%	70%	130%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

O. Reg. 153(511) - OC Pesticides (Soil)															
Hexachloroethane	8556646		< 0.01	< 0.01	NA	< 0.01	76%	50%	140%	62%	50%	140%	64%	50%	140%
Gamma-Hexachlorocyclohexane	8556646		< 0.005	< 0.005	NA	< 0.005	90%	50%	140%	70%	50%	140%	70%	50%	140%
Heptachlor	8556646		< 0.005	< 0.005	NA	< 0.005	89%	50%	140%	82%	50%	140%	96%	50%	140%
Aldrin	8556646		< 0.005	< 0.005	NA	< 0.005	93%	50%	140%	78%	50%	140%	74%	50%	140%
Heptachlor Epoxide	8556646		< 0.005	< 0.005	NA	< 0.005	94%	50%	140%	94%	50%	140%	88%	50%	140%
Endosulfan	8556646		< 0.005	< 0.005	NA	< 0.005	97%	50%	140%	84%	50%	140%	87%	50%	140%
Chlordane	8556646		< 0.007	< 0.007	NA	< 0.007	95%	50%	140%	93%	50%	140%	98%	50%	140%
DDE	8556646		< 0.007	< 0.007	NA	< 0.007	99%	50%	140%	98%	50%	140%	86%	50%	140%
DDD	8556646		< 0.007	< 0.007	NA	< 0.007	101%	50%	140%	96%	50%	140%	88%	50%	140%
DDT	8556646		< 0.007	< 0.007	NA	< 0.007	95%	50%	140%	82%	50%	140%	97%	50%	140%
Dieldrin	8556646		< 0.005	< 0.005	NA	< 0.005	94%	50%	140%	94%	50%	140%	92%	50%	140%
Endrin	8556646		< 0.005	< 0.005	NA	< 0.005	94%	50%	140%	97%	50%	140%	90%	50%	140%
Methoxychlor	8556646		< 0.005	< 0.005	NA	< 0.005	95%	50%	140%	102%	50%	140%	94%	50%	140%
Hexachlorobenzene	8556646		< 0.005	< 0.005	NA	< 0.005	83%	50%	140%	84%	50%	140%	99%	50%	140%
Hexachlorobutadiene	8556646		< 0.01	< 0.01	NA	< 0.01	85%	50%	140%	80%	50%	140%	62%	50%	140%
O. Reg. 558 - VOCs															
Vinyl Chloride	8547092		< 0.030	< 0.030	NA	< 0.030	81%	60%	140%	72%	60%	140%	NA	60%	140%
1,1 Dichloroethene	8547092		< 0.020	< 0.020	NA	< 0.020	99%	70%	130%	75%	70%	130%	NA	60%	140%
Dichloromethane	8547092		< 0.030	< 0.030	NA	< 0.030	98%	70%	130%	72%	70%	130%	NA	60%	140%
Methyl Ethyl Ketone	8547092		< 0.090	< 0.090	NA	< 0.090	87%	70%	130%	97%	70%	130%	NA	60%	140%
Chloroform	8547092		< 0.020	< 0.020	NA	< 0.020	106%	70%	130%	86%	70%	130%	NA	60%	140%
1,2-Dichloroethane	8547092		< 0.020	< 0.020	NA	< 0.020	95%	70%	130%	76%	70%	130%	NA	60%	140%
Carbon Tetrachloride	8547092		< 0.020	< 0.020	NA	< 0.020	100%	70%	130%	76%	70%	130%	NA	60%	140%
Benzene	8547092		< 0.020	< 0.020	NA	< 0.020	101%	70%	130%	74%	70%	130%	NA	60%	140%
Trichloroethene	8547092		< 0.020	< 0.020	NA	< 0.020	113%	70%	130%	94%	70%	130%	NA	60%	140%
Tetrachloroethene	8547092		< 0.050	< 0.050	NA	< 0.050	120%	70%	130%	100%	70%	130%	NA	60%	140%
Chlorobenzene	8547092		< 0.010	< 0.010	NA	< 0.010	95%	70%	130%	92%	70%	130%	NA	60%	140%
1,2-Dichlorobenzene	8547092		< 0.010	< 0.010	NA	< 0.010	103%	70%	130%	107%	70%	130%	NA	60%	140%
1,4-Dichlorobenzene	8547092		< 0.010	< 0.010	NA	< 0.010	114%	70%	130%	106%	70%	130%	NA	60%	140%

AGAT Laboratories

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Trace Organics Analysis (Continued)

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Ignitability		EPA SW-846 1030	BURN MOLD
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Fluoride Leachate	INOR-93-6018	EPA SW-846-1311 & SM4500-F- C	ION SELECTIVE ELECTRODE
Cyanide Leachate	INOR-93-6052	EPA SW-846-1311 & MOE 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & SM 4500 - NO3- I	LACHAT FIA

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P &T GC / FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P & T GC / FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	Balance
Moisture Content	VOL-91-5009	CCME Tier 1 Method, SW846 5035,8015	BALANCE
Terphenyl	VOL-91-5009	CCME Tier 1 Method	GC/FID
Dichlorodifluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromomethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Acetone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methylene Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trans- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl tert-butyl Ether	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Cis- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chloroform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Benzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromodichloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Toluene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Dibromochloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromoform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Styrene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
o-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Xylene Mixture	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
n-Hexane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,1 Dichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Dichloromethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Trichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS

AGAT Laboratories

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

Chain of Custody Record

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

Laboratory Use Only

Work Order #: 17T230186
Cooler Quantity: Med
Arrival Temperatures: 3.9 | 3.5 | 3.4 / 3 | 2.7 | 2.8
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Report Information:

Company: Amec Foster Wheeler
Contact: Shami Malla
Address: 104 Crockford Blvd
Scarborough
Phone: 416-751-6565 Fax:
Reports to be sent to:
1. Email: shami.malla@amecfw.com
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table (Indicate One): ☑ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region (Indicate One)

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

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

Report Guideline on Certificate of Analysis ☐ Yes ☑ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

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

OR Date Required (Rush Surcharges May Apply):

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

Project Information:

