REVISED
FOUNDATION INVESTIGATION AND DESIGN REPORT

PRELIMINARY DESIGN OF PROPOSED BRIDGE OVER HIGHWAY 410 FOR THE ENTRY RAMP TO NORTHBOUND HIGHWAY 410 FROM HIGHWAY 10 TOWN OF CALEDON, ONTARIO

CONSULTING SERVICES FOR THE SCHEDULE 'C' CLASS ENVIRONMENTAL ASSESSMENT (EA) FOR WIDENING OF McLAUGHLIN ROAD AND CONSTRUCTION OF EAST-WEST SPINE ROAD (MAYFIELD WEST PHASE 2)

THE CORPORATION OF THE TOWN OF CALEDON
2016-62

GEOCRES 30M12-442

Submitted to:

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1.0 INTRODUCTION

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited ("Wood"), was retained by The Corporation of the Town of Caledon ("Town") to provide Consulting Services for Schedule 'C' Class Environmental Assessment ("EA") for the "project" of the proposed widening of McLaughlin Road (from Mayfield Road to approximately 1700 m north) and Construction of East-West Spine Road (Hurontario Street (Hwy 10) to Chinguacousy Road, Ontario), as per the Town's '*Mayfield West Phase 2 – Transportation Master Plan*'.

As part of the Class EA, a foundation investigation was carried out by Wood's Richmond Hill Office ("Wood – Foundation Group") to support the preliminary (30 %) design of a proposed new bridge planned to be constructed over Highway 410, as shown in the plan and the preliminary general arrangement attached in Appendix A.

As the planned bridge will be located within the Right-of-Way ("RoW") of Ministry of Transportation Ontario ("MTO"), this report has been prepared as per requirements of MTO.

This report is the Foundation Investigation and Design Report for the proposed bridge over Highway 410, presenting the factual results of foundation investigation together with design discussion and recommendations. The investigation findings and recommendations for other aspects of the project (i.e., widening of McLaughlin Road and construction of east-west Spine Road, and related work) are not within the scope of this report and they are presented in a separate Wood report (titled "*Final Report - Geotechnical Investigation (Mayfield West – Phase 2), Widening of McLaughlin Road and Construction of East-West Spine Road*", Wood Reference TPB166090.6000, dated 12 April 2018).

The purpose of the foundation investigation was to obtain information on the subsurface conditions at the proposed bridge location by means of boreholes, in-situ tests and laboratory tests on selected soil samples. The number, location depths of the boreholes for the bridge were selected after discussion with and approval from Town of Caledon / MTO. Based on Wood's interpretation of the data obtained in the investigation, recommendations are provided on the geotechnical aspects of the bridge and approach ramp to the bridge. The site for the proposed bridge, along with the borehole locations, are shown in Drawing No. 1.

The factual results of the soil conditions for the proposed bridge as encountered in the boreholes and laboratory tests (without design discussion and recommendations) are also presented in a separate report titled "Foundation Investigation Report", as per requirement of MTO.

2.0 SITE AND PROJECT DESCRIPTION

Based on the available information, a new bridge and the approach ramps leading to the new bridge are proposed to be constructed over the existing five (5) lanes of Highway 410, and located at the north of an existing bridge (carrying Highway 10 / Valleywood Boulevard over Highway 410), as shown in Sheet P1 (and Appendix A). It is understood that the proposed new bridge is planned to be a two-span bridge with the abutments located at the north and south of Highway 410, and a centre pier located at the existing median area, and total length of the bridge will likely be about 75 m. The bridge will be aligned generally in the north-south direction. Details of the proposed bridge were not available at the time of preparation of this report.

At the site of the proposed bridge, the existing Highway 410 is generally aligned in the east – west direction. At the time of investigation, the site consisted of three northbound lanes and two southbound lanes, separated by a concrete barrier. Wide paved shoulders were located at both sides along both the northbound and the southbound lanes. Most areas in either side of the highway were covered with vegetation. A high earth berm (about 10 m high and 250 m long) was present at the north side of the highway.

The alignment of the proposed south approach to the bridge will pass through the vegetated area beside the existing highway and the existing off-ramp from southbound Highway 410 to existing Highway 10. The proposed north approach to the bridge is aligned along the existing berm.

Four photographs taken during the field investigation showing the existing site conditions are included in Appendix B.

3.0 GEOLOGY

Based on Map 2223 – *Quaternary Geology, Brampton Area* prepared by Ontario Geological Survey (2005), the site is located in an area where the overburden comprises "red to brown, gritty to clayey silt till (Halton Till).

Based on Map 2179 – *Brampton Area, Southern Ontario, Drift Thickness Sheet* - prepared by Ontario Geological Survey, the overburden thickness in the area at the vicinity of the proposed bridge site is more than 30 m below ground surface.

4.0 INVESTIGATION PROCEDURES

4.1 Field Investigation

A total of ten (10) boreholes (BH 1 to BH 10) were drilled at the proposed bridge site and along the proposed alignment of bridge approaches. Locations of boreholes are described below.

- Borehole BH 1 was drilled at the proposed south approach;
- Boreholes BH 2 and BH-3 were drilled at the proposed south abutment area;
- Borehole BH 4 was drilled at the proposed central pier;
- Boreholes BH 5 and BH-6 were drilled at the proposed north abutment area;
- Borehole BH 7 was drilled at the proposed north approach area;
- Boreholes BH 8 to BH 10 were drilled along the north approach area to investigate the soil condition of the existing earth berm.

Detailed locations of each borehole are summarized in Table 4.1. The site of the proposed bridge and borehole locations are presented in Drawing Nos. 1 and 2, respectively.

Table 4.1: Details of Boreholes drilled for Proposed Bridge

Component	Borehole No.	Appx. Chainage on the new alignment	Depth (m)	Top / Termination Elevation (1) (m)	GPS Coordinates (MTM, NAD83, Zone 10 (CSRS, 2010)	Latitude / Longitude (°)	Location
South Approach	BH 1	20+230	9.8	262.7 / 252.9	N:4844617; E:277898	N:43.74101842N / E:79.83399240W	Left shoulder of existing southbound off-ramp to Hwy 10
South Abutment	BH 2	20+250	20.1	261.3 / 241.2	N:4844640; E:277911	N:43.74123134N / E:79.83383318W	Right shoulder of the southbound Hwy 410 (east end of proposed abutment)
	BH 3	20+265	20.0	261.6 / 241.5	N:4844646; E:277889	N:43.74128319N / E:79.83410623W	Right shoulder of the southbound Hwy 410 (west end of proposed abutment)
Central Pier	BH 4	20+280	20.2	261.1 / 240.8	N:4844662; E:277884	N:43.74142377N / E:79.83416456W	Left shoulder of the southbound Hwy 410 (mid area of proposed pier)
	BH 5	20+320	20.1	260.3 / 240.3	N:4844700; E:277876	N:43.74176712N / E:79.83427521W	Right shoulder of the northbound Hwy 410

Component	Borehole No.	Appx. Chainage on the new alignment	Depth (m)	Top / Termination Elevation [1] (m)	GPS Coordinates (MTM, NAD83, Zone 10 (CSRS, 2010)	Latitude / Longitude (°)	Location
South Abutment							(east end of proposed abutment)
	BH 6	20+335	20.3	260.7 / 240.5	N:4844697; E:277849	N:43.74173764N / E:79.83461241W	Right shoulder of the northbound Hwy 410 (west end of proposed abutment)
North Approach	BH 7	20+355	9.8	259.6 / 249.9	N:4844709; E:277835	N:43.74184448N / E:79.83477644W	Left shoulder of the northbound Hwy 410
	BH 8	20+370	5.2	263.8 / 258.6	N:4844722; E:277833	N:43.74196148N / E:79.83481215W	On the slope of existing berm
	BH 9	20+395	5.0	265.3 / 260.2	N:4844735; E:277807	N:43.74207539N / E:79.83513157W	
	BH 10	20+430	6.6	267.0 / 260.4	N:4844754; E:277777	N:43.74224763N / E:79.83550194W	

[1] Discrepancies, if any, between borehole depth and elevation, are due to rounding-off of the numbers.

After acquiring all necessary permits for road occupancy, and obtaining clearance for the underground utilities, the fieldwork was performed between October 16th and November 14th, 2018. Traffic control during the field investigation was provided by TCI Field Services located in Brooklyn, Ontario, a licensed traffic control company. The elevations of the ground surface at borehole locations were surveyed by MacKay, MacKay and Peters Limited (MMP), Land Surveyors and Mapper of Burlington, Ontario, a member of The Association of Ontario Land Surveyors ("OLS"), using a Trimble R10 GPS unit referencing the CAN-NET network resolutions. The as-drilled borehole locations were recorded as northing and easting coordinates using a NAD83-CSRS MTM Zone 10 datum.

The drilling, sampling and in-situ testing operations were conducted by using hollow-stem / solid-stem augers, from truck- and/or track-mounted drilling rigs equipped with automatic hammers and/or Big Beaver auger drill rig, equipped with manual hammer, owned and operated by Terra Firma Environmental Services of Toronto, Ontario, and were overseen full-time by Wood geotechnical personnel.

Soil samples were generally taken at regular intervals of 0.75 m (2.5 ft) up to a depth of 3.0 m and at intervals of 1.5 m (5 ft) thereafter, while performing the Standard Penetration Test (SPT) in accordance with ASTM D1586. This consisted of freely dropping a 63.5 kg (140 lb) hammer for a vertical distance of 0.76 m (30 inches) to drive a 51 mm (2 inch) diameter O.D. split-barrel (split spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively

undisturbed ground by a vertical distance of 0.30 m (12 inches) was recorded as SPT 'N' value of the soil which indicated the consistency of cohesive soils or the compactness of non-cohesive soils.

Groundwater conditions were observed in the boreholes during sampling and upon completion of drilling. The measured groundwater depths, wherever groundwater was encountered, are presented in the Record of Boreholes.

A monitoring well was installed in each of two borehole locations (BH 2 and BH 6) for monitoring groundwater levels and hydrogeological investigation (including slug testing). Groundwater levels measured subsequently in the monitoring wells are shown in the Record of Boreholes. The findings of the hydrogeological investigation are presented in separate report prepared by Wood (*Hydrogeological Investigation Report, Preliminary Design of Proposed Bridge over Highway 410 for the Entry Ramp to Northbound Highway 410 from Highway 10, dated February 2019*).

Upon completion of drilling, the boreholes not equipped with a monitoring were backfilled in accordance with the general requirements of Regulation 903 issued by the Ministry of the Environment and Climate Change Resources, Ontario. At time of preparation of this report, monitoring wells had not yet been decommissioned, as it may be used for groundwater monitoring during detail design. If they are not required, the wells may be decommissioned in accordance to Ontario Regulation 903.

Soil samples were collected for each soil layer exposed in the boreholes for laboratory inspection and testing. The soil samples collected during the field investigation were transported to Wood's Advanced Soil Laboratory in Richmond Hill for further examination and laboratory soil testing. The program of laboratory testing included, where applicable, grain size analysis, liquid and plastic limit tests, and in-situ water content determination.

The results of the in-situ, groundwater measurements and laboratory tests are presented in the corresponding Record of Boreholes and Laboratory Test Results (Appendix C).

The soil samples will be retained for a period of one (1) year after submission of the final report, unless otherwise advised in writing by the Town.

Upon recovery, all soil samples were screened to assess for evidence of potential contamination, which included visual inspection as well as vapour screening for combustible organic vapours, using a portable hand-held hydrocarbon surveyor (RKI Eagle 2). The results are presented on the Record of Boreholes.

Soil chemical analyses were carried out on selected soil samples from boreholes for assessment of potential contamination and soil disposal options. Two selected soils samples were analyzed for corrosive potential of soil with respect to concrete and steel. The soil chemical analyses were

performed by Maxxam Analytics, an accredited CAEL laboratory located in Mississauga, Ontario. As per project requirement, two asphaltic concrete samples were tested for presence of asbestos. The asbestos test was carried out by Maxxam Analytics.

4.2 Laboratory Tests

The following tests were conducted in the laboratory:

- Water content determination;
- Grain size distribution analyses;
- Atterberg Limit tests;
- Soil Chemical Analyses; and
- Soil corrosivity Analyses.

The results of laboratory tests presented in the Record of Boreholes are included in Appendix C (grain size distribution curves and plasticity charts). Tables summarizing the analytical test results are included in Appendix D. The Certificates of Analyses of Chemical Tests are included in Appendix E.

5.0 SUB-SURFACE CONDITIONS

Boreholes BH 1 to BH 10 were drilled at the proposed bridge approaches and abutments/central pier foundations, as listed in Table 4.1. Based on the investigation results, the soil profile at the borehole locations generally consisted of surficial cover (i.e. asphaltic concrete or topsoil) and/or sand and gravel/gravelly sand fill underlain by clayey silt / silty clay fill overlying native soils (in descending order - stiff to hard clayey silt / silty clay till, compact to very dense sandy silt / sand and silt / silt and very dense sandy silt till). The inferred groundwater level, based on change is soil colour (brown to grey), varied at depths from about 4.1 m to 7.8 m (Elevations 255.5 m to 253.8 m) below grade. Groundwater levels measured in the monitoring wells installed in Boreholes BH 2 and BH 6 were at depths of 10.3 m below ground surface (Elevation 250.9 m) and 6.8 m (Elevation 253.9 m).

The stratigraphic units and groundwater conditions at the borehole locations (BH 1 to BH 10) are discussed in the following sections. Additional information is provided in the Record of Boreholes. The longitudinal profile along the road alignment (within the investigation area) and two cross-sections at locations of the proposed new bridge abutments, presenting the interpolated soil strata, are presented in Drawing Nos. 1 and 2.

It should be noted that the soil and groundwater conditions may vary between and beyond the borehole locations.

5.1 Surficial Cover

5.1.1 Asphaltic Concrete

Asphaltic concrete thicknesses observed in the boreholes drilled through the paved shoulders are shown in Table 5.1.

Table 5.1: Asphalt Thickness in Boreholes

Borehole No.	Thickness (mm)	Location
BH 1	100	Left shoulder, adjacent to the off-ramp from the southbound Hwy 410 to Hwy 10
BH 4	120	Left shoulder, Hwy 410 the eastbound lanes

Asphaltic concrete samples were obtained at two boreholes locations (BH 1 and BH 4) to carry out tests for presence of asbestos. Asbestos was not detected in both samples. The certificates of analyses for the asbestos tests are attached in Appendix E.