Project: Mississauga Road (CoC)
Site Location: Mississauga Road at Financial Drive
Sampled By: J. Farhoodi
AGAT Quote #: PO: TP115085.01.6000
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: Amec Foster Wheeler
Contact: Meikle, Lynn
Address: 104 Crockford Blvd, Scarborough, Ontario
Email: lynn.meikle@amecfw.com

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	(Check Applicable) ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻ ☐ Cr⁶⁺ ☑ EC ☐ FOC ☐ NO_3/NO_2 ☐ Total N ☐ Hg ☐ pH ☑ SAR	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3/NO_2	Volatiles: ☑ VOC ☑ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	TCLP VOC	Ignitability	Sulphate					ON HOLD - Do not Test
BH 3, 1.0 m - 1.5 m	19/06/20	13:10	5	Soil	2X120, 3x250							☑																☑
BH B-5, 2.0 ft - 4.0 ft	19/06/20	11:00	3	Soil	1X40, 1X120, 1x250							☑																☑
BH 39, 600 mm - 1.5 m	19/06/20	11:30	1	Soil	1x250							☑																☑
BH 42, 450 mm - 1.0 m	19/06/20	13:20	1	Soil	1x250							☑																☑
BH 13, SS 4, 7.5 ft - 9.0 ft	20/06/20	13:45	1	Soil	1x250							☑																☑
BH 29, AS 3	20/06/20	14:15	1	Soil	1x250							☑																
BH 36, AS 3	20/06/20	14:20	1	Soil	1x250							☑																

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Shami malla	20/06/2017			2017/6/21	10:42
	2017/6/21	3:30			

Page 1 of 1

Document ID: DIV-78-1021-003

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

Date Issued: Jan 8, 2015

AGAT Laboratories

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

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
104 CROCKFORD BLVD
SCARBOROUGH, ON M1R3C3
(416) 751-6565

ATTENTION TO: Shami Malla

PROJECT: Mississauga Rd. EA

AGAT WORK ORDER: 17T251600

SOIL ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

TRACE ORGANICS REVIEWED BY: Gyulhan Yalamova, Report Reviewer

DATE REPORTED: Aug 23, 2017

PAGES (INCLUDING COVER): 7

VERSION*: 1

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

NOTES

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

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T251600

PROJECT: Mississauga Rd. EA

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-08-02

DATE REPORTED: 2017-08-23

		SAMPLE DESCRIPTION:		BH 13 / AS2	BH 20 / AS2	BH 29 / AS2	BH 36 / AS1
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-06-20	2017-06-22	2017-06-20	2017-06-20
Parameter	Unit	G / S	RDL	8655263	8655269	8655272	8655273
Antimony	µg/g		0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g		1	2	4	5	4
Barium	µg/g		2	13	31	34	39
Beryllium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5
Boron	µg/g		5	<5	<5	7	5
Boron (Hot Water Soluble)	µg/g		0.10	0.14	0.18	0.45	0.86
Cadmium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g		2	6	7	9	12
Cobalt	µg/g		0.5	2.5	3.7	3.4	4.3
Copper	µg/g		1	10	19	11	17
Lead	µg/g		1	5	12	24	12
Molybdenum	µg/g		0.5	<0.5	<0.5	0.9	<0.5
Nickel	µg/g		1	4	6	5	8
Selenium	µg/g		0.4	<0.4	<0.4	<0.4	<0.4
Silver	µg/g		0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g		0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g		0.5	<0.5	<0.5	<0.5	<0.5
Vanadium	µg/g		1	10	12	12	14
Zinc	µg/g		5	20	68	79	79
Chromium VI	µg/g		0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g		0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g		0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm		0.005	3.09	0.261	0.839	0.326
Sodium Adsorption Ratio	NA		NA	57.4	4.69	3.28	3.81
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.96	7.72	10.8	7.84

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

8655263-8655273 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Iris Verástegui

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T251600

PROJECT: Mississauga Rd. EA

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - OC Pesticides (Soil)

DATE RECEIVED: 2017-08-02

DATE REPORTED: 2017-08-23

		SAMPLE DESCRIPTION:		BH 20 / AS2
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-06-22
Parameter	**Unit**	**G / S**	**RDL**	**8655269**
Hexachloroethane	µg/g		0.01	<0.01
Gamma-Hexachlorocyclohexane	µg/g		0.005	<0.005
Heptachlor	µg/g		0.005	<0.005
Aldrin	µg/g		0.005	<0.005
Heptachlor Epoxide	µg/g		0.005	<0.005
Endosulfan	µg/g		0.005	<0.005
Chlordane	µg/g		0.007	<0.007
DDE	µg/g		0.007	<0.007
DDD	µg/g		0.007	<0.007
DDT	µg/g		0.007	<0.007
Dieldrin	µg/g		0.005	<0.005
Endrin	µg/g		0.005	<0.005
Methoxychlor	µg/g		0.005	<0.005
Hexachlorobenzene	µg/g		0.005	<0.005
Hexachlorobutadiene	µg/g		0.01	<0.01
Moisture Content	%		0.1	6.6
Surrogate	**Unit**	**Acceptable Limits**		
TCMX	%	50-140		116
Decachlorobiphenyl	%	60-130		118

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

8655269 Results are based on the dry weight of the soil.
Note: DDT applies to the total of op'DDT and pp'DDT, DDD applies to the total of op'DDD and pp'DDD and DDE applies to the total of op'DDE and pp'DDE. Endosulfan applies to the total of Endosulfan I and Endosulfan II.
Chlordane applies to the total of Alpha-Chlordane and Gamma-Chlordane.

Certified By:

AGAT Laboratories

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T251600

PROJECT: Mississauga Rd. EA

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8655263	8655263	<0.8	<0.8	NA	< 0.8	101%	70%	130%	96%	80%	120%	106%	70%	130%
Arsenic	8655263	8655263	2	2	NA	< 1	118%	70%	130%	99%	80%	120%	122%	70%	130%
Barium	8655263	8655263	13	14	7.4%	< 2	107%	70%	130%	98%	80%	120%	98%	70%	130%
Beryllium	8655263	8655263	<0.5	<0.5	NA	< 0.5	77%	70%	130%	105%	80%	120%	94%	70%	130%
Boron	8655263	8655263	<5	<5	NA	< 5	81%	70%	130%	110%	80%	120%	92%	70%	130%
Boron (Hot Water Soluble)	8655263	8655263	0.14	0.14	NA	< 0.10	112%	60%	140%	103%	70%	130%	104%	60%	140%
Cadmium	8655263	8655263	<0.5	<0.5	NA	< 0.5	97%	70%	130%	105%	80%	120%	101%	70%	130%
Chromium	8655263	8655263	6	6	NA	< 2	87%	70%	130%	104%	80%	120%	93%	70%	130%
Cobalt	8655263	8655263	2.5	2.4	NA	< 0.5	91%	70%	130%	104%	80%	120%	93%	70%	130%
Copper	8655263	8655263	10	10	0.0%	< 1	89%	70%	130%	108%	80%	120%	91%	70%	130%
Lead	8655263	8655263	5	5	0.0%	< 1	104%	70%	130%	102%	80%	120%	97%	70%	130%
Molybdenum	8655263	8655263	<0.5	<0.5	NA	< 0.5	107%	70%	130%	110%	80%	120%	116%	70%	130%
Nickel	8655263	8655263	4	4	NA	< 1	90%	70%	130%	107%	80%	120%	93%	70%	130%
Selenium	8655263	8655263	<0.4	<0.4	NA	< 0.4	99%	70%	130%	102%	80%	120%	108%	70%	130%
Silver	8655263	8655263	<0.2	<0.2	NA	< 0.2	93%	70%	130%	106%	80%	120%	93%	70%	130%
Thallium	8655263	8655263	<0.4	<0.4	NA	< 0.4	98%	70%	130%	101%	80%	120%	99%	70%	130%
Uranium	8655263	8655263	<0.5	<0.5	NA	< 0.5	98%	70%	130%	100%	80%	120%	95%	70%	130%
Vanadium	8655263	8655263	10	10	0.0%	< 1	95%	70%	130%	95%	80%	120%	88%	70%	130%
Zinc	8655263	8655263	20	19	NA	< 5	110%	70%	130%	109%	80%	120%	112%	70%	130%
Chromium VI	8654504		<0.2	<0.2	NA	< 0.2	94%	70%	130%	97%	80%	120%	95%	70%	130%
Cyanide	8655242		<0.040	<0.040	NA	< 0.040	91%	70%	130%	103%	80%	120%	101%	70%	130%
Mercury	8655263	8655263	<0.10	<0.10	NA	< 0.10	102%	70%	130%	89%	80%	120%	93%	70%	130%
Electrical Conductivity	8655263	8655263	3.09	3.48	11.9%	< 0.005	95%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8655263	8655263	57.4	59.8	4.1%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8655269	8655269	7.72	7.70	0.3%	NA	101%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable
Duplicate Qualifier: 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.

Certified By: Iris Verástegui

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T251600

PROJECT: Mississauga Rd. EA

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - OC Pesticides (Soil)															
Hexachloroethane	8641660		< 0.01	< 0.01	NA	< 0.01	94%	50%	140%	70%	50%	140%	64%	50%	140%
Gamma-Hexachlorocyclohexane	8641660		< 0.005	< 0.005	NA	< 0.005	96%	50%	140%	86%	50%	140%	80%	50%	140%
Heptachlor	8641660		< 0.005	< 0.005	NA	< 0.005	86%	50%	140%	70%	50%	140%	70%	50%	140%
Aldrin	8641660		< 0.005	< 0.005	NA	< 0.005	98%	50%	140%	80%	50%	140%	80%	50%	140%
Heptachlor Epoxide	8641660		< 0.005	< 0.005	NA	< 0.005	100%	50%	140%	90%	50%	140%	86%	50%	140%
Endosulfan	8641660		< 0.005	< 0.005	NA	< 0.005	98%	50%	140%	82%	50%	140%	77%	50%	140%
Chlordane	8641660		< 0.007	< 0.007	NA	< 0.007	99%	50%	140%	89%	50%	140%	87%	50%	140%
DDE	8641660		< 0.007	< 0.007	NA	< 0.007	105%	50%	140%	102%	50%	140%	98%	50%	140%
DDD	8641660		< 0.007	< 0.007	NA	< 0.007	102%	50%	140%	89%	50%	140%	86%	50%	140%
DDT	8641660		< 0.007	< 0.007	NA	< 0.007	80%	50%	140%	73%	50%	140%	65%	50%	140%
Dieldrin	8641660		< 0.005	< 0.005	NA	< 0.005	99%	50%	140%	90%	50%	140%	84%	50%	140%
Endrin	8641660		< 0.005	< 0.005	NA	< 0.005	98%	50%	140%	76%	50%	140%	76%	50%	140%
Methoxychlor	8641660		< 0.005	< 0.005	NA	< 0.005	74%	50%	140%	72%	50%	140%	62%	50%	140%
Hexachlorobenzene	8641660		< 0.005	< 0.005	NA	< 0.005	94%	50%	140%	88%	50%	140%	86%	50%	140%
Hexachlorobutadiene	8641660		< 0.01	< 0.01	NA	< 0.01	104%	50%	140%	70%	50%	140%	76%	50%	140%

Comments:
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T251600

PROJECT: Mississauga Rd. EA

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE

AGAT Laboratories

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

Chain of Custody Record

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

Laboratory Use Only
Work Order #: 17T251600
Cooler Quantity:
Arrival Temperatures:
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes:

Report Information:
Company: Amec Foster Wheeler
Contact: Shami Molla / Tracey Schranz
Address:
Phone: 416-751-6565 Fax:
Reports to be sent to:
1. Email: sham.molla@amecfw.com
2. Email: tracy.schranz@amecfw.com

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)

☒ Regulation 153/04 — Table 1 (Indicate One): ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☐ Fine
☐ Sewer Use — ☐ Sanitary ☐ Storm — Region (Indicate One)
☐ Regulation 558 ☐ CCME ☐ Prov. Water Quality Objectives (PWQO) ☐ Other (Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☐ No
Report Guideline on Certificate of Analysis ☐ Yes ☐ No