5.1.2 Topsoil

Topsoil was observed in Boreholes BH 5, and BH 7 to BH 10 drilled out of the adjacent pavement/shoulders as shown in Table 5.2.

Table 5.2: Topsoil Thickness in Boreholes

Borehole No.	Thickness (mm)	Location
BH 5	600	Vegetated area at the north side of Hwy 410
BH 7	200	Beside the north ditch of Hwy 410
BH 8	100	On the mid-slope of the existing berm at north side of Hwy 410
BH 9	75	
BH 10	100	

5.2 Fill Soils

5.2.1 Granular Fill

Exposed granular fill, consisting of sand and gravel to gravelly sand, was observed at the ground surface at locations of Boreholes BH 2, BH 3 and BH 6, which were drilled at the unpaved shoulders of Highway 410.

The granular fill (sand and gravel / gravelly sand) was exposed at the surface or encountered below the surficial cover at locations of Boreholes BH1 to BH 6 and extended to depths varying from about

0.6 m to 1.1 m below the existing ground / road surface (Elevations 261.8 m to 259.6 m), as shown in Table 5.3.

SPT 'N' values measured in the granular fill ranged from 7 to 29 blows per 0.3 m penetration. Water contents measured in the samples varied between 3 % and 13 %.

Table 5.3: Granular Fill

Component	Borehole No.	Depth (from-to) (m)	Elevation (from-to) (m)	SPT 'N' (blows per 0.3 m)	Water Content (%)
South Approach	BH 1	0.1 – 0.9	262.6 – 261.8	13, 29	3, 4
South Abutment	BH 2	0.0 – 1.1	261.3 – 260.2	9	-
	BH 3	0.0 – 1.1	261.6 – 260.5	14	5
Central Pier	BH 4	0.1 – 0.6	261.0 – 260.5	-	3
North Abutment	BH 5	0.6 – 0.7	259.7 – 259.6	-	13
	BH 6	0.0 – 0.9	260.7 – 259.8	7, 10	5

5.2.2 Clayey Silt / Silty Clay Fill

A layer of the clayey silt / silty clay fill was encountered in all boreholes underlying the surficial cover and / or the granular fill, and extended to depths of about 0.8 m to 5.6 m below existing ground surface as shown in Table 5.4.

The clayey silt / silty clay fill was described as brown / grey / dark grey in colour, some sand to sandy, and trace gravel. Rootlets and organic matter was observed in some of the samples of clayey silt / silty clay.

SPT 'N' values measured in the clayey silt / silty clay fill ranged from 8 to 24 blows per 0.3 m indicating stiff to very stiff consistency. Water contents measured in the samples varied from 11 % to 24 %.

Table 5.4: Clayey Silt / Silty Clay Fill

Component	Borehole No.	Depth (from-to) (m)	Elevation (from-to) (m)	SPT 'N' (blows per 0.3 m)	Water Content (%)
South Approach	BH 1	0.9 – 4.1	261.8 – 258.6	10 - 13	12 - 21
South Abutment	BH 2	1.1 – 3.2	260.2 – 258.1	9 - 16	11 - 19
	BH 3	1.1 – 4.0	260.5 – 257.5	11 - 15	11 - 18
Central Pier	BH 4	0.6 – 2.0	260.5 – 259.0	10, 18	11

Component	Borehole No.	Depth (from-to) (m)	Elevation (from-to) (m)	SPT 'N' (blows per 0.3 m)	Water Content (%)
North Abutment	BH 5	0.7 – 2.2	259.6 – 258.1	10, 24	10, 12
	BH 6	0.9 - 1.8	259.8 – 258.9	10, 15	13
North Approach	BH 7	0.2 – 0.7	259.4 – 259.0	9	14
	BH 8	0.1 – 4.1	263.7 – 259.7	9 - 18	13 - 24
	BH 9	0.1 – 4.0	265.2 – 261.2	9 - 24	12 - 23
	BH 10	0.1 – 5.6	266.9 – 261.4	8 - 21	11 - 21

The results of grain size analyses and Atterberg Limit tests carried out on selected samples of the clayey silt / silty clay fill are presented in Table 5.5.

Table 5.5: Results of Grain Size Distribution Analyses and Atterberg Limit Tests (Clayey Silt / Silty Clay Fill)

Borehole No.	Sample No.	Depth (m)	Elevation (m)	Grain Size Distribution				Atterberg Limit			MTC Group Symbol
				Gravel (%)	Sand (%)	Fines		LL	PL	PI	
						Silt (%)	Clay (%)				
BH 1	SS 3	1.8	260.9	9	32	43	16	25	16	9	CL
BH 3	SS 2	1.8	259.7	6	30	45	19	25	16	9	CL
BH 9	SS 4	3.3	262.0	3	23	46	28	36	23	13	CI
BH 10	SS 3	1.8	265.2	9	28	44	19	15	8	7	CL-ML

LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index

The plasticity chart is presented in Figure Nos. C1 to C4, and the grain size distribution curves are presented in Figure No. C5, in Appendix C.

5.3 Clayey Silt / Silty Clay Till

The clayey silt / silty clay till deposit was encountered below the fill soils at locations of all boreholes, and extended to the termination depths of Boreholes BH 1 and BH 7 to BH 10) at depths ranging from 5.0 m to 9.8 m below existing ground surface (Elevations 260.4 m to 252.9 m). In the remaining boreholes (BH 2 to BH 6), the clayey silt / silty clay till deposit, underlying the clayey silt / silty clay fill, extended to depths ranging from 8.7 m to 11.7 m below existing ground surface (Elevations 251.6 m to 249.5 m) as shown in Table 5.6.

The clayey silt / silty clay till deposit was described as brown to grey in colour, trace to some sand, or sandy, and trace to some gravel. Cobbles / boulders were encountered at some locations.

SPT 'N' values measured in the clayey silt / silty clay till ranged from 11 to 52 blows per 0.3 m, indicating stiff to hard consistency. Measured water contents in the clayey silt / silty clay till ranged from 9 % to 20 %.

Table 5.6: Clayey Silt / Silty Slay Till

Component	Borehole No.	Depth (from-to) (m)	Elevation (from-to) (m)	SPT 'N' (blows per 0.3 m)	Water Content (%)
South Approach	BH 1	4.1 – 9.8*	258.6 – 252.9	19 to 42	10 - 18
South Abutment	BH 2	3.2 – 11.6	258.1 – 249.7	11 – 31	9 - 18
	BH 3	4.0 – 11.7	257.5 – 249.9	26 - 52	9 - 16
Central Pier	BH 4	2.0 –11.6	259.0 – 249.5	18 – 43	9 - 15
North Abutment	BH 5	2.2 – 8.7	258.1 – 251.6	14 - 27	9 - 15
	BH 6	1.8 – 10.1	258.9 – 250.6	16 - 49	10 - 20
North Approach	BH 7	0.7 – 9.8*	259.0 – 249.9	16 - 63	10 - 18
	BH 8	4.1 – 5.2*	259.7 – 258.6	23	12
	BH 9	4.0 – 5.0*	261.2 – 260.2	36	14
	BH 10	5.6 – 6.6*	261.4 – 260.4	27	15

* Termination depth of borehole

The results of grain size analyses and Atterberg Limit tests carried out on selected samples of the clayey silt / silty clay till are presented in Table 5.7.

Table 5.7: Results of Grain Size Distribution Analyses and Atterberg Limit Tests (Clayey Silt / Silty Clay Till)

Borehole No.	Sample No.	Depth (m)	Elevation (m)	Grain Size Distribution				Atterberg Limit			MTC Group Symbol
				Gravel (%)	Sand (%)	Fines		LL	PL	PI	
						Silt (%)	Clay (%)				
BH 1	SS 6	4.8	257.9	5	25	51	19	26	17	9	CL
	SS 7	6.3	256.4	*Not tested*				20	13	7	CL-ML
	SS 8	7.9	254.8	9	33	44	14	18	12	6	CL-ML
BH 2	SS 5	4.8	256.5	6	27	46	21	25	16	9	CL
BH 3	SS 9	10.9	250.7	1	5	53	31	26	16	10	CL
BH 4	SS 7	7.9	253.2	3	7	64	26	23	15	8	CL
BH 5	SS 4	2.6	257.7	6	29	48	17	22	15	7	CL-ML

Borehole No.	Sample No.	Depth (m)	Elevation (m)	Grain Size Distribution				Atterberg Limit			MTC Group Symbol
				Gravel (%)	Sand (%)	Fines		LL	PL	PI	
						Silt (%)	Clay (%)				
BH 6	SS 4	2.5	258.2	4	27	51	18	23	15	8	CL
	SS 7	6.3	254.5	12	29	42	17	19	13	6	CL-ML
BH 7	SS 2	1.0	258.6	3	27	50	20	25	16	9	CL
	SS 5	3.3	256.3	7	27	47	19	21	14	7	CL-ML
	SS 9	9.4	250.2	0	3	80	17	23	18	5	CL-ML
BH 8	SS 5	4.8	259.0	6	23	47	24	26	16	10	CL

LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index

The plasticity chart is presented in Figure Nos. C1 to C4, and the grain size distribution curves are presented in Figure Nos. C6 and C7, in Appendix C.

5.4 Sandy Silt / Sand and Silt / Silt

The natural sandy silt / sand and silt / silt deposit was encountered below the clayey silt / silty clay till deposit in Boreholes BH 2 to BH 6 and extended to depths of about 14.7 m to 16.2 m below existing ground / road surface (Elevations 246.0 m to 244.9 m), as shown in Table 5.8.

The sandy silt / sand and silt / silt deposit was described as grey in colour and included trace to some clay and trace to some gravel.

SPT 'N' values measured in the sandy silt / sand and silt / silt ranged from 10 to 57 blows per 0.3 m, indicating compact to very dense compactness. Measured water contents in the sandy silt / sand and silt / silt ranged from 9 % to 27 %.

Table 5.8: Sandy Silt / Sand and Silt / Silt

Component	Borehole No.	Depth (from-to) (m)	Elevation (from-to) (m)	SPT 'N' (blows per 0.3 m)	Water Content (%)
South Abutment	BH 2	11.6 – 16.2	249.7 – 245.0	26 - 44	9 - 16
	BH 3	11.7 – 16.2	249.9 – 245.3	10 - 18	17 - 27
Central Pier	BH 4	11.6 – 16.2	249.5 – 244.9	12 - 39	13 - 20
North Abutment	BH 5	8.7 – 14.8	251.6 – 245.5	11 - 57	9 - 26
	BH 6	10.1 – 14.7	250.6 – 246.0	14 - 33	10 - 22

The results of grain size analyses and Atterberg Limit tests carried out on selected samples of the sandy silt / sand and silt / silt are presented in Table 5.9.

Table 5.9: Results of Grain Size Distribution Analyses and Atterberg Limit Tests (Sandy Silt / Sand and Silt / Silt)

Borehole No.	Sample No.	Depth (m)	Elevation (m)	Grain Size Distribution				Atterberg Limit			MTC Group Symbol
				Gravel (%)	Sand (%)	Fines		LL	PL	PI	
						Silt (%)	Clay (%)				
BH 2	SS 10	12.4	248.9	11	42	40	7	Non-plastic			SM/ML
BH 3	SS 11	13.9	247.7	1	39	58	2	Not tested			ML
BH 4	SS 10	12.4	248.7	8	31	55	6	Non-plastic			ML
BH 5	SS 8	9.4	250.9	1	2	88	9	19	17	2	ML
	SS 11	14.0	246.3	4	76	17	3	Non-plastic			SM
BH 6	SS 10	10.8	249.9	-	2	83	15	21	18	3	ML
	SS 11	12.4	248.3	8	37	48	7	13	12	1	ML

LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index

The plasticity chart is presented in Figure Nos. C1 to C4, and the grain size distribution curves are presented in Figure No. C8, in Appendix C.

5.5 Sandy Silt Till

The sandy silt till deposit was encountered below the native sandy silt / sand and silt / silt in Boreholes BH 2 to BH 6 and extended to the termination depths of these boreholes at about 20.0 m to 20.3 m below existing ground / road surface (Elevations 241.5 m and 240.3 m), as shown in Table 5.10.

The sandy silt till was grey in colour and included trace to some clay and gravel. Clayey silt samples were observed with the till in Boreholes BH 5 and BH 6.

SPT 'N' values measured in the sandy silt till were all more than 50 blows per 0.3 m, indicating very dense compactness. Measured water contents in the sandy silt till ranged from 9 % to 13 %.

Table 5.10: Sandy Silt Till

Component	Borehole No.	Depth (from-to) (m)	Elevation (from-to) (m)	SPT 'N' (blows per 0.3 m)	Water Content (%)
South Abutment	BH 2	16.2 – 20.1	245.0 – 241.2	> 50	9 - 11
	BH 3	16.2 – 20.0	245.3 – 241.5	> 50	10 - 11
Central Pier	BH 4	16.2 – 20.2	244.9 – 240.8	> 50	9 - 13
North Abutment	BH 5	14.8 – 20.1	245.5 – 240.3	> 50	11 - 12
	BH 6	14.7 – 20.3	246.0 – 240.5	> 50	10 - 12

The results of grain size analyses and Atterberg Limit tests carried out on selected samples of the sandy silt till are presented in Table 5.11.

Table 5.11: Results of Grain Size Distribution Analyses and Atterberg Limit Tests (Clayey Silt / Silty Clay Till)

Borehole No.	Sample No.	Depth (m)	Elevation (m)	Grain Size Distribution				Atterberg Limit			MTC Group Symbol
				Gravel (%)	Sand (%)	Fines		LL	PL	PI	
						Silt (%)	Clay (%)				
BH 2	SS 14	18.5	242.8	7	33	53	7	14	13	1	ML
BH 3	SS 13	16.9	244.7	17	30	46	7	14	13.6	0.4	ML
BH 4	SS 13	17.0	244.1	27	26	41	6	14	13.9	0.1	ML
BH 5	SS 12	15.3	245.0	3	35	55	7	14	13	1	ML
	SS 14	18.5	241.8	5	7	70	18	21	16	5	CL-ML
BH 6	SS 15	18.5	242.2	2	17	66	15	18	14	4	CL-ML

LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index

The plasticity chart is presented in Figure Nos. C1 to C4, and the grain size distribution curves are presented in Figure No. C9, and, in Appendix C.