Turnaround Time (TAT) Required:
Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:
Project: Mississauga Rd. EA
Site Location: Brampton
Sampled By:
AGAT Quote #: PO: TP115085
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information: Bill To Same: Yes ☐ No ☐
Company: Amec Foster Wheeler
Contact: Lynn Meikle
Address:
Email: Lynn.Meikle@amecfw.com

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Please Circle) Y/N	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	(Check Applicable) ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ NO_3/NO_2 ☐ Total N ☐ Hg ☐ pH ☐ SAR	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_2 ☐ NO_3 ☐ NO_3/NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use
BH 13 / AS2	20/06/17		1	Soil			X														
BH 20 / AS2	20/06/17		2	"			X											X			
BH 29 / AS2	20/06/17		1	"			X														
BH 36 / AS1	20/06/17		1	"			X														

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Shami	24 Aug 17				

Page 1 of 1
N°: T 035264

AGAT Laboratories

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

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
104 CROCKFORD BLVD
SCARBOROUGH, ON M1R3C3
(416) 751-6565

ATTENTION TO: Shami Malla

PROJECT: Mississauga Road (COC)

AGAT WORK ORDER: 17T249411

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Aug 22, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

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

NOTES

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

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T249411

PROJECT: Mississauga Road (COC)

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2017-07-24

DATE REPORTED: 2017-08-22

				BH13, SS4, 7.		BH B3, SS6,
		SAMPLE DESCRIPTION:		5ft-9ft		10ft-11.5ft
		SAMPLE TYPE:		Soil		Soil
		DATE SAMPLED:		2017-07-21		2017-07-21
Parameter	Unit	G / S	RDL	8643048	RDL	8643064
Sulfide (S2-)	%		0.05	0.05	0.05	0.06
Chloride (2:1)	µg/g		2	338	8	1730
Sulphate (2:1)	µg/g		2	20	8	70
pH (2:1)	pH Units		NA	9.92	NA	9.03
Electrical Conductivity (2:1)	mS/cm		0.005	0.694	0.005	2.89
Resistivity (2:1)	ohm.cm		1	1440	1	346
Redox Potential (2:1)	mV		5	129	5	153

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

8643048 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

8643064 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Elevated RDL indicates the degree of sample dilution prior to the analysis for Anions in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.

Certified By: Amanjot Bhela

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T249411

PROJECT: Mississauga Road (COC)

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Aug 22, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8643048	8643048	0.05	0.05	NA	< 0.05	99%	80%	120%						
Chloride (2:1)	8641961		4	5	NA	< 2	95%	80%	120%	99%	80%	120%	101%	70%	130%
Sulphate (2:1)	8641961		265	281	5.9%	< 2	91%	80%	120%	98%	80%	120%	104%	70%	130%
pH (2:1)	8641961		8.35	8.28	0.8%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8642550		0.229	0.240	4.7%	< 0.005	96%	90%	110%	NA			NA		
Redox Potential (2:1)	8641961		223	219	1.8%	< 5	105%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: 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.

Certified By: Amanjot Bhela

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T249411

PROJECT: Mississauga Road (COC)

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

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

Chain of Custody Record

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

Laboratory Use Only

Work Order #: 17T249411

Cooler Quantity: Bag in large cooler

Arrival Temperatures:

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: Amec Foster Wheeler
Contact: Shami Malla
Address: 104 Crockford Blvd
Scarborough
Phone: 416-751-6565 Fax:
Reports to be sent to:
1. Email: shami.malla@amecfw.com
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table (Indicate One)
☑ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region (Indicate One)

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

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

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

OR Date Required (Rush Surcharges May Apply):

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

Project Information:

Project: Mississauga Road (CoC)
Site Location: Mississauga Road at Embleton Road
Sampled By: Dan Urian
AGAT Quote #: PO: TP115085.01.6000
Please note: If quotation number is not provided, client will be billed full price for analysis.

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

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

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: Amec Foster Wheeler
Contact: Meikle, Lynn
Address: 104 Crockford Blvd, Scarborough, Ontario
Email: lynn.meikle@amecfw.com

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐B-HWS ☐Cr ☐CN⁻ ☐Cr⁶⁺ ☑EC ☐FOC ☐NO_3/NO_2 ☐Total N ☐Hg ☐pH ☑SAR (Check Applicable)	Nutrients: ☐TP ☐NH_3 ☐TKN ☐NO_3 ☐NO_2 ☐NO_3/NO_2	Volatiles: ☑VOC ☑BTEX ☐THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	Corrosivity Complete								ON HOLD - Do not Test
BH 13, SS4, 7.5ft-9ft	21/07/2017	11:30	1	Soil	1x250																	☑								
BH B3, SS6, 10ft-11.5ft	21/07/2017	11:30	1	Soil	1x250																	☑								

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Dan Urian	21/07/2017			2017/7/24	1:43
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
	2017/7/24	4:33			

Page 1 of 1

N°:

Document ID: DIV 78 3523 Rev 8

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

Date Issued: Jan 8, 2016

APPENDIX D
ONTARIO REGULATION 347 TCLP ANDCERTIFICATE OF ANALYSIS

Ontario Regulation 347 TCLP

Sample Location				Borehole 3
Sample ID				BH 3, 1.0m - 1.5m
Soil Type				Silty Clay
Depth (metres below ground level)				1.0 - 1.5
Field Vapour Reading (COV/TOV)				25/5
Sampling Date				06/19/2017
Laboratory ID				8556975
Certificate of Analysis No.				17T230186
	Units	**RDL**	**Schedule 4[A]**	
Ignitability				Non-Flammable
Metals				
Arsenic Leachate	mg/L	0.010	2.5	<
Barium Leachate	mg/L	0.100	100	0.515
Boron Leachate	mg/L	0.050	500	0.078
Cadmium Leachate	mg/L	0.010	0.5	<
Chromium Leachate	mg/L	0.010	5	<
Lead Leachate	mg/L	0.010	5	<
Mercury Leachate	mg/L	0.01	0.1	<
Selenium Leachate	mg/L	0.010	1	<
Silver Leachate	mg/L	0.010	5	<
Uranium Leachate	mg/L	0.050	10	<
Fluoride Leachate	mg/L	0.05	150	0.28
Cyanide Leachate	mg/L	0.05	20	<
(Nitrate + Nitrite) as N Leachate	mg/L	0.70	1000	<
Volatile Organic Compounds				
Vinyl Chloride	mg/L	0.030	0.2	<
1,1 Dichloroethene	mg/L	0.020	1.4	<
Dichloromethane	mg/L	0.030	5.0	<
Methyl Ethyl Ketone	mg/L	0.090	200	<
Chloroform	mg/L	0.020	10.0	<
1,2-Dichloroethane	mg/L	0.020	0.5	<
Carbon Tetrachloride	mg/L	0.020	0.5	<
Benzene	mg/L	0.020	0.5	<
Trichloroethene	mg/L	0.020	5.0	<
Tetrachloroethene	mg/L	0.050	3.0	<
Chlorobenzene	mg/L	0.010	8.0	<
1,2-Dichlorobenzene	mg/L	0.010	20.0	<
1,4-Dichlorobenzene	mg/L	0.010	0.5	<

Notes: (A) Ontario Ministry of the Environment (MOE) "Registration Guidance Manual for Generators of Liquid Industrial and Hazardous Waste" (October 2000) Leachate Quality Criteria, as amended by Ontario Regulation 558/00. Schedule 4 exceedances if any, indicated by **BOLD**. "RDL" means reportable detection limit. "<" indicates not detected above the reportable detection limit. "mg/L" means milligrams per litre.

AGAT Laboratories

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

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
104 CROCKFORD BLVD
SCARBOROUGH, ON M1R3C3
(416) 751-6565

ATTENTION TO: Shami Malla

PROJECT: Mississauga Rd

AGAT WORK ORDER: 17T230186

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist

DATE REPORTED: Jul 19, 2017

PAGES (INCLUDING COVER): 12

VERSION*: 1

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

NOTES

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

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

O. Reg. 558 Metals and Inorganics

DATE RECEIVED: 2017-06-21

DATE REPORTED: 2017-07-19

		SAMPLE DESCRIPTION:		BH 3, 1.0m - 1.5m
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-06-19
Parameter	Unit	G / S	RDL	8556975
Arsenic Leachate	mg/L	2.5	0.010	<0.010
Barium Leachate	mg/L	100	0.100	0.515
Boron Leachate	mg/L	500	0.050	0.078
Cadmium Leachate	mg/L	0.5	0.010	<0.010
Chromium Leachate	mg/L	5	0.010	<0.010
Lead Leachate	mg/L	5	0.010	<0.010
Mercury Leachate	mg/L	0.1	0.01	<0.01
Selenium Leachate	mg/L	1	0.010	<0.010
Silver Leachate	mg/L	5	0.010	<0.010
Uranium Leachate	mg/L	10	0.050	<0.050
Fluoride Leachate	mg/L	150	0.05	0.28
Cyanide Leachate	mg/L	20	0.05	<0.05
(Nitrate + Nitrite) as N Leachate	mg/L	1000	0.70	<0.70

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Certified By: Amanjot Bhela

AGAT Laboratories

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

Certificate of Analysis

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

O. Reg. 558 - VOCs

DATE RECEIVED: 2017-06-21

DATE REPORTED: 2017-07-19

		SAMPLE DESCRIPTION:		BH 3, 1.0m - 1.5m
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-06-19
Parameter	Unit	G / S	RDL	8556975
Vinyl Chloride	mg/L	0.2	0.030	<0.030
1,1 Dichloroethene	mg/L	1.4	0.020	<0.020
Dichloromethane	mg/L	5.0	0.030	<0.030
Methyl Ethyl Ketone	mg/L	200	0.090	<0.090
Chloroform	mg/L	10.0	0.020	<0.020
1,2-Dichloroethane	mg/L	0.5	0.020	<0.020
Carbon Tetrachloride	mg/L	0.5	0.020	<0.020
Benzene	mg/L	0.5	0.020	<0.020
Trichloroethene	mg/L	5.0	0.020	<0.020
Tetrachloroethene	mg/L	3.0	0.050	<0.050
Chlorobenzene	mg/L	8.0	0.010	<0.010
1,2-Dichlorobenzene	mg/L	20.0	0.010	<0.010
1,4-Dichlorobenzene	mg/L	0.5	0.010	<0.010
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	60-130		83

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8556975 Sample was prepared using Regulation 558 protocol and a zero headspace extractor.