5.6 Groundwater Conditions

Groundwater conditions in the open boreholes were observed during and on completion of drilling. Groundwater was not encountered upon completion of in most boreholes. The inferred groundwater levels, where observed, were estimated based on the change in soil colour (i.e. from brown to grey) and groundwater measurements in the monitoring wells (i.e. BH 2 and BH 6) are shown in Table 5.12.

Table 5.12: Groundwater Measurement

Borehole No.	During / Upon completion of boreholes			In Monitoring Wells		
	Date	Depth (m)	Elevation (m)	Date	Depth (m)	Elevation (m)
BH 1	16 Oct 2018	-	-	Not installed		
BH 2	17 Oct 2018	-	-	1 Nov 2018	10.3	251.0
BH 3	17 Oct 2018	7.8*	253.8	Not installed		
BH 4	18 Oct 2018	5.6*	255.5			
BH 5	1 Nov 2018	5.6*	254.7			
BH 6	16 Oct 2018	-	-	2 Nov 2018	6.8	253.9
BH 7	2 Nov 2018	4.1*	255.5	Not installed		
BH 8	14 Nov 2018	-	-			
BH 9	14 Nov 2018	-	-			
BH 10	14 Nov 2018	-	-			

* Inferred groundwater level based on change in soil colour (brown to grey).

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

6.0 DISCUSSIONS AND RECOMMENDATIONS

A proposed new bridge is planned cross over existing Highway 410, just at the north of the existing bridge (Highway 10 / Valleywood Boulevard Underpass). The new bridge would carry a planned entry ramp from Highway 10 to the northbound Highway 410. The new entry ramp, along with the other Highway 410 / Highway 10 improvements, is proposed as part of the Town of Caledon's planned project for widening of McLaughlin Road and construction of new East-West Spine Road, for which Wood is conducting a Class EA. The planned improvements at and in the vicinity of the proposed new bridge is shown in the drawing Sheet P1 attached in Appendix A. This report has been prepared only for the preliminary design (30 %) of the proposed new bridge and its immediate approach areas to the new bridge. Other improvements shown in Appendix A, are not within the scope of this report.

Based on available information, the proposed new bridge will likely be a two-span bridge. Other details of the proposed bridge (length, width, height, abutment / pier details, etc.) and the approach area (height / width of embankment, etc.) were not available at the time of preparation of this report.

A total of ten boreholes (BH 1 to BH 10) were drilled at the proposed bridge location and the associated north / south approaches to the new bridge. Two boreholes (BH 1 and BH 7) were drilled along (or in the vicinity of) the approaches, four boreholes (BH 2, BH 3, BH 5 and BH 6) were drilled at the proposed abutment locations and one borehole (BH 4) was drilled at the proposed central pier location. Boreholes BH 8 to BH 10 were drilled along (or in the vicinity of) the planned north approach to investigate the soil types / conditions of the existing berm, and were, therefore, drilled only to about 1 m below the bottom of clayey silt/silty clay fill.

At the borehole locations, the surficial cover (asphaltic concrete or topsoil or exposed granular fill) was underlain by fills (consisting of sand and gravel, gravelly sand and/or clayey silt / silty clay), which was in turn underlain by natural soils (in descending order - stiff to hard clayey silt / silty clay till, compact to very dense sandy silt / sand and silt / silt deposit and very dense sandy silt till). The very dense sandy silt deposit was encountered at the borehole locations (i.e. BH 2 to 6) at Elevations ranging from 244.9 m to 246.0 m).

Groundwater levels measured in the two monitoring wells were at Elevations 250.9 m (BH 2) and 253.9 m (BH 6). The inferred groundwater levels (based on the change in colours of the soil (brown to grey) observed in the remaining boreholes, where present, from Elevations 253.8 m to 255.5 m. As such, the groundwater levels increased from south side (BH 2) to north side (BH 6), as measured in the monitoring wells installed at the borehole locations.

Based on soil conditions observed at the borehole locations, the shallow foundations or the deep foundations (i.e. with driven piles or augered cast-in-place caissons) are feasible, depending on design requirements. Deep foundations should be constructed at least 1.5 m into the very dense

sandy silt till deposit. **If driven piles are selected, they should be equipped with proper shoe to penetrate the stiff to hard clayey silt / silty clay till, compact to very dense sandy silt / sand and silt/ silt deposit and the very dense sandy silt till deposit.**

Approach embankments will be required at both sides of the bridge approaches. The existing stiff to very stiff clayey silt / silty clay fill, at the approaches (including in the existing berm), immediately underlain by stiff to hard clayey silt / silty clay till, may be suitable to be used as the subgrade for the approaches and / or approach embankments, depending on heights of the new approach embankments and pavement design requirements. Settlement analyses should be carried out during the detailed design, or when the details are available, to assess the settlements induced by the grade raise of embankment (including immediate, long-term, total and differential settlement) to address MTO Embankment Settlement Criteria for Design (2010).

The new side slopes under the new bridge and / or at the approach areas should be constructed by the compacted engineered fill per OPSS.PROV 1010 or equivalent. Deep-seated slope stability should be analyzed for the slopes once the details are available.

As the new construction site is located within the existing operational lanes and ramps of Highway 410, temporary detours may be required, especially for the off-ramp from southbound Highway 410, during construction of the new bridge and approaches. Site investigation for the potential temporary detours is not within the scope of this investigation and is not discussed herein.

Based on the groundwater levels observed and inferred, dewatering could be not required for construction of the proposed shallow foundation as discussed in Section 6.1.1. For the caisson construction, presence of groundwater should be considered. For dewatering requirements, findings of Wood's hydrogeological investigation and recommendations provided in the separate hydrogeological report (*as noted in Section 4.1*) should considered.

The presence of existing underground utilities at the site should be considered during design and construction. Based on the utility clearances carried out during the investigation, the underground utilities present in the areas include the watermain, bell cables, cables for the high-mast poles and storm sewers.

6.1 Foundation

Results of the investigation indicate that the use of shallow foundations (spread/strip footings) or deep foundations (using driven piles or augered cast-in-place caissons) are feasible to support the bridge foundations. The selection of the foundation type will depend on the design and performance requirements and constructability. Feasible foundations are discussed in the following sections. Comparison of the feasible foundations is listed in Table 6.1.

Table 6.1 - Comparison of Alternative Foundation Types for Bridge Replacement

Foundation Type	Description	Advantages	Disadvantages	Risks / Consequences	Cost Comparison
Deep foundation with driven steel piles	Steel H piles driven down to the specified depth or till the specified capacity is achieved	- Steel H piles are stronger and require less soil displacement during pile driving than other driven pile types (steel pipe, timber, and concrete). - No dewatering required during pile driving. - Geotechnical resistance of pile can be confirmed by pile driving records or pile driving analyzer. - Low post-construction settlement.	- Driving piles may encounter cobbles/boulders which may obstruct pile advance and/or damage piles. - Variation in pile lengths could be high if the main pile driving criterion is based on the design pile resistance.	- Risks of encountering possible cobbles/boulders in till deposits, which may require relocating piles, adding more piles, pre-augering prior to/during driving piles, etc. - Risks of accurate pile length due to variation in subsurface conditions and possible presence of cobbles/boulders in till deposits, which may require some pile cutting or splicing an additional pile section during pile driving.	- Medium to high. Steel price could change significantly in a short period.
Deep foundation with augered, cast-in-place caissons	Caissons installed by augering soil, installing temporary steel casing, and filling the augered hole with re-bars and concrete to form caissons.	- Augering may allow for removing cobbles/boulders, depending on the sizes of rock fragments, if encountered. - Caisson lengths can be specified.	- For the same axial geotechnical resistance, caisson cross-sectional areas would typically be larger than those of driven steel piles. - Temporary steel casing will be required to stabilize the sidewalls of the augered holes. - Dewatering may be required, otherwise the tremie concrete under groundwater is necessary. - Difficult to clean the bottom of the	- Risks of borehole collapse, bottom heave / disturbance due to groundwater, which would result in reducing the side and the end bearing resistances. - Risks of "necking" in caissons during pulling out the steel casing while pouring concrete, resulting in weak zones in the constructed caisson.	- Medium to high.

Foundation Type	Description	Advantages	Disadvantages	Risks / Consequences	Cost Comparison
			caisson, prior to installing re-bars and pouring the concrete. - Geotechnical resistance cannot be confirmed during drilling, although the exposed soil conditions during augering can confirm the soil conditions considered in the design.		
Shallow foundation Spread / strip footings	Support the bridge structure by spreading its load onto ground surface.	- Use only adequate excavator to excavate the existing soils to the footing founding level during construction. - The soil conditions at the founding level can be inspected and confirmed.	- The base of the footing may have to be relatively large to provide sufficient bearing resistance. - The native subgrade may be disturbed during construction. - May require significant dewatering during construction, depending on foundation and groundwater levels. -Long term settlement may exceed the design criteria, if soft cohesive soils exist below the founding level.	- Large excavation may require significant dewatering, thereby increasing construction cost and time. -Long term settlement of the shallow foundation may become issues if difficult ground conditions are encountered.	- Low to medium.

Foundations should be designed in accordance with the latest versions of applicable design codes, manuals and guidelines (Canadian Highway Bridge Design Code (CHBDC), Canadian Foundation Engineering Manual (CFEM), etc.) using the soil parameters provided in Section 6.2.

6.1.1 Shallow Foundation

Based on the soil conditions encountered at the borehole locations, the stiff to hard clayey silt / silty clay till are present up to approximate Elevation 249.5 m (about 11.6 m below the existing ground surface at location of BH 4), below which the compact to very dense sandy silt / sand and silt / silt deposit was encountered, which was further underlain by the very dense sandy silt till deposit. As such, for preliminary design, a geotechnical reaction at Serviceability Limit States (SLS) of 175 kPa and the factored geotechnical resistance at Ultimate Limit States (ULS) of 250 kPa may be considered for design of the proposed shallow foundations founding at Elevation 257 m or below. The SLS value provided should correspond to not more than 25 mm of settlement without considering any grade raise. The values provided are based on semi-empirical soil parameters provided in Table 6.3 without considering any grade raise at the approach areas. Such ULS / SLS values should be confirmed by the detailed foundation analyses once the design foundation loads and grade raises are known.

6.1.2 Deep Foundation

Based on the soil conditions encountered at the borehole locations, the proposed new bridge foundations can be supported by the deep foundations using driven piles or augered cast-in-place caissons. Construction of deep foundation should be in accordance to OPSS.PROV 903 (Construction Specification for Deep Foundations). The bearing values provided for the piles / caissons are based on semi-empirical soil parameters provided in Table 6.3. The detailed foundation analyses should be conducted during the detailed design.

Depending on the anticipated settlement induced by the designed grade raise at the bridge approaches, the potential downdrag (negative friction) should be evaluated on the piles. For design of piles, two loading cases should be considered: (i) permanent load plus downdrag (no live load), and (ii) permanent load plus live load (not downdrag).

6.1.2.1 Driven Piles

The driven steel piles (e.g., HP 310 x 110) may be considered using the following proposed axial geotechnical resistances:

Factored downward axial geotechnical resistance at Ultimate Limit States = 900 kN
(applied resistance factor = 0.4)

Axial downward reaction at Serviceability Limit States = 600 kN

The SLS value provided should correspond to not more than 25 mm of settlement of the pile group without considering any grade raise. If necessary, the pile group settlement should be calculated based on the design pile group configuration.

The steel piles should be driven sufficiently into the very dense sandy silt till, preferably a minimum of 1.5 m or more. The pile tips should be equipped with adequate piles shoes to avoid potential damage during driving through the stiff to hard till. Pile driving shoes should be in accordance with relevant MTO Standard, i.e. OPSD 3000.100 (*Foundation, Piles, Steel H-Pile Driving Shoe*).

It should be noted that the possible presence of cobbles / boulders could cause shallow pile refusal. Pile driving shoes and hard driving should be planned. The vibration caused by pile driving could impact the existing structures (e.g. the existing bridge). Vibration can also be caused by other construction activities, such as excavation. Therefore, a monitoring program, including vibration monitoring, should be developed prior to start of construction to monitor settlement / movement of nearby existing structures. The monitoring program should include pre-construction, during construction and post-construction monitoring. Vibration monitoring should evaluate the impacts induced by pile driving, if any, on the nearby structures and services, especially the existing bridge.

Table 6.2 summarizes the recommended approximate pile tip elevations for preliminary design purposes. Pile capacities should be verified during pile driving at the site.

Construction of the driven piles should comply with the requirements of OPSS.PROV 903 (*Construction Specifications for Deep Foundations*).

Table 6.2: Pile Founding Stratum and Approximate Pile Tip Levels

Structure	Borehole No.	Founding Stratum	Approximate Pile Depth below Existing Ground Surface (m)	Approximate Geodetic Elevation (m)
South Abutment	BH 2	Very dense sandy silt till	18.2±	243±
	BH 3		18.1±	243.5±
Central Pier	BH 4		18.1±	243±
North Abutment	BH 5		16.3±	244±
	BH 6		16.3±	244.5±

6.1.2.2 Caissons

For caissons founded at the depths recommended in Table 6.2, an end bearing value of 700 kPa at SLS and the factored end bearing value of 1000 kPa at ULS may be used for the preliminary design. The SLS value provided should correspond to not more than 25 mm of settlement without

considering any grade raise. The resistance of the proposed caisson will depend on its founding depth, diameter of caisson, side friction and end bearing. The detailed foundation analyses should be conducted to estimate the adequate capacity of a group of caissons.

The coefficient of friction between the concrete and the native soils provided in Section 6.2 should be used for calculation of the skin friction values for design of caissons. For conservative design, frictional resistances from the existing fill soils and the soils within the frost penetration depth (refer to Section 6.2) should not be considered.

The spacing of the caissons should not be closer than 2.5 times the caisson diameter.

It should be noted that drilling for installing the caissons will likely encounter groundwater and cobbles / boulders at some locations. A temporary steel liner will likely be required to prevent sloughing of the surrounding soil. After inserting reinforcing steel cage and well cleaning the bottom in the caisson hole, concrete should be placed by tremie method, while pulling the steel liner out. Dewatering may be required prior to pouring concrete into the caisson, if the caisson is constructed below the groundwater levels, depending on the construction method and equipment. For concreting by the tremie method, relatively high (minimum 100 mm) slump concrete is recommended for the caissons and the liner should be withdrawn at a slow rate to prevent "necking" (intrusion of the soil from the sides of the caisson-hole into the shaft of the caisson). Use of liner will increase cost of installation of caisson, but will prevent the risk of sloughing / necking of surrounding soil during construction, and thereby, reduce the risk of construction delays, which in turn would affect construction schedule and total cost. An experienced caisson contractor should be engaged to construct caissons.