Certified By: N Popowich

AGAT Laboratories

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Soil Analysis

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8556975	8556975	<0.8	<0.8	NA	< 0.8	85%	70%	130%	102%	80%	120%	102%	70%	130%
Arsenic	8556975	8556975	4	4	NA	< 1	92%	70%	130%	99%	80%	120%	103%	70%	130%
Barium	8556975	8556975	32	32	0.0%	< 2	102%	70%	130%	104%	80%	120%	100%	70%	130%
Beryllium	8556975	8556975	<0.5	<0.5	NA	< 0.5	81%	70%	130%	103%	80%	120%	94%	70%	130%
Boron	8556975	8556975	<5	<5	NA	< 5	86%	70%	130%	106%	80%	120%	100%	70%	130%
Boron (Hot Water Soluble)	8556975	8556975	0.17	0.15	NA	< 0.10	84%	60%	140%	94%	70%	130%	97%	60%	140%
Cadmium	8556975	8556975	<0.5	<0.5	NA	< 0.5	102%	70%	130%	102%	80%	120%	105%	70%	130%
Chromium	8556975	8556975	7	8	NA	< 2	75%	70%	130%	105%	80%	120%	104%	70%	130%
Cobalt	8556975	8556975	3.6	3.7	2.7%	< 0.5	92%	70%	130%	106%	80%	120%	103%	70%	130%
Copper	8556975	8556975	23	24	4.3%	< 1	91%	70%	130%	110%	80%	120%	105%	70%	130%
Lead	8556975	8556975	23	24	4.3%	< 1	101%	70%	130%	105%	80%	120%	103%	70%	130%
Molybdenum	8556975	8556975	<0.5	<0.5	NA	< 0.5	88%	70%	130%	108%	80%	120%	107%	70%	130%
Nickel	8556975	8556975	7	7	0.0%	< 1	96%	70%	130%	112%	80%	120%	107%	70%	130%
Selenium	8556975	8556975	<0.4	<0.4	NA	< 0.4	82%	70%	130%	104%	80%	120%	109%	70%	130%
Silver	8556975	8556975	<0.2	<0.2	NA	< 0.2	82%	70%	130%	106%	80%	120%	110%	70%	130%
Thallium	8556975	8556975	<0.4	<0.4	NA	< 0.4	79%	70%	130%	104%	80%	120%	102%	70%	130%
Uranium	8556975	8556975	<0.5	<0.5	NA	< 0.5	88%	70%	130%	105%	80%	120%	100%	70%	130%
Vanadium	8556975	8556975	11	10	9.5%	< 1	89%	70%	130%	103%	80%	120%	105%	70%	130%
Zinc	8556975	8556975	41	41	0.0%	< 5	99%	70%	130%	112%	80%	120%	114%	70%	130%
Chromium VI	8558036		<0.2	<0.2	NA	< 0.2	93%	70%	130%	101%	80%	120%	98%	70%	130%
Cyanide	8552648		<0.040	<0.040	NA	< 0.040	92%	70%	130%	100%	80%	120%	102%	70%	130%
Mercury	8556975	8556975	<0.10	<0.10	NA	< 0.10	96%	70%	130%	95%	80%	120%	98%	70%	130%
Electrical Conductivity	8556975	8556975	0.177	0.184	3.9%	< 0.005	96%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8556975	8556975	3.62	3.70	2.2%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8556981	8556981	7.77	7.79	0.3%	NA	101%	80%	120%	NA			NA		
O. Reg. 558 Metals and Inorganics															
Arsenic Leachate	8553822		<0.010	<0.010	NA	< 0.010	99%	90%	110%	92%	80%	120%	103%	70%	130%
Barium Leachate	8553822		0.495	0.467	NA	< 0.100	103%	90%	110%	102%	80%	120%	98%	70%	130%
Boron Leachate	8553822		0.057	0.058	NA	< 0.050	98%	90%	110%	99%	80%	120%	88%	70%	130%
Cadmium Leachate	8553822		<0.010	<0.010	NA	< 0.010	102%	90%	110%	97%	80%	120%	115%	70%	130%
Chromium Leachate	8553822		<0.010	<0.010	NA	< 0.010	103%	90%	110%	102%	80%	120%	107%	70%	130%
Lead Leachate	8553822		0.012	0.012	NA	< 0.010	103%	90%	110%	98%	80%	120%	95%	70%	130%
Mercury Leachate	8553822		<0.01	<0.01	NA	< 0.01	100%	90%	110%	94%	80%	120%	92%	70%	130%
Selenium Leachate	8553822		<0.010	<0.010	NA	< 0.010	102%	90%	110%	100%	80%	120%	104%	70%	130%
Silver Leachate	8553822		<0.010	<0.010	NA	< 0.010	103%	90%	110%	96%	80%	120%	103%	70%	130%
Uranium Leachate	8553822		<0.050	<0.050	NA	< 0.050	101%	90%	110%	100%	80%	120%	98%	70%	130%
Fluoride Leachate	8553822		<0.05	<0.05	NA	< 0.05	101%	90%	110%	107%	90%	110%	101%	70%	130%
Cyanide Leachate	8553822		<0.05	<0.05	NA	< 0.05	92%	90%	110%	100%	90%	110%	100%	70%	130%
(Nitrate + Nitrite) as N Leachate	8553822		<0.70	<0.70	NA	< 0.70	101%	80%	120%	98%	80%	120%	96%	70%	130%

AGAT Laboratories

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Soil Analysis (Continued)

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: NA signifies Not Applicable.
Duplicate Qualifier: 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.