Construction of the caissons should comply with the requirement of OPSS.PROV 903 (*Construction Specifications for Deep Foundations*).

6.2 Geotechnical Parameters for Design

For the preliminary design, the unfactored soil parameters listed in Table 6.3 may be used for design the proposed retaining structures and piles, as applicable.

Table 6.3 - Unfactored Static Soil Parameters for Design

Material	Total Stress Analysis		Effective Stress Analysis		Static Earth Pressure Coefficients [1]			Bulk Unit Weight (kN/m^3)	Coefficient of Friction / Adhesion between Concrete and Soil
	C (kPa)	Φ (deg)	c′ (kPa)	Φ′ (deg)	Active K_a	At-Rest K_o	Passive K_p		
Existing Fill	25	0	0	26	0.39	0.56	2.6	18	0.31
Stiff clayey silt / silty clay	50	0	0	28	0.36	0.53	2.8	18	0.33
Very stiff to hard clayey silt / silty clay	100	0	0	30	0.33	0.50	3.0	19	0.36
Compact to dense sandy silt / sand and silt / silt	0	30	0	30	0.33	0.50	3.0	20	0.36
Very dense sandy silt / sand and silt / silt	0	33	0	33	0.29	0.46	3.4	21	0.40
Very dense sandy silt till	0	33	0	33	0.29	0.46	3.4	21	0.40
Engineered Fill [2]									
Granular A (OPSS.PROV 1010)	0	35	0	35	0.27	0.43	3.7	24	0.40
Granular B Type I (OPSS.PROV 1010)	0	32	0	32	0.31	0.47	3.3	23	

Notes: [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.

A frost penetration depth of 1.4 m should be used of design, as per OPSD 3090.101 (Foundation Frost Penetration Depths for Southern Ontario).

Below the frost penetration depth, a modulus of horizontal subgrade reaction of 10 MN/m^3 for the fill and 30 MN/m^3 for the natural soils may be considered for pile design. Soil resistances within the 1.4 m frost penetration depth should not be considered.

For the preliminary design of the proposed bridge foundation, a groundwater level at Elevation 254.9 m (i.e., approximately 1 m higher than the highest groundwater level measured at BH 6) should be considered.

For assessment of soil corrosivity potential, the results of corrosivity tests provided in Section 6.5 should be considered.

Recommendation for earthquake considerations are provided in Section 6.6.

6.3 Wing Wall / Retaining Wall

To support the new approach embankments, stable slopes and / or retaining wall structures can be used. Soil retaining wall structures typically used are for the integral / semi-integral abutments with wing walls and the conventional abutments (where the superstructure is not directly connected to the substructure) with retaining wall structures (e.g., reinforced-concrete retaining wall, retained soil system (RSS), etc.). The retaining wall structures are required to support the approach embankment typically in two directions – one where the retaining wall structure is underneath the bridge deck and the other where length of the retaining wall structure is parallel to the road alignment. Where space is available, slopes can be constructed.

If the retained soil system (RSS) wall is used, the design of the RSS wall should be carried out as per the Ministry of Transportation's (MTO) RSS Design Guidelines, including the Standard Special Provisions OPSS - SSP 599S22 (March 2018) and OPSS - SSP 599S23 (August 2018), should be used for the design, supply and construction of the RSS, in addition to any contract requirements and RSS manufacturer's standards.

Backfill materials behind abutments and wing (retaining) walls should consist of non-frost susceptible, free-draining granular materials (i.e., Granular 'A' or Granular 'B' per OPSS.PROV 1010), along with the drain pipes and the weep holes, etc., to prevent build-up of the hydrostatic pressure acting behind the wall. Backfilling for RSS wall should conform to RSS Design Guidelines. Backfilling and drains for the proposed retaining walls and abutments should be constructed in accordance with OPSS 902 (*Construction Specifications for Excavating and Backfilling of Structures*), OPSD 3101.150 (*Walls, Abutments, Backfill, Minimum Granular Requirements*), OPSD 3102.100 (*Walls, Abutments, Backfill, Drain*), OPSD 3121.150 (*Walls, Retaining, Backfill, Minimum Granular Requirements*), OPSD 3121.150 (*Walls, Retaining, Backfill, Minimum Granular Requirements*). and OPSD 3190.100 (*Walls, Retaining and Abutment, Wall Drain*). Computation of earth pressures should be in accordance with Section 6.12 – Ground Pressures of Canadian Highway Bridge Design Code (CAN / CSA-S6-14).

The wing walls or retaining structures should consider using the soil parameters provided in Table 6.3 (Section 6.2) for design. It should be noted that the design parameters provided assume relatively-level ground surface and backfill behind the retaining structure.

Slope stability analyses should be carried out for the abutments / retaining walls during the detailed design.

6.4 Approach Embankment

The proposed south approach to the new bridge will be aligned through the vegetated area beside the existing highway and the existing off-ramp from the southbound Highway 410 to the existing Highway 10. The proposed north approach to the bridge will be aligned along the existing berm. The proposed bridge and approach alignments are shown in Sheet P1 in Appendix A.

Based on the boreholes drilled at the approach areas to the new bridge, the native stiff to hard clayey silt / silty clay till was present at an elevation of about 258.6 m at location of the borehole (BH 1) drilled at the proposed south approach, and at elevation of about 259.0 m to 261.4 m at locations of the boreholes (BH 7 to BH 10) drilled at the proposed north approach. The existing clayey silt / silty clay fill overlying the native till consisted of generally very stiff to hard clayey silt / silty clay till, encountered in the existing berm located at the north of the highway. The existing fill may be suitable to be used as the subgrade for construction of the new approaches and / or the approach embankments, depending on the heights of the proposed approaches and associated pavement design requirements. Suitability of the subgrade should be confirmed by proof-rolling on site.

The design grades of the proposed new approach embankments were not available at the time of this report. The embankments should be constructed with a side slope of 2H : 1V or flatter. Based on existing sub-surface condition, settlement in the approach embankment should not be significant with the limited grade raises.

Settlement estimation and slope stability analyses should be carried out for the proposed new embankments once the details of the slopes are available.

Depending on the height of grade raise and associated long term settlement, preventive measures for reducing long-term settlement and/or improving stability (such as, pre-loading, use of light-weight fill) may be considered.

6.5 Soil Corrosivity

To determine the soil corrosivity potential with respect to concrete and steel, two selected soil samples were submitted to Maxxam Analytics Laboratory in Mississauga, and tested for pH, soluble chloride, sulphate, electrical conductivity and resistivity. The test results are summarized in Table 6.4. The Certificate of Analysis is included in Appendix E.

Table 6.4: Results of Corrosivity Testing

Soil Sample No.	pH	Electrical Conductivity µmho/cm	Resistivity (ohms-cm)	Chloride (µg/g)	Sulphate (µg/g)
BH 2 - SS 11	8.01	138	7200	<20	33
BH 6 - SS 4	7.84	176	5700	24	38

As per Table 3 "Additional Requirements for concrete subjected to sulphate attack", Clause 4.1.1.6 of CSA Standards Specification A23.1-09, any soil with a sulphate content below 0.1 % (i.e., 1,000 ppm or µg/g) is below "moderate degree of exposure" with respect to the concrete. As such, in accordance with Table 6 of CSA A23.1-09, Type GU (general use) cement can be used for the concrete.

Based on the results of soil resistivity of analyzed soil samples, the soil corrosivity calls is considered as "*Low*" for exposed metallic structures, as per Table 3 of STP 1000, ASTM (Corrosion Testing and Evaluation: Silver Anniversary Volume, 1990).

A corrosion specialist should be retained, if necessary, to review the test results and provide relevant recommendation.

6.6 Earthquake Considerations

In conformance with the criteria in Table 4.1 (Section 4.4.3.2 – Site Properties) of the Canadian Highway Bridge Design Code S6-14 ("CHBDC S6-14"), the project site may be classified as Site Class D (Stiff Soil), based on the available borehole information.

The design values of site coefficients F(T), F(PGA) and F(PGV) should conform to Tables 4.2 to 4.9 (Section 4.4.3.3 – Site Coefficients) of CHBDC S6-14, and the design spectral acceleration, S (T) should be determined as per Section 4.4.3.4 (Design Spectral Acceleration and Displacement Values) of CHBDC S6-14.

For design of bridge, seismic performance category of the bridge should be based on the spectral acceleration, as per Section 4.4.4 of CHBDC S6-14.

The project site is located in the Southern Great Lakes Seismic Zone, as categorized by the Natural Resources Canada. According to the information provided in the website, this region has a low to moderate level of seismicity compared to the more active seismic zones to the east, along the Ottawa River and in Quebec. Over the past 30 years, on average, 2 to 3 magnitude 2.5 or larger earthquakes have been recorded in the southern Great Lakes region. Three moderate-sized (magnitude 5) events have occurred in the 250 years of European settlement of this region, all of them in the United States.

Importance category of the bridge may be designated as "major-route bridges" or as specified by the Region of Peel and/or MTO. For "major-route bridges", a consequence factor of 1.0 may be used together with a resistance factor of unity used for the foundation strengths per Section 4.6.3 of CHBDC S6-14.

Geotechnical resistance factors should be selected as per Table 6.2 of CHBDC S6-14. Geotechnical resistance factors of 0.5 for bearing and 0.8 for sliding may be used for the shallow foundation. The geotechnical resistance factors of 0.4 for axial load and 0.5 for lateral Load may be used for the deep foundation.

As per Section 4.6.5 of CHBDC S6-14. the lateral soil pressures due to seismic ground motions should be used in design of bridge abutment and retaining wall. Minimum lateral earthquake force should be calculated at the base of the structure as per Section 4.4.7.4 of CHBDC S6-14.

According to the latitude and longitude (43.741943° N and -79.835610° W) at the proposed bridge location, the estimated peak horizontal ground acceleration (PHGA) is 0.095g as obtained from the NRCan website for a 2 % probability of exceedance in 50 years as required by the CHBDC S6-14. Based on experiences for the subsurface conditions at this site, a 25 percent amplification of the ground motion may occur, resulting in an increase in the ground surface acceleration to approximately 0.12g.

Based on the sub-surface condition observed at borehole location, the liquefaction potential can be considered negligible.

In accordance with Section 4.6.5 of the CHBDC S6-14 and Section C4.6.5 of Commentary S6.1-14, the seismic horizontal coefficient (k_h) equal to 0.12 is considered in calculation of the seismic lateral earth pressure coefficients for structures which do not allow lateral yielding (i.e. the abutment walls for this structure). For structures which allow lateral yielding (i.e. the wing walls for this structure), the seismic horizontal coefficient (k_h) equal to 0.06 is considered in calculation of the seismic lateral earth pressure coefficients. The seismic active pressure coefficients (K_{AE}) and the seismic passive pressure coefficients (K_{PE}) shown in Table 6.5 may be used in design. It should be noted that these seismic earth pressure coefficients assume that the back of the wall is vertical and the ground surface behind the wall is flat. Where sloping backfill is present above the top of the wall, the lateral earth pressures under seismic loading conditions should be calculated by treating the weight of the backfill located above the top of the wall as a surcharge.

Table 6.5 - Unfactored Soil Parameters for Seismic Design

Material	Effective Friction Angle Φ' (deg)	Seismic Earth Pressure Coefficients (1)			
		Active K_{AE}		Passive K_{PE}	
		Yielding Wall	Non-yielding Wall	Yielding Wall	Non-yielding Wall
Existing Fill	26	0.4	0.45	3.58	3.35
Stiff clayey silt / silty clay	28	0.37	0.42	4.1	3.84
Very stiff to hard clayey silt / silty clay	30	0.34	0.39	4.72	4.43
Compact to dense sandy silt / sand and silt / silt	30	0.34	0.39	4.72	4.43
Very dense sandy silt / sand and silt / silt	33	0.30	0.35	5.93	5.64
Very dense sandy silt till	33	0.30	0.35	5.93	5.64
Granular A (OPSS.PROV 1010)	35	0.28	0.32	7.0	6.67
Granular B Type I (OPSS.PROV 1010)	32	0.32	0.36	5.48	5.21

Note: All engineered fill should be compacted to at least 100% SPMDD for supporting foundations.

6.7 General Construction Comments

6.7.1 Site Preparation

Site preparation should include stripping of asphalt / topsoil, existing fill (where required), organic matter, deleterious materials and soft/loose spots, if and where encountered. The exposed subgrade should be proof-rolled to identify the weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with engineered fill per OPSS.PROV 1010 (or similar). Excavation, backfilling and compaction should be in accordance with OPSS 902 (*Construction Specification for Excavating and Backfilling*).

6.7.2 Excavation and Dewatering

All excavations should be carried out in accordance with the Ontario Health and Safety Regulations. The soils to be excavated can be classified as follows:

Fill soils	Type 3
Stiff clayey silt / silty clay	Type 3
Compact sandy silt / sand and silt / silt	Type 3

Very stiff to hard silty clay	Type 2
Dense to very dense sandy silt / sand and silt / silt	Type 2
Very dense sandy silt till	Type 2

Accordingly, a temporary slope not steeper than 2H:1V is required for excavations 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, soils under the groundwater table, if encountered, may not be stable and flatter slopes may be required, depending on requirements of global slope stability.

Near the ground surface, occasional 3H:1V slopes may be required if any loose, surficial (Type 4) soils are encountered. If open cut cannot be carried out, a temporary shoring system may be used to limit the extent of excavations, subject to engineering design and approval. Design soil parameters are provided in Table 6.3 in Section 6.2.

Stockpiles of excavated materials and heavy construction equipment should be kept at least the same horizontal distance from the edge of excavation as the depth of the excavation to prevent slope instability, subject to confirmation by the geotechnical engineer. Care should also be taken to avoid overloading of any underground services / structures induced by stockpiles.

No major excavation difficulties are foreseen but allowance should be made for removing cobbles and possible boulders. Normal excavation equipment will likely be suitable for excavation, although special equipment may be required (e.g., impact hammer, rippers, etc.) if the rock fragments of cobbles/boulders are encountered. The terms describing the relative density (very loose, loose, compact, dense, very dense) or consistency (very soft, soft, firm, stiff, very stiff, hard) of soil strata give indications of the effort needed for excavation.

Based on the groundwater levels observed and inferred, dewatering may not be required, especially for construction of the proposed shallow foundation as discussed in Section 6.1.1. For the caisson construction, presence of groundwater should be considered. Dewatering, if required, should conform OPSS.PROV 517 (*Construction Specifications for Dewatering)*, Special Provision SP 517F01 - Amendment to OPSS 517 (*Dewatering System and Temporary Flow Passage System*, dated July 2017), OPSS 902 (*Construction Specification for Excavating and Backfilling – Structures*) and Special Provision SP FOUN0003 – Amendment to OPSS 902 (*Dewatering of Structure Excavation*, dated 21 January 2019). Findings and recommendations of the hydrogeological investigation carried out by Wood, which are presented under a separate cover (*as noted in Section 4.1*), should be considered for dewatering.

6.7.3 Construction Inspection

The Contract Administrator should ensure that a quality control programme of inspection and testing is carried out during the construction phase of the project to confirm that the ground conditions encountered are consistent with design assumptions; and to confirm that the various project specifications and material requirements and handling are followed.

7.0 LIMITED SOIL CHEMICAL ANALYSIS

7.1 Limited Soil Sampling Program

Some limited soil sampling and chemical analyses was carried out during the geotechnical investigation to provide a preliminary assessment of soil quality.

Soil samples recovered from selected geotechnical boreholes were initially placed on zip bags and screened with a hand-held organic vapour surveyor (RKI Eagle 2 Gas Detector) for combustible organic vapours (COV) and total organic vapours (TOV).

The COV measurements were ranged from non-detect to 55 parts per million (ppm). TOV readings ranged from non-detect to 1 ppm. The soil samples did not demonstrate any evidence of environmental concern (i.e., staining, odours, unusual soil conditions).

Selected soil samples were submitted to Maxxam Analytics of Mississauga, Ontario ("Maxxam") for chemical analyses:

- Five (5) soil samples, plus one (1) field duplicate sample for Quality Analysis/Quality Control (QA/QC) purposes, were analyzed for selected metals and general inorganic parameters (including pH, electrical conductivity (EC), and sodium adsorption ratio (SAR)), petroleum hydrocarbons (PHCs), benzene, toluene, ethylbenzene and xylenes (BTEX);
- Four (4) soil samples, plus one (1) field duplicate sample for QA/QC purposes, were analyzed for polycyclic aromatic hydrocarbons (PAHs); and
- One (1) soil sample was analyzed for Ontario Regulation 347/90 as amended (O.Reg. 347/90) parameters including: inorganics, VOCs, benzo(a)pyrene, and PCBs for waste characterization purposes. Flammability and ignitability tests were also conducted on the soil sample.

7.2 Regulatory Framework

The chemical analyses results were evaluated with respect to the following references:

- *"Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, Ontario Ministry of the Environment, Conservation and Parks (MECP), 15 April 2011:
  - Table 1 Full Depth Background Site Condition Standards (SCS) for all types of property use (Table 1 SCS).
  - Table 2 Full Depth Generic SCS in a potable groundwater condition for industrial/commercial/community property use and coarse textured soils (Table 2 SCS).
- *Table 3 Full Depth Generic SCS in a non-potable groundwater condition for industrial/commercial/community property use and coarse textured soils (Table 3 SCS). O.Reg.347/90 analyses were compared to Schedule 4 Leachate Quality Criteria to determine if the waste would be considered leachate toxic (i.e., hazardous waste) for disposal purposes at MOECC approved receiving facilities (such as landfills).*

7.3 Analytical Results

Soil samples recovered from boreholes BH3, BH5, BH7, BH9, and BH10 were analyzed for BTEX, PHCs, metals and inorganics; soil samples recovered from boreholes BH3, BH5, BH7, and BH9 were also analyzed for PAHs, as below detailed.

7.3.1 Petroleum Hydrocarbons and BTEX

As shown in Table 1 (Appendix D), BTEX and PHCs were not detected in the analyzed soil samples. Therefore, BTEX and PHC concentrations would meet the applicable SCS.

7.3.2 Metals and Inorganics

The results of the metals and inorganics analysis are summarized in Table 2 (Appendix D).

The analyzed soil samples met the applicable SCS with the following exception:

- SAR exceeded the Table 1/2/3 SCS in the soil sample recovered from BH7 SS1 (surface - 0.6 mbgs).
- EC exceeded the Table 1 SCS soil samples BH7 SS1 (surface - 0.6 mbgs) and BH10 SS5 (4.6-5.0 mbgs).

7.3.3 Polycyclic Aromatic Hydrocarbons

As shown in Table 3 (Appendix D), the analyzed soil samples met the applicable SCS for PAHs.

7.3.4 Ontario Regulation 347/90

Soil sample (ID – TCLP-410/10 was analyzed using the TCLP for inorganics, metals, VOCs, benzo(a)pyrene, PCBs, and ignitability.

The results of the O. Reg. 347/90 TCLP analyses and their respective Schedule 4 Leachate Quality Criteria are summarized in Table 4 (Appendix D).

Based on the analytical results, the tested parameters were determined to be within the Schedule 4 Leachate Quality Criteria for inorganics, metals, VOCs, benzo(a)pyrene, PCBs.

7.4 Conclusions and Recommendations

Based on the limited soil chemical analyses results obtained during this geotechnical investigation, the following conclusions and recommendations are made:

1. The management of excess soil should be based on the requirements of the MECP's Management of Excess Soil: A Guide to Best Management Practices or any other excess soils regulations that may be in place at the time of construction. These requirements would include the preparation of soil management plans and fill management plans (FMPs).
2. Excess soils with SAR values exceeding the Table 3 SCS can be reused at the site, with certain restrictions, including:
    - Placement below a depth of 1.5 metres below final grade or
    - Placement within roadways, except any portions located within 30 m of a surface water body or other environmentally sensitive areas
3. Excess soils with EC values exceeding the Table 1 SCS may not be suitable for offsite management at un-regulated receiver sites without additional characterization and management unless otherwise confirmed by the receiver site (i.e. quarries, re-use under roads, etc.). Alternatively, unsaturated, excess soils could likely be transported to MECP approved facilities for non-hazardous wastes.
4. The quality of excess soils generated during the widening of McLaughlin Road and the construction of east-west Spine Road is expected to be variable, and as such, soil conditions

will need to be monitored during excavation. If stockpiling of soil is not permitted during construction, additional sampling and chemical analysis should be conducted prior to initiating the construction activities.

5. This characterization was based on Wood's limited understanding of soil quality and available information at the time of the geotechnical investigation. Further assessment and/or chemical analyses may be needed depending on the soil management options and/or receiver's requirements that would be specified in a FMP authored by a Qualified Person, as defined under Ontario Regulation 153/04, as amended.

8.0 CLOSURE

The sub-soil information contained in this report should be used solely for the purpose of the preliminary foundation assessment for the proposed new bridge to be constructed over existing Highway 410, just at the north of Highway 10 / Valleywood Drive Underpass, under The Corporation of the Town of Caledon contract for Class EA for widening of McLaughlin Road and construction of East-West Spine Road.

A list of applicable construction specifications and drawings is attached.

The Limitations of Report is an integral part of this report.

This report was prepared by Shami Malla, M.Civ.Eng., P. Eng. and Alessandro Pellerito, Ph.D. C.Chem.; and was reviewed by Ian Powell, B.E.S. P.Geo., QP_{ESA} and Sen Hu, M. Sc., P. Eng.

Sincerely,

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

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

Sen Hu, M.Sc., P.Eng.
Senior Associate Geotechnical Engineer
Designated Key Personnel of MTO

LIMITATIONS TO GEOTECHNICAL REPORTS

1. The work performed in the preparation of this report and the conclusions presented herein are subject to the following:

    a) The contract between Wood and the Client, including any subsequent written amendment or Change Order dully signed by the parties (hereinafter together referred as the "Contract");
    b) Any and all time, budgetary, access and/or site disturbance, risk management preferences, constraints or restrictions as described in the contract, in this report, or in any subsequent communication sent by Wood to the Client in connection to the Contract; and
    c) The limitations stated herein.

2. **Standard of care:** Wood has prepared this report in a manner consistent with the level of skill and are ordinarily exercised by reputable members of Wood's profession, practicing in the same or similar locality at the time of performance, and subject to the time limits and physical constraints applicable to the scope of work, and terms and conditions for this assignment. No other warranty, guaranty, or representation, expressed or implied, is made or intended in this report, or in any other communication (oral or written) related to this project. The same are specifically disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.

3. **Limited locations:** The information contained in this report is restricted to the site and structures evaluated by Wood and to the topics specifically discussed in it, and is not applicable to any other aspects, areas or locations.

4. **Information utilized:** The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth in this report.

5. **Accuracy of information:** No attempt has been made to verify the accuracy of any information provided by the Client or third parties, except as specifically stated in this report (hereinafter "Supplied Data"). Wood cannot be held responsible for any loss or damage, of either contractual or extra-contractual nature, resulting from conclusions that are based upon reliance on the Supplied Data.

6. **Report interpretation:** This report must be read and interpreted in its entirety, as some sections could be inaccurately interpreted when taken individually or out-of-context. The contents of this report are based upon the conditions known and information provided as of the date of preparation. The text of the final version of this report supersedes any other previous versions produced by Wood.

7. **No legal representations:** Wood makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

8. **Decrease in property value:** Wood shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.

9. **No third party reliance:** This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or Contract. Any use or reproduction which any third party makes of the report, in whole or in part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this document, or any information contained in this document, for use or consideration by any third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on this report or anything set out therein. including without limitation, any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.

LIMITATIONS TO GEOTECHNICAL REPORTS

10. **Assumptions**: Where design recommendations are given in this report, they apply only if the project contemplated by the Client is constructed substantially in accordance with the details stated in this report. It is the sole responsibility of the Client to provide to Wood changes made in the project, including but not limited to, details in the design, conditions, engineering or construction that could in any manner whatsoever impact the validity of the recommendations made in the report. Wood shall be entitled to additional compensation from Client to review and assess the effect of such changes to the project.

11. **Time dependence**: If the project contemplated by the Client is not undertaken within a period of 18 months following the submission of this report, or within the time frame understood by Wood to be contemplated by the Client at the commencement of Wood's assignment, and/or, if any changes are made, for example, to the elevation, design or nature of any development on the site, its size and configuration, the location of any development on the site and its orientation, the use of the site, performance criteria and the location of any physical infrastructure, the conclusions and recommendations presented herein should not be considered valid unless the impact of the said changes is evaluated by Wood, and the conclusions of the report are amended or are validated in writing accordingly.

    Advancements in the practice of geotechnical engineering, engineering geology and hydrogeology and changes in applicable regulations, standards, codes or criteria could impact the contents of the report, in which case, a supplementary report may be required. The requirements for such a review remain the sole responsibility of the Client or their agents.

    Wood will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

12. **Limitations of visual inspections:** Where conclusions and recommendations are given based on a visual inspection conducted by Wood, they relate only to the natural or man-made structures, slopes, etc. inspected at the time the site visit was performed. These conclusions cannot and are not extended to include those portions of the site or structures, which were not reasonably available, in Wood's opinion, for direct observation.

13. **Limitations of site investigations**: Site exploration identifies specific subsurface conditions only at those points from which samples have been taken and only at the time of the site investigation. Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions.

    The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite this investigation, conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

    Final sub-surface/bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports.

    Bedrock, soil properties and groundwater conditions can be significantly altered by environmental remediation and/or construction activities such as the use of heavy equipment or machinery, excavation, blasting, pile-driving or draining or other activities conducted either directly on site or on adjacent terrain. These properties can also be indirectly affected by exposure to unfavorable natural events or weather conditions, including freezing, drought, precipitation and snowmelt.

    During construction, excavation is frequently undertaken which exposes the actual subsurface and groundwater conditions between and beyond the test locations, which may differ from those encountered at the test locations. It is recommended practice that Wood be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered at the test locations, that construction work has no negative impact on the geotechnical aspects of the design, to adjust recommendations in accordance with conditions as additional site information is gained and to deal quickly with geotechnical considerations if they arise.

Interpretations and recommendations presented herein may not be valid if an adequate level of review or inspection by Wood is not provided during construction.

14. **Factors that may affect construction methods, costs and scheduling**: The performance of rock and soil materials during construction is greatly influenced by the means and methods of construction. Where comments are made relating to possible methods of construction, construction costs, construction techniques, sequencing, equipment or scheduling, they are intended only for the guidance of the project design professionals, and those responsible for construction monitoring. The number of test holes may not be sufficient to determine the local underground conditions between test locations that may affect construction costs, construction techniques, sequencing, equipment, scheduling, operational planning, etc.

    Any contractors bidding on or undertaking the works should draw their own conclusions as to how the subsurface and groundwater conditions may affect their work, based on their own investigations and interpretations of the factual soil data, groundwater observations, and other factual information.

15. **Groundwater and Dewatering**: Wood will accept no responsibility for the effects of drainage and/or dewatering measures if Wood has not been specifically consulted and involved in the design and monitoring of the drainage and/or dewatering system.

16. **Environmental and Hazardous Materials Aspects**: Unless otherwise stated, the information contained in this report in no way reflects on the environmental aspects of this project, since this aspect is beyond the Scope of Work and the Contract. Unless expressly included in the Scope of Work, this report specifically excludes the identification or interpretation of environmental conditions such as contamination, hazardous materials, wild life conditions, rare plants or archeology conditions that may affect use or design at the site. This report specifically excludes the investigation, detection, prevention or assessment of conditions that can contribute to moisture, mould or other microbial contaminant growth and/or other moisture related deterioration, such as corrosion, decay, rot in buildings or their surroundings. Any statements in this report or on the boring logs regarding odours, colours, and unusual or suspicious items or conditions are strictly for informational purposes

17. **Sample Disposal**: Wood will dispose of all uncontaminated soil and rock samples after 30 days following the release of the final geotechnical report. Should the Client request that the samples be retained for a longer time, the Client will be billed for such storage at an agreed upon rate. Contaminated samples of soil, rock or groundwater are the property of the Client, and the Client will be responsible for the proper disposal of these samples, unless previously arranged for with Wood or a third party.