Certified By: Amanjot Bhela

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Trace Organics Analysis

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - VOCs (Soil)															
Dichlorodifluoromethane	8551744		< 0.05	< 0.05	NA	< 0.05	89%	50%	140%	94%	50%	140%	87%	50%	140%
Vinyl Chloride	8551744		< 0.02	< 0.02	NA	< 0.02	93%	50%	140%	92%	50%	140%	89%	50%	140%
Bromomethane	8551744		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	90%	50%	140%	96%	50%	140%
Trichlorofluoromethane	8551744		< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	86%	50%	140%	89%	50%	140%
Acetone	8551744		< 0.50	< 0.50	NA	< 0.50	99%	50%	140%	95%	50%	140%	90%	50%	140%
1,1-Dichloroethylene	8551744		< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	95%	60%	130%	99%	50%	140%
Methylene Chloride	8551744		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	95%	60%	130%	97%	50%	140%
Trans- 1,2-Dichloroethylene	8551744		< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	97%	60%	130%	91%	50%	140%
Methyl tert-butyl Ether	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	94%	60%	130%	97%	50%	140%
1,1-Dichloroethane	8551744		< 0.02	< 0.02	NA	< 0.02	87%	50%	140%	97%	60%	130%	92%	50%	140%
Methyl Ethyl Ketone	8551744		< 0.50	< 0.50	NA	< 0.50	99%	50%	140%	96%	50%	140%	91%	50%	140%
Cis- 1,2-Dichloroethylene	8551744		< 0.02	< 0.02	NA	< 0.02	91%	50%	140%	96%	60%	130%	97%	50%	140%
Chloroform	8551744		< 0.04	< 0.04	NA	< 0.04	97%	50%	140%	94%	60%	130%	94%	50%	140%
1,2-Dichloroethane	8551744		< 0.03	< 0.03	NA	< 0.03	96%	50%	140%	93%	60%	130%	92%	50%	140%
1,1,1-Trichloroethane	8551744		< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	96%	60%	130%	99%	50%	140%
Carbon Tetrachloride	8551744		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	99%	60%	130%	98%	50%	140%
Benzene	8551744		< 0.02	< 0.02	NA	< 0.02	96%	50%	140%	87%	60%	130%	92%	50%	140%
1,2-Dichloropropane	8551744		< 0.03	< 0.03	NA	< 0.03	97%	50%	140%	95%	60%	130%	91%	50%	140%
Trichloroethylene	8551744		< 0.03	< 0.03	NA	< 0.03	88%	50%	140%	90%	60%	130%	91%	50%	140%
Bromodichloromethane	8551744		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	94%	60%	130%	93%	50%	140%
Methyl Isobutyl Ketone	8551744		< 0.50	< 0.50	NA	< 0.50	83%	50%	140%	95%	50%	140%	90%	50%	140%
1,1,2-Trichloroethane	8551744		< 0.04	< 0.04	NA	< 0.04	88%	50%	140%	97%	60%	130%	96%	50%	140%
Toluene	8551744		< 0.02	< 0.02	NA	< 0.02	91%	50%	140%	97%	60%	130%	97%	50%	140%
Dibromochloromethane	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	98%	60%	130%	94%	50%	140%
Ethylene Dibromide	8551744		< 0.04	< 0.04	NA	< 0.04	93%	50%	140%	97%	60%	130%	98%	50%	140%
Tetrachloroethylene	8551744		< 0.05	< 0.05	NA	< 0.05	97%	50%	140%	98%	60%	130%	100%	50%	140%
1,1,1,2-Tetrachloroethane	8551744		< 0.04	< 0.04	NA	< 0.04	97%	50%	140%	93%	60%	130%	90%	50%	140%
Chlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	95%	50%	140%	97%	60%	130%	87%	50%	140%
Ethylbenzene	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	81%	60%	130%	83%	50%	140%
m & p-Xylene	8551744		< 0.05	< 0.05	NA	< 0.05	75%	50%	140%	72%	60%	130%	73%	50%	140%
Bromoform	8551744		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	94%	60%	130%	91%	50%	140%
Styrene	8551744		< 0.05	< 0.05	NA	< 0.05	85%	50%	140%	92%	60%	130%	89%	50%	140%
1,1,2,2-Tetrachloroethane	8551744		< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	96%	60%	130%	100%	50%	140%
o-Xylene	8551744		< 0.05	< 0.05	NA	< 0.05	96%	50%	140%	92%	60%	130%	87%	50%	140%
1,3-Dichlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	88%	60%	130%	99%	50%	140%
1,4-Dichlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	87%	60%	130%	95%	50%	140%
1,2-Dichlorobenzene	8551744		< 0.05	< 0.05	NA	< 0.05	91%	50%	140%	82%	60%	130%	98%	50%	140%
1,3-Dichloropropene	8551744		< 0.04	< 0.04	NA	< 0.04	95%	50%	140%	90%	60%	130%	84%	50%	140%
n-Hexane	8551744		< 0.05	< 0.05	NA	< 0.05	98%	50%	140%	90%	60%	130%	90%	50%	140%

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Trace Organics Analysis (Continued)

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (-BTEX) (Soil)															
F1 (C6 to C10)	8556979	8556979	< 5	< 5	NA	< 5	73%	60%	130%	85%	85%	115%	80%	70%	130%
F2 (C10 to C16)	8556979	8556979	< 10	< 10	NA	< 10	102%	60%	130%	97%	80%	120%	73%	70%	130%
F3 (C16 to C34)	8556979	8556979	56	54	NA	< 50	105%	60%	130%	99%	80%	120%	71%	70%	130%
F4 (C34 to C50)	8556979	8556979	< 50	< 50	NA	< 50	104%	60%	130%	95%	80%	120%	79%	70%	130%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

O. Reg. 153(511) - OC Pesticides (Soil)															
Hexachloroethane	8556646		< 0.01	< 0.01	NA	< 0.01	76%	50%	140%	62%	50%	140%	64%	50%	140%
Gamma-Hexachlorocyclohexane	8556646		< 0.005	< 0.005	NA	< 0.005	90%	50%	140%	70%	50%	140%	70%	50%	140%
Heptachlor	8556646		< 0.005	< 0.005	NA	< 0.005	89%	50%	140%	82%	50%	140%	96%	50%	140%
Aldrin	8556646		< 0.005	< 0.005	NA	< 0.005	93%	50%	140%	78%	50%	140%	74%	50%	140%
Heptachlor Epoxide	8556646		< 0.005	< 0.005	NA	< 0.005	94%	50%	140%	94%	50%	140%	88%	50%	140%
Endosulfan	8556646		< 0.005	< 0.005	NA	< 0.005	97%	50%	140%	84%	50%	140%	87%	50%	140%
Chlordane	8556646		< 0.007	< 0.007	NA	< 0.007	95%	50%	140%	93%	50%	140%	98%	50%	140%
DDE	8556646		< 0.007	< 0.007	NA	< 0.007	99%	50%	140%	98%	50%	140%	86%	50%	140%
DDD	8556646		< 0.007	< 0.007	NA	< 0.007	101%	50%	140%	96%	50%	140%	88%	50%	140%
DDT	8556646		< 0.007	< 0.007	NA	< 0.007	95%	50%	140%	82%	50%	140%	97%	50%	140%
Dieldrin	8556646		< 0.005	< 0.005	NA	< 0.005	94%	50%	140%	94%	50%	140%	92%	50%	140%
Endrin	8556646		< 0.005	< 0.005	NA	< 0.005	94%	50%	140%	97%	50%	140%	90%	50%	140%
Methoxychlor	8556646		< 0.005	< 0.005	NA	< 0.005	95%	50%	140%	102%	50%	140%	94%	50%	140%
Hexachlorobenzene	8556646		< 0.005	< 0.005	NA	< 0.005	83%	50%	140%	84%	50%	140%	99%	50%	140%
Hexachlorobutadiene	8556646		< 0.01	< 0.01	NA	< 0.01	85%	50%	140%	80%	50%	140%	62%	50%	140%
O. Reg. 558 - VOCs															
Vinyl Chloride	8547092		< 0.030	< 0.030	NA	< 0.030	81%	60%	140%	72%	60%	140%	NA	60%	140%
1,1 Dichloroethene	8547092		< 0.020	< 0.020	NA	< 0.020	99%	70%	130%	75%	70%	130%	NA	60%	140%
Dichloromethane	8547092		< 0.030	< 0.030	NA	< 0.030	98%	70%	130%	72%	70%	130%	NA	60%	140%
Methyl Ethyl Ketone	8547092		< 0.090	< 0.090	NA	< 0.090	87%	70%	130%	97%	70%	130%	NA	60%	140%
Chloroform	8547092		< 0.020	< 0.020	NA	< 0.020	106%	70%	130%	86%	70%	130%	NA	60%	140%
1,2-Dichloroethane	8547092		< 0.020	< 0.020	NA	< 0.020	95%	70%	130%	76%	70%	130%	NA	60%	140%
Carbon Tetrachloride	8547092		< 0.020	< 0.020	NA	< 0.020	100%	70%	130%	76%	70%	130%	NA	60%	140%
Benzene	8547092		< 0.020	< 0.020	NA	< 0.020	101%	70%	130%	74%	70%	130%	NA	60%	140%
Trichloroethene	8547092		< 0.020	< 0.020	NA	< 0.020	113%	70%	130%	94%	70%	130%	NA	60%	140%
Tetrachloroethene	8547092		< 0.050	< 0.050	NA	< 0.050	120%	70%	130%	100%	70%	130%	NA	60%	140%
Chlorobenzene	8547092		< 0.010	< 0.010	NA	< 0.010	95%	70%	130%	92%	70%	130%	NA	60%	140%
1,2-Dichlorobenzene	8547092		< 0.010	< 0.010	NA	< 0.010	103%	70%	130%	107%	70%	130%	NA	60%	140%
1,4-Dichlorobenzene	8547092		< 0.010	< 0.010	NA	< 0.010	114%	70%	130%	106%	70%	130%	NA	60%	140%