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

List of Relevant Construction Specifications and Drawings

SPECIFICATION / DRAWING	TITLE
STANDARD SPECIFICATIONS	
OPSS 180.PROV (Nov/16)	General Specification for the Management and Disposal of Excess Materials
OPSS.PROV 206 (Nov/14)	Construction Specification for Grading
OPSS.PROV 209 (Nov/14)	Construction Specification for Embankments over Swamps and Compressible Soils
OPSS.PROV 501 (Nov/14)	Construction Specification for Compacting
OPSS. PROV 517 (Nov/16)	Construction Specifications for Dewatering
OPSS 539. PROV (Nov/14)	Construction Specification for Temporary Protection Systems
OPSS 802 (Nov/10)	Construction Specification for Topsoil
OPSS 803 (Apr/18)	Construction Specification for Sodding
OPSS 804 (Nov/14)	Construction Specification for Seed and Cover
OPSS 902 (Nov/10)	Construction Specifications for Excavating and Backfilling - Structures
OPSS.PROV 903 (Apr/16)	Construction Specifications for Deep Foundation
OPSS.PROV 904 (Nov/14)	Construction Specification for Concrete Structures
OPSS.PROV 905 (Nov/14)	Construction Specification for Steel Reinforcement for Concrete
OPSS.PROV 1010 (Apr/13)	Material Specifications for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material
OPSS.PROV 1004 (Nov/12)	Material Specifications for Aggregates - Miscellaneous
OPSS.PROV 1860 (Apr/18)	Material Specification for Geotextiles
STANDARD DRAWINGS	
OPSD 208.010	Benching of Earth Slopes
OPSD 3000.100	Foundation, Piles, Steel H-Pile Driving Shoe
OPSD 3000.150	Foundation, Piles, Steel H-Pile Splice
OPSD 3001.100	Foundation, Piles, Steel Tube Pile Driving Shoe
OPSD 3001.150	Foundation, Piles, Steel Tube Pile Splice
OPSD 3090.101	Foundation Frost Penetration Depths for Southern Ontario
OPSD 3101.150	Walls, Abutment, Backfill, Minimum Granular Requirement
OPSD 3102.100	Walls, Abutment, Backfill, Drain
OPSD 3121.150	Walls, retaining, Backfill, Minimum Granular Requirement
OPSD 3190.100	Walls, Retaining and Abutment, Wall Drain

DRAWINGS

Drawing No. 1	Borehole Locations and Soil Strata
Drawing No. 2	Soil Strata - Cross-Sections

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

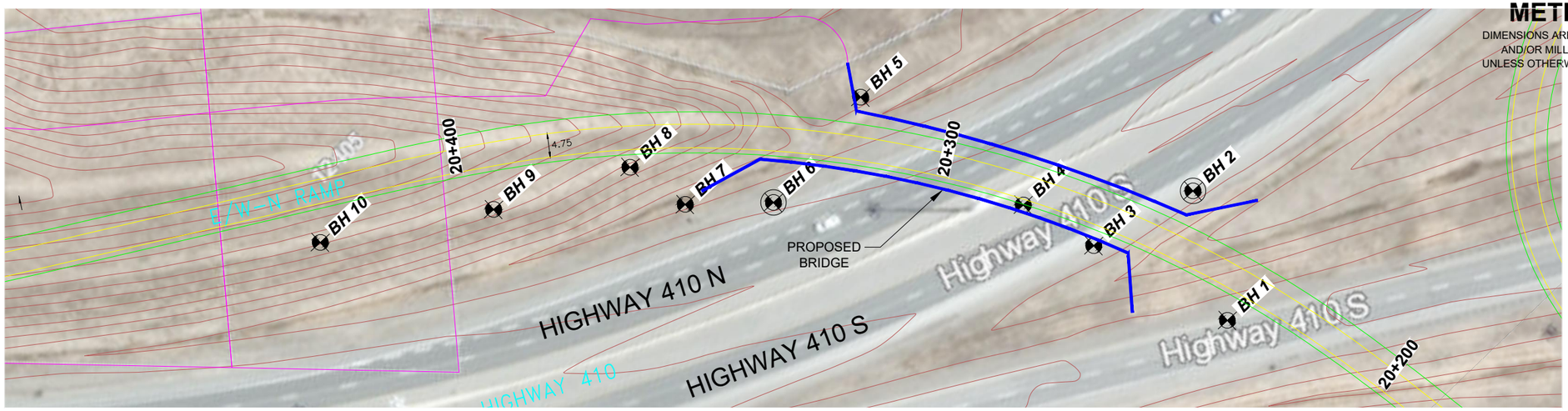
AGREEMENT NUMBER.
(WOOD REF.: TPB166090)

G.W.P. No.
-

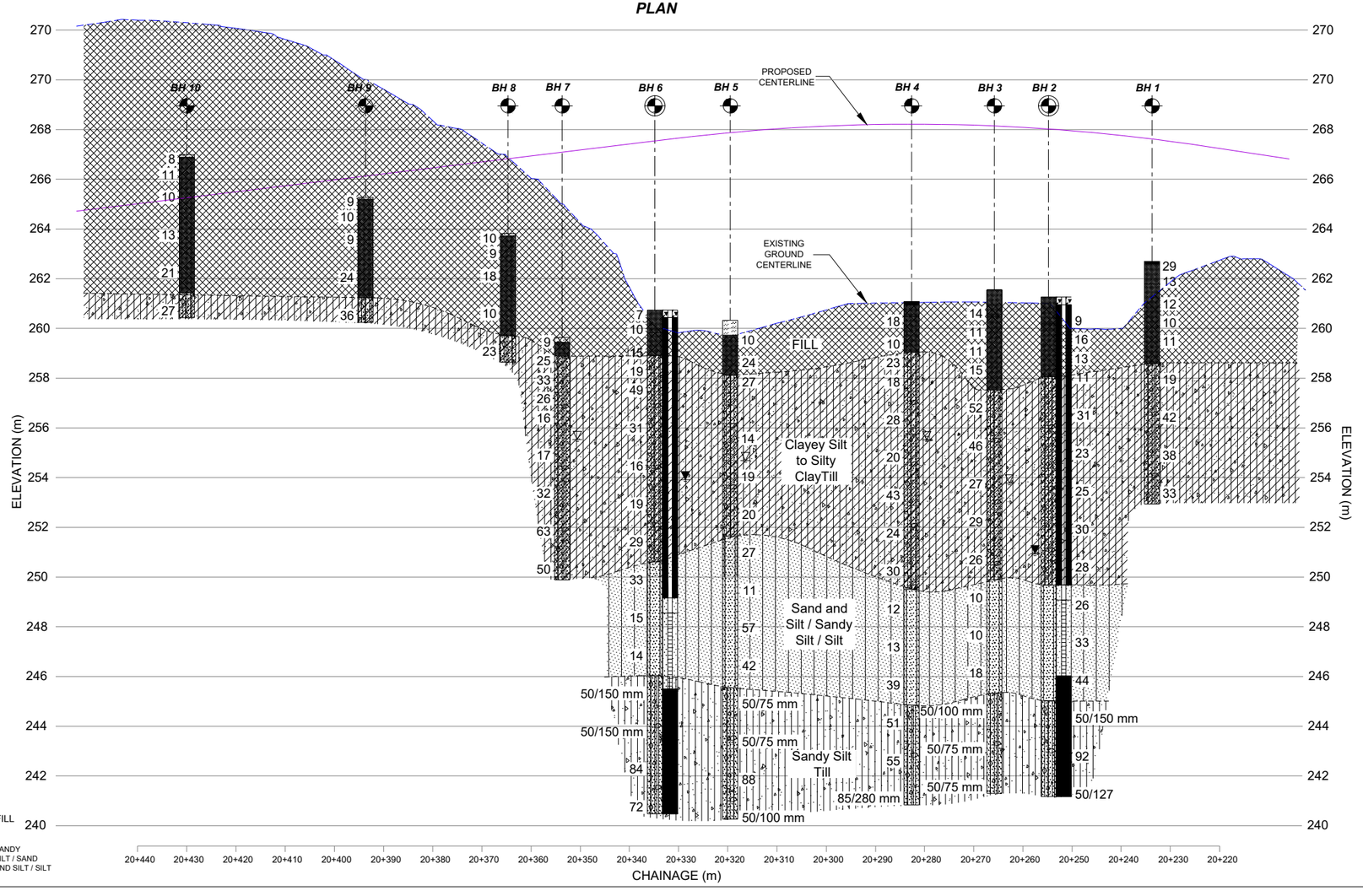
FOUNDATION INVESTIGATION AND DESIGN REPORT
PROPOSED BRIDGE OVER HIGHWAY 410 FOR THE ENTRY RAMP TO NORTHBOUND HIGHWAY 410 FROM HIGHWAY 10
TOWN OF CALEDON, ONTARIO
BOREHOLE LOCATION & SOIL STRATA

SHEET 1 OF 1

wood.
Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited
50 Vogell Road, Units 3 & 4, Richmond Hill, Ontario, L4B 3K6



PLAN



SOIL STRATIGRAPHY

CLAYEY SILT / SILTY CLAY TILL
FILL
SANDY SILT TILL
SANDY SILT / SAND AND SILT / SILT

KEY PLAN

400m 0 400 800 1200 1600m
Approximate Scale

LEGEND

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- GROUND WATER LEVEL IN MONITORING WELL
- INFERRED GROUND WATER LEVEL

BOREHOLE INFORMATION

DESCRIPTION	CHAINAGE	NORTHING	EASTING	ELEVATION (m)
BH 1	20+233.7	4844617	277898	262.7
BH 2	20+254.8	4844640	277911	261.3
BH 3	20+265.8	4844646	277889	261.6
BH 4	20+282.6	4844662	277884	261.1
BH 5	20+319.5	4844700	277876	260.3
BH 6	20+334.8	4844697	277849	260.7
BH 7	20+353.7	4844709	277835	259.6
BH 8	20+364.7	4844722	277833	263.8
BH 9	20+393.7	4844735	277807	265.3
BH 10	20+430.0	4844754	277777	267.0

NOTES:
1. The interpreted stratigraphy represents simplified subsurface conditions. The boundaries between soil strata have been defined at borehole locations only. Conditions between borehole locations could differ from illustrated conditions.
2. This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
3. Horizontal Datum: MTM10, NAD83 (CSRS, 2010). Vertical Datum: CGVD-1928:1978
4. Base file provided by Wood Design Team.

0 2 4 6 8m VER
0 10 20 30 40m HOR
APPROXIMATE SCALE

REVISIONS			
DESIGN -	CHK -	CODE -	-	DATE NOV. 2018
DRAWN KW	CHK SH	SITE HWY 410	BRIDGE	DWG 1

Plotted: 2018-11-27
Last Saved: 2018-11-26
Plotted By: kent.wong
Last Saved By: kent.wong
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METRIC

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AGREEMENT NUMBER.
(WOOD REF.: TPB166090)

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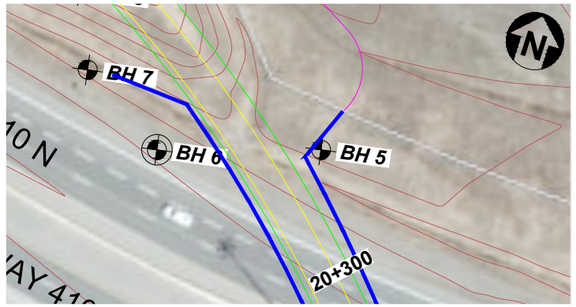
FOUNDATION INVESTIGATION AND DESIGN REPORT
PROPOSED BRIDGE OVER HIGHWAY 410 FOR THE ENTRY RAMP TO NORTHBOUND HIGHWAY 410 FROM HIGHWAY 10
TOWN OF CALEDON, ONTARIO
SOIL STRATA - CROSS-SECTIONS

SHEET 1 OF 1

wood.
Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited
50 Vogell Road, Units 3 & 4, Richmond Hill, Ontario, L4B 3K6



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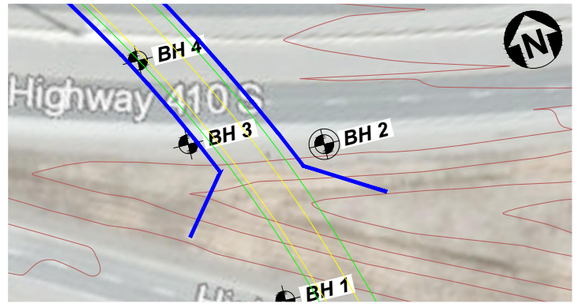

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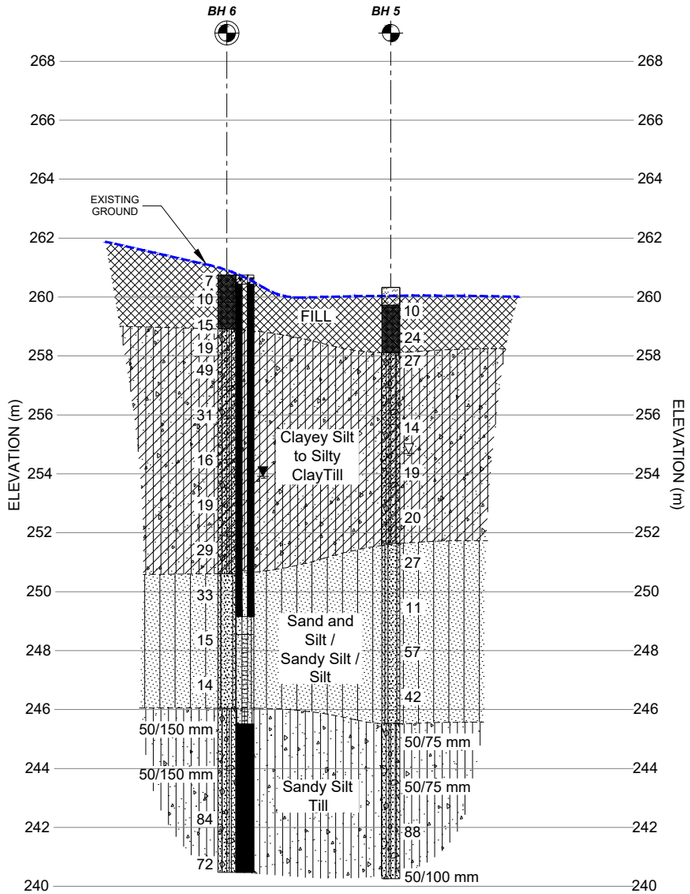
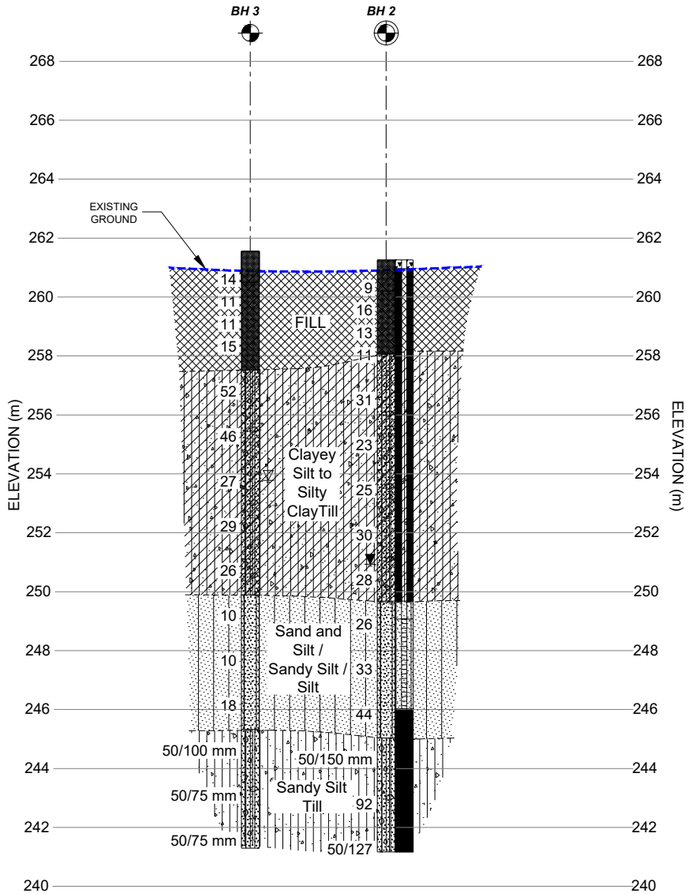


PROPOSED NORTH ABUTMENT



PROPOSED SOUTH ABUTMENT

SOIL STRATIGRAPHY

- CLAYEY SILT / SILTY CLAY TILL
- FILL
- SANDY SILT TILL
- SANDY SILT / SAND AND SILT / SILT

KEY PLAN

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Approximate Scale

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4. Base file provided by Wood Design Team.

0 2 4 6 8m VER
0 10 20 30 40m HOR
APPROXIMATE SCALE

REVISIONS

DESIGN -	CHK -	CODE -	-	DATE NOV. 2018	
DRAWN KW	CHK SH	SITE HWY 410	BRIDGE	DWG 2	

Plotted: 2018-11-26
Last Saved: 2018-11-23
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Last Saved By: kent.wong
Path: Z:\Projects\2017\PB Burlington\TPB166090.6000 - McLoughlin & Spine Rd Brampton (Caledon)\# Ph.A1801.080 - 2018 - Bridge Over Hwy 410\Drawings\TPB166090.A1801.08 - Bridge Over HWY 410_Stratigraphy.dwg

RECORD OF BOREHOLES

Explanation of Boreholes
Record of Boreholes (BH 1 to BH 10)

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 *MTC Soil Classification Manual*.

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

Compactness of Cohesionless Soils	SPT N-Value*
Very loose	0 to 5
Loose	5 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	Undrained Shear Strength kPa
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	Over 200

* For penetration of less than 0.3 m, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeter penetration).

Soil Sampling

Sample types are abbreviated as follows:

SS Split Spoon	TW Thin Wall Open (Pushed)	RC Rock Core	GS Grab Sample
AS Auger Sample	TP Thin Wall Piston (Pushed)	WS Washed Sample	AR Air Return 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.

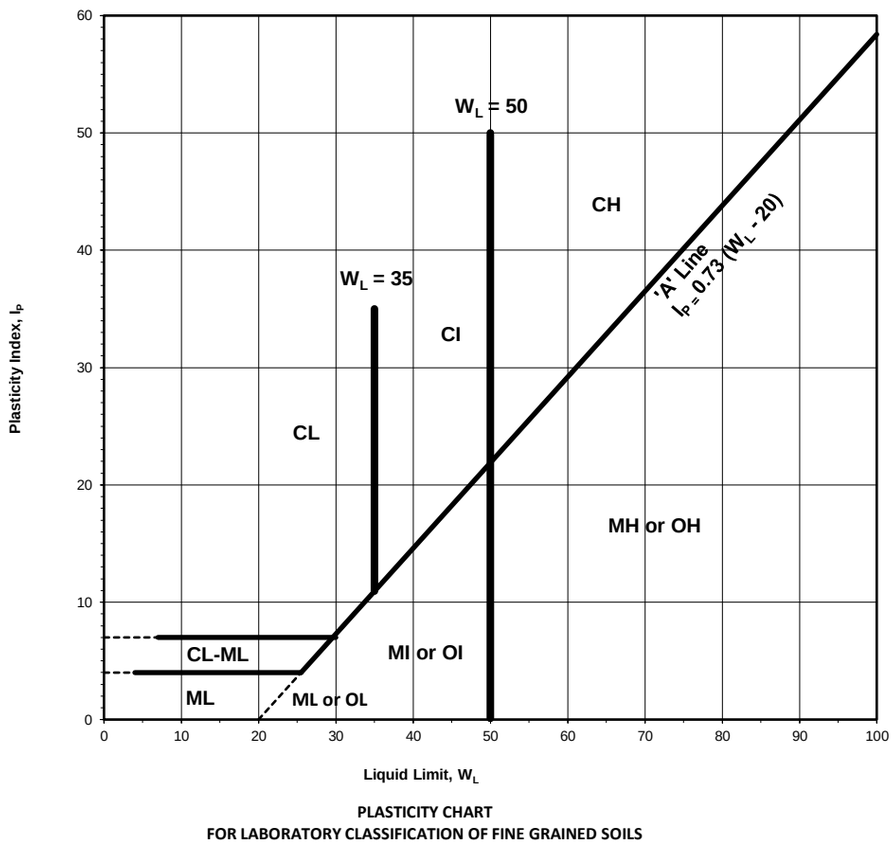
MTC SOIL CLASSIFICATION
Based on MTC Soil Classification Manual

Ontario

MAJOR DIVISION				GROUP SYMBOL	TYPICAL DESCRIPTION	INFORMATION REQUIRED FOR DESCRIBING SOILS	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 (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICAL SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	GIVE TYPE, NAME, IF NECESSARY, INDICATE APPROX % OF SAND & GRAVEL ; MAX SIZE; ANGULARITY, SURFACE CONDITION, & HARDNESSOF THE COARSE GRAINS, LOCAL OR GEOLOGICAL NAME & OTHER PERTINENT DESCRICTIVE INFORMATION, & SYMBOL IN PARENTHESIS. FOR UNDISTURBED SOILS ADD INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITION & DRAINAGE CHARACTERISTICS	USE GRAIN SIZE CURVE IN IDENTIFYING THE FACTORS AS GIVEN UNDER FIELD IDENTIFICATION DETERMINE PERCENTAGE OF GRAVEL & SAND FROM GRAIN SIZE CURVE. DEPENDING ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 75 µm) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS: LESS THAN 5% GW, GP, SW, SP MORE THAN 12% GM, GC, SM, SC 5% TO 12% BORDER LINE CASES REQUIRE USE OF DUAL SYMBOL.
			PREDOMINANTLY ONE SIZE OF A RANGE OF SIZES WITH STONE INTERMEDIATE SIZES MISSING	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES		
		GRAVEL WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND- SILT MIXTURES		
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)	GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES		
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNT OF ALL INTERMEDIATE PARTICLE SIZES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ BETWEEN 1 AND 3
			PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZE MISSING	SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		NOT MEETING ALL GRADATION REQUIREMENTS FOR GW
		SANDS WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES		ATTERBERG LIMITS BELOW A-LINE OR Ip LESS THAN 4
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)	SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE A- LINE WITH Ip GREATER THAN 7
							ABOVE A-LINE WITH Ip BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	IDENTIFICATION PROCEDURE ON FRACTION SMALLER THAN 425µm						
	SILT AND CLAYS	LIQUID LIMIT LESS THAN 35	DRY STRENGTH (CRUSHING CHARACTERISTICS) / DILATANCY (REACTION TO SHAKING) / TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)				
			NONE / QUICK / NONE	ML	INORGANIC SILTS & SANDY SILTS OR SLIGHTLY PLASTICITY, ROCK FLOUR	GIVE TYPE, NAME, IF NECESSARY, INDICATE DEGREE AND CHARACTER OF PLASTICITY, AMOUNT AND MAXIMUM SIZE OF COURSE GRAINS, COLOUR IN WET CONDITION, ODOUR, IF ANY, LOCAL OR GEOLOGIC NAME & OTHER PERTINENT DESCRICTIVE INFORMATION & SYMBOL IN PARENTHESIS. FOR UNDISTURBED SOILS AND INFORMATION ON STRUCTURE, STRATIFICATION, CONSISTANCY IN UNDISTURBED AND REMOLDED STATES, MOISTURE & DRAINAGE CONDITION.	$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ BETWEEN 1 AND 3
			MEDIUM TO HIGH / NONE TO VERY SLOW / MEDIUM	CL	SILTY CLAYS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS		
			SLIGHT TO MEDIUM / SLOW / SLIGHT	OL	ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS		
		LIQUID LIMIT BETWEEN 35 AND 50	NONE TO SLIGHT / SLOW TO QUICK / SLIGHT	MI	INORGANIC COMPRESSIBLE FINE SANDY SILT WITH CLAY OF MEDIUM PLASTICIT, CLAYEY SILTS		NOT MEETING ALL GRADATION FOR SW
			HIGH / NONE / MEDIUM TO HIGH	CI	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY		
			SLIGHT TO MEDIUM / VERY SLOW / SLIGHT	OI	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY		
		LIQUID LIMIT GREATER THAN 50	SLIGHT TO MEDIUM / SLOW TO NONE / MEDIUM	MH	INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMECACOUS FINE SANDY SILTS, ELASTIC SILTS		ATTERBERG LIMITS BELOW A- LINE OR Ip LESS THAN 4
			HIGH TO VERY HIGH / NONE / HIGH	CH	CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS		ATTERBERG LIMITS ABOVE A- LINE WITH Ip GREATER THAN 7
			MEDIUM TO HIGH / NONE TO VERY SLOW / SLIGHT TO MEDIUM	OH	ORGANIC CLAYS OF HIGH PLASTICITY		ABOVE A-LINE WITH Ip BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS
HIGH ORGANIC SOILS	READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS		

FRACTION	U.S STANDARD SIEVE SIZE			DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	75 mm	26.5 mm	40-50	AND
	FINE	26.5 mm	4.75 mm	30-40	Y/EY
SAND	COARSE	4.75 mm	2.00 mm	20-30	WITH
	MEDIUM	2.00 mm	425 µm	10-20	SOME
	FINE	425 µm	75 µm	1-10	TRACE
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			
OVERSIZED MATERIAL					

ROUNDED OR SUBROUNDED:	NOT ROUNDED:
COBBLES 75 mm TO 200 mm BOULDERS > 200 mm	ROCK FRAGMENTS > 75 mm ROCKS > 0.76 CUBIC METRE IN VOLUME



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

BOUNDARY CLASSIFICATION: BOUNDARY CLASSIFICATION: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS FOE EXAMPLE GW-GC
WELL GRADED GRAVEL-SAND MIXTURE WITH CLAY BINDER

wood.

Wood Environment & Infrastructure Solutions,
a Division of Wood Canada Limited

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ENGINEERING PROPERTIES OF SOIL

Ontario

TYPICAL NAMES OF SOIL GROUPS	GROUP SYMBOLS	PERMEABILITY WHEN COMPACTED	STRENGTH WHEN COMPACTED	COMPRESSIBILITY WHEN COMPACTED	WORKABILITY AS A CONSTRUCTION MATERIAL	SCOUR RESISTANCE	SUSCEPTIBI LIIY TO SURFICIAL EROSION	SUSCEPTIBILI TY TO FROST ACTION	DRAINAGE CHARACTERISTICS
WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	GW	PERVIOUS	EXCELLENT	NEGLIGIBLE	EXCELLENT	MEDIUM	NEGLIGIBLE	NEGLIGIBLE	EXCELLENT
POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	GP	VERY PERVI0US	GOOD	NEGLIGIBLE	GOOD	MEDIUM	NEGLIGIBLE	NEGLIGIBLE	EXCELLENT
SILTY GRAVELS, POORLY GRADED GRAVEL- SAND-SILT MIXTURES	GM	SEMI-PERVIOUS TO IMPERVIOUS	GOOD	NEGLIGIBLE	GOOD	LOW TO MEDIUM	SLIGHT	SLIGHT	FAIR TO SEMI IMPERVIOUS
CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES	GC	IMPERVIOUS	GOOD TO FAIR	VERY LOW	GOOD	MEDIUM	SLIGHT	NEGLIGIBLE TO SLIGHT	PRACTICALLY IMPERVIOUS
WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	SW	PERVIOUS	EXCELLENT	NEGLIGIBLE	EXCELLENT	LOW TO MEDIUM	SLIGHT	NEGLIGIBLE	EXCELLENT
POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	SP	PERVIOUS	GOOD	VERY LOW	FAIR TO GOOD	LOW TO MEDIUM	MODERATE	NEGLIGIBLE TO SLIGHT	EXCELLENT
SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES	SM	SEMI-PERVIOUS TO IMPERVIOUS	GOOD	LOW	FAIR	LOW	MODERATE	SLIGHT TO MODERATE	FAIR TO SEMI IMPERVIOUS IMPERVIOUS
CLAYEY SANDS, POORLY GRADED SAND WITH SOME CLAY MIXTURES	SC	IMPERVIOUS	GOOD TO FAIR	LOW	GOOD	VERY LOW TO LOW	MODERATE TO SLIGHT	NEGLIGIBLE	PRACTICALLY IMPERVIOUS
INORGANIC SILTS AND SANDY SILTS OF SLIGHT PLASTICITY, ROCK FLOUR	ML	SEMI-PERVIOUS TO IMPERVIOUS	FAIR	MEDIUM	FAIR	VERY LOW	SEVERE	SEVERE	FAIR TO POOR
INORGANIC CLAYEY SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS	CL	IMPERVIOUS	FAIR	MEDIUM	GOOD TO FAIR	LOW TO MEDIUM	SLIGHT TO MODERATE	MODERATE TO SEVERE	PRACTICALLY IMPERVIOUS
ORGANIC SILTS OF LOW PLASTICITY	OL	SEMI-PERVIOUS TO IMPERVIOUS	POOR	MEDIUM	FAIR TO POOR	VERY LOW TO LOW	SEVERE	SEVERE	POOR
INORGANIC COMPRESSIBLE SILTS OF MEDIUM PLASTICITY	MI	SEMI-PERVIOUS TO IMPERVIOUS	FAIR	MEDIUM TO HIGH	FAIR TO POOR	LOW	MODERATE	MODERATE TO SEVERE	FAIR TO POOR
INORGANIC SILTY CLAYS OF MEDIUM PLASTICITY	CI	IMPERVIOUS	FAIR TO POOR	HIGH	FAIR	LOW TO MEDIUM	SLIGHT	MODERATE TO SEVERE	SEMI IMPERVIOUS TO PRACTICALL Y
ORGANIC SILTY CLAY OF MEDIUM PLASTICITY	OI	SEMI-PERVI0US TO IMPERVIOUS	POOR	HIGH	POOR	VERY LOW TO LOW	SEVERE	MODERATE TO SEVERE	POOR TO PRACTICALLY IMPERVIOUS
INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	MH	SEMI-PERVIOUS TO IMPERVIOUS	FAIR TO POOR	HIGH	POOR	VERY LOW	MEDIUM	SEVERE	POOR
INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	CH	IMPERVIOUS	POOR	HIGH	FAIR TO POOR	LOW TO MEDIUM	SLIGHT TO NEGLIGIBLE	NEGLIGIBLE	PRACT I.CALL Y IMPERVIOUS
ORGANIC CLAYS OF HIGH PLASTICITY	OH	IMPERVIOUS	POOR	HIGH	POOR	LOW	MODERATE	NEGLIGIBLE TO SLIGHT	PRACTICALLY IMPERVIOUS
PEAT AND OTHER HIGHLY ORGANIC SOILS	Pt	-	-	-	-	LOW	SEVERE	-	FAIR TO GOOD

Ontario

RECORD OF BOREHOLE No. BH 1

wood.