AGAT Laboratories

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

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

Trace Organics Analysis (Continued)

RPT Date: Jul 19, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Ignitability		EPA SW-846 1030	BURN MOLD
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Fluoride Leachate	INOR-93-6018	EPA SW-846-1311 & SM4500-F- C	ION SELECTIVE ELECTRODE
Cyanide Leachate	INOR-93-6052	EPA SW-846-1311 & MOE 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & SM 4500 - NO3- I	LACHAT FIA

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Hexachloroethane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Gamma-Hexachlorocyclohexane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Aldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Heptachlor Epoxide	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endosulfan	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Chlordane	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDE	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDD	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
DDT	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Dieldrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Endrin	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Methoxychlor	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobenzene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Hexachlorobutadiene	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
TCMX	ORG-91-5112	EPA SW-846 3541,3620 & 8081	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541,3620 & 8081	GC/ECD
Moisture Content		MOE E3139	BALANCE
F1 (C6 to C10)	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P &T GC / FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P & T GC / FID
F2 (C10 to C16)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F3 (C16 to C34)	VOL-91-5009	CCME Tier 1 Method	GC / FID
F4 (C34 to C50)	VOL-91-5009	CCME Tier 1 Method	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	Balance
Moisture Content	VOL-91-5009	CCME Tier 1 Method, SW846 5035,8015	BALANCE
Terphenyl	VOL-91-5009	CCME Tier 1 Method	GC/FID
Dichlorodifluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromomethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichlorofluoromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Acetone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methylene Chloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trans- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl tert-butyl Ether	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Cis- 1,2-Dichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chloroform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Benzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichloropropane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Trichloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromodichloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Methyl Isobutyl Ketone	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2-Trichloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS

AGAT Laboratories

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

Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 17T230186

PROJECT: Mississauga Rd

ATTENTION TO: Shami Malla

SAMPLING SITE:

SAMPLED BY:J. Farhoodi

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Toluene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Dibromochloromethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylene Dibromide	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Tetrachloroethylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,1,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Bromoform	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Styrene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
o-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Xylene Mixture	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
1,3-Dichloropropene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
n-Hexane	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Vinyl Chloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,1 Dichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Dichloromethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Trichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS

AGAT Laboratories

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

Chain of Custody Record

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

Laboratory Use Only

Work Order #: 17T230186
Cooler Quantity: Med
Arrival Temperatures: 3.9 | 3.5 | 3.4 / 3.3 | 2.7 | 2.8
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Report Information:

Company: Amec Foster Wheeler
Contact: Shami Malla
Address: 104 Crockford Blvd
Scarborough
Phone: 416-751-6565 Fax:
Reports to be sent to:
1. Email: shami.malla@amecfw.com
2. Email:

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☑ Regulation 153/04
Table (Indicate One): ☑ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One): ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region (Indicate One)

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

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

Report Guideline on Certificate of Analysis ☐ Yes ☑ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

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

OR Date Required (Rush Surcharges May Apply):

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

Project Information:

Project: Mississauga Road (CoC)
Site Location: Mississauga Road at Financial Drive
Sampled By: J. Farhoodi
AGAT Quote #: PO: TP115085.01.6000
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: Amec Foster Wheeler
Contact: Meikle, Lynn
Address: 104 Crockford Blvd, Scarborough, Ontario
Email: lynn.meikle@amecfw.com

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	(Check Applicable) ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻ ☐ Cr⁶⁺ ☑ EC ☐ FOC ☐ NO_3/NO_2 ☐ Total N ☐ Hg ☐ pH ☑ SAR	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3/NO_2	Volatiles: ☑ VOC ☑ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	TCLP VOC	Ignitability	Sulphate					ON HOLD - Do not Test
BH 3, 1.0 m - 1.5 m	19/06/20	13:10	5	Soil	2X120, 3x250																						☑
BH B-5, 2.0 ft - 4.0 ft	19/06/20	11:00	3	Soil	1X40, 1X120, 1x250																						☑
BH 39, 600 mm - 1.5 m	19/06/20	11:30	1	Soil	1x250																						☑
BH 42, 450 mm - 1.0 m	19/06/20	13:20	1	Soil	1x250																						☑
BH 13, SS 4, 7.5 ft - 9.0 ft	20/06/20	13:45	1	Soil	1x250																						☑
BH 29, AS 3	20/06/20	14:15	1	Soil	1x250																						
BH 36, AS 3	20/06/20	14:20	1	Soil	1x250																						

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Shami malla	20/06/2017			2017/6/21	10:42
	2017/6/21	3:30			

Page 1 of 1

Document ID: DIV-78-1021-003

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

Date Issued: Jan 8, 2015