1 OF 1

G.W.P. _____ LOCATION Vicinity of south approach to bridge (N:4844617 E:277898) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 16 October 2018 - 16 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
262.7												
262.6 / 0.1	100 mm Asphaltic Concrete											
	brown **Sand and Gravel FILL** dry to wet		1	SS	29					3	0/ 0	
261.8								262				
0.9	brown/grey **Clayey Silt / Silty Clay FILL** some sand to sandy, trace gravel		2	SS	13		1			4, 14	0/ 0	
			3	SS	12			261		16 25 / 12	0/ 1	9 32 43 16
			4	SS	10		2	260		18	0/ 0	
	-------- dark grey		5	SS	11		3	259		21	0/ 0	
258.6							4					
4.1	brown **CLAYEY SILT / SILTY CLAY TILL** some sand to sandy, trace gravel very stiff to hard		6	SS	19		5	258		17 26 / 14	0/ 1	5 25 51 19
			7	SS	42		6	257		1320 / 11	0/ 0	LL=20, PL=13
			8	SS	38		7	256		1218 / 18	55/ 1	9 33 44 14 LL=18, PL=12
			9	SS	33		8	255		10	0/ 0	
252.9							9	254				
9.8	**End of Borehole**							253				

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

Ontario

RECORD OF BOREHOLE No. BH 2

wood.

G.W.P. _____ LOCATION Vicinity of south abutment, east end (N:4844640 E:277911) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 17 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	SOIL VAPOUR READING COV/TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
261.3												
0.0	brown **Sand and Gravel FILL** moist											
260.2			1	SS	9		1	260		11	0/ 0	
1.1	brown/dark grey **Clayey Silt / Silty Clay FILL** some sand, trace gravel		2	SS	16		2	259		12	0/ 0	
	-------- dark grey		3	SS	13		3	258		19	0/ 0	
258.1												
3.2	brown to grey **CLAYEY SILT / SILTY CLAY TILL** some sand to sandy, trace to some gravel, cobbles/boulders stiff to hard		4	SS	11		4	257		18	0/ 0	
			5	SS	31		5	256		16 25 12	0/ 0	6 27 46 21
	------- cobbles/boulders		6	SS	23		6	255		9	0/ 0	
			7	SS	25		7	254		10	0/ 0	
	-------- grey		8	SS	30		8	253		13	0/ 0	
							9	252				

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 2

G.W.P. _____ LOCATION Vicinity of south abutment, east end (N:4844640 E:277911) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 17 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown to grey **CLAYEY SILT / SILTY CLAY TILL** some sand to sandy, trace to some gravel, cobbles/boulders stiff to hard							251				Groundwater level measured in the monitoring on 1 Nov. 2018.
			9	SS	28		11			16 ○	0/ 0	
249.7 / 11.6	grey **SAND AND SILT** trace clay, some gravel compact to dense wet							250				
			10	SS	26		12	249		13 ○	0/ 0	11 42 40 7 Non-plastic
							13	248				
			11	SS	33		14			9 ○	0/ 0	
							15	247				
			12	SS	44		16	246		16 ○	0/ 0	
245.0 / 16.2	grey **SANDY SILT TILL** trace clay, trace gravel, cobbles/boulders very dense wet to moist							245				
			13	SS	50/150 mm		17			11 ○	0/ 0	
							18	244				
			14	SS	92		19	243		14 / 9 ○	0/ 0	7 33 53 7 LL=14, PL=13
								242				
			15	SS	50/127					10 ○	0/ 0	

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 2

G.W.P. _____ LOCATION Vicinity of south abutment, east end (N:4844640 E:277911) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 17 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
241.2					mm							
20.1	**End of Borehole**											
	50 mm dia. monitoring well with flushmound protective casing installed (depth below ground surface): Concrete: 0.0 - 0.3 m Bentonite: 0.3 - 11.6 m Sand Filter: 11.6 - 15.2 m Screen: 12.2 - 15.2 m Bentonite: 15.2 - 20.1 m											

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

Ontario

RECORD OF BOREHOLE No. BH 3

wood.

1 OF 3

G.W.P. _____ LOCATION Vicinity of south abutment, west end (N:4844646 E:277889) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 17 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
261.6												
0.0	brown **Sand and Gravel FILL** moist											
260.5			1	SS	14		1	261		5, 11	0/ 0	
1.1	brown/grey **Clayey Silt / Silty Clay FILL** some sand to sandy, trace gravel		2	SS	11		2	260		16 25 (11)	0/ 0	6 30 45 19
			3	SS	11		3	259		15	0/ 0	
			4	SS	15		4	258		18	0/ 0	
257.5												
4.0	brown to grey **CLAYEY SILT / SILTY CLAY TILL** trace sand, trace gravel very stiff to hard		5	SS	52		5	257		13	0/ 0	
			6	SS	46		6	256		11	0/ 0	
	-------- grey		7	SS	27	▽	8	254		9	0/ 0	Inferred groundwater level based on change in soil colour.
			8	SS	29		9	253		14	0/ 0	

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 3

wood.

G.W.P. _____ LOCATION Vicinity of south abutment, west end (N:4844646 E:277889) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 17 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown to grey **CLAYEY SILT / SILTY CLAY TILL** trace sand, trace gravel very stiff to hard											
			9	SS	26		11	251		16 26 (16)	0/ 0	1 5 53 31
249.9												
11.7	grey **SANDY SILT** trace clay, trace gravel compact wet		10	SS	10		12	250		27 ○	0/ 0	
							13	249				
			11	SS	10		14	248		18 ○	0/ 0	1 39 58 2
							15	247				
			12	SS	18		16	246		17 ○	0/ 0	
245.3												
16.2	grey **SANDY SILT TILL** trace clay, some gravel very dense moist		13	SS	50/100 mm		17	245		14 (10) ○	0/ 0	17 30 46 7 LL=14, PL=13.6
							18	244				
			14	SS	50/75 mm		19	243		11 ○	0/ 0	
			15	SS	50/75			242		11 ○	0/ 0	

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 3

wood.

G.W.P. _____ LOCATION Vicinity of south abutment, west end (N:4844646 E:277889) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 17 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL WATER CONTENT / LIQUID LIMIT / WATER CONTENT (%)	SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
					mm		m	m	20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	w_P w w_L 20 40 60	COV/ TOV (ppm)	GR SA SI CL
220.5 220.0	**End of Borehole**											

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

Ontario

RECORD OF BOREHOLE No. BH 4

wood.

G.W.P. _____ LOCATION Vicinity of pier location (N:4844662 E:277884) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 18 October 2018 - 18 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
261.1												
261.0 / 0.0	120 mm Asphaltic Concrete											
0.1	brown **Sand and Gravel FILL** cobbles moist											
260.5 / 0.6	brown/grey **Clayey Silt / Silty Clay FILL** some sand to sandy, trace gravel, trace organics		1	SS	18		1	260		11	0/ 0	
			2	SS	10		2	259		11	0/ 0	
259.0 / 2.0	brown to grey **CLAYEY SILT / SILTY CLAY TILL** trace sand, trace gravel very stiff to hard		3	SS	23		3	258		12	0/ 0	
			4	SS	18		4	257		13	0/ 0	
			5	SS	28		5	256		12	0/ 0	
	-------- grey					▽	6	255				Inferred groundwater level based on change in soil colour.
			6	SS	20					9	0/ 0	
			7	SS	43		7	254		15 23 12	0/ 0	3 7 64 26
							8	253				
			8	SS	24		9	252		15	0/ 0	

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 4

G.W.P. _____ LOCATION Vicinity of pier location (N:4844662 E:277884) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 18 October 2018 - 18 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	brown to grey **CLAYEY SILT / SILTY CLAY TILL** trace sand, trace gravel very stiff to hard							251				
			9	SS	30		11	250		15	0/ 0	
249.5 11.6	grey **SANDY SILT** trace clay, trace gravel compact to dense wet		10	SS	12		12	249		18	0/ 0	8 31 55 6 Non-plastic.
			11	SS	13		13	248		20	0/ 0	
			12	SS	39		14	247		13	0/ 0	
244.9 16.2	grey **SANDY SILT TILL** trace clay, trace to with gravel very dense moist		13	SS	51		16	245		14 9	0/ 0	27 26 41 6 LL=14, PL=13.9
			14	SS	55		17	244		11	0/ 0	
							18	243				
							19	242				

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 4

G.W.P. _____ LOCATION Vicinity of pier location (N:4844662 E:277884) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 18 October 2018 - 18 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		m	m				GR SA SI CL
240.8			15	SS	85/280 mm			241		13 ○	0/ 0	
20.2	**End of Borehole**											

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

Ontario

RECORD OF BOREHOLE No. BH 5

G.W.P. _____ LOCATION Vicinity of north abutment, east end (N:4844700 E:277876) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 1 November 2018 - 1 November 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
260.3												
0.0	600 mm Topsoil / Organic mixed soil		1A	AS				260		18	0/ 0	
259.7												
~~259.6~~	brown		1B	AS								
0.7	**Silty Sand and Gravel FILL** some clay moist		2	SS	10		1	259		13 / 10	0/ 0	
	brown **Clayey Silt / Silty Clay FILL** some sand, trace gravel		3	SS	24		2			12	0/ 0	
258.1								258				
2.2	brown to grey **CLAYEY SILT TILL** trace to with sand, trace gravel stiff to very stiff		4	SS	27		3			1522 / 11	0/ 0	6 29 48 17 LL=22, PL=15
			5	SS	14		4	257		9	0/ 0	
	-------- grey		6	SS	19	▽	5	256		9	0/ 0	Inferred groundwater level based on change in soil colour.
			7	SS	20		6	255		15	0/ 0	
251.6							7	254				
8.7	grey **SANDY SILT / SILT** trace clay, trace gravel compact to very dense moist to wet		8	SS	27		8	253		17 / 16	0/ 0	1 2 88 9 LL=19, PL=17
							9	252				
								251				

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

Ontario

RECORD OF BOREHOLE No. BH 5

G.W.P. _____ LOCATION Vicinity of north abutment, east end (N:4844700 E:277876) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 1 November 2018 - 1 November 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING / COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	grey **SANDY SILT / SILT** trace clay, trace gravel compact to very dense moist to wet -------- wet											
			9	SS	11		11	250		26	0/ 0	
								249				
							12					
			10	SS	57			248		9	0/ 0	
							13					
								247				
	sand		11	SS	42		14			16	0/ 0	4 76 17 3 Non-plastic.
245.5 14.8								246				
	grey **SANDY SILT TILL** trace to some clay, trace gravel very dense wet to moist		12	SS	50/75 mm		15			14 11	0/ 0	3 35 55 7 LL=14, PL=13
							16	245				
								244				
			13	SS	50/75 mm		17			11	0/ 0	
								243				
							18					
	clayey silt		14	SS	88			242		21 16 12	0/ 0	5 7 70 18 LL=21, PL=16
							19					
								241				
			15	SS	50/100					12	0/ 0	

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 5

G.W.P. _____ LOCATION Vicinity of north abutment, east end (N:4844700 E:277876) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 1 November 2018 - 1 November 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL WATER CONTENT / LIQUID LIMIT / WATER CONTENT (%)	SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
							m	m	○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100	w_P w w_L; 20 40 60	COV/ TOV (ppm)	GR SA SI CL
240.3 20.1	**End of Borehole**				mm							

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

Ontario

RECORD OF BOREHOLE No. BH 6

G.W.P. _____ LOCATION Vicinity of north abutment, east end (N:4844697 E:277849) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 16 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
260.7												
0.0	brown **Sand and Gravel / Gravelly Sand FILL** moist		1	SS	7					5	0/ 0	
259.8			2	SS	10		1	260		13	0/ 0	
0.9	brown/grey **Clayey Silt / Silty Clay FILL** some sand, trace gravel											
258.9			3	SS	15		2	259		13 / 20	0/ 0	
1.8	brown to grey **CLAYEY SILT / SILTY CLAY TILL** some to with sand, trace to some gravel, cobbles/boulders stiff to hard		4	SS	19		3	258		15 23 11	0/ 0	4 27 51 18
			5	SS	49					10	0/ 0	
	cobbles/boulders						4	257				Hard augering
	--- grey		6	SS	31		5	256		10	0/ 0	
	cobbles/boulders		7	SS	16		6	255		13 19 11	0/ 0	12 29 42 17 LL=19, PL=13
			8	SS	19	▽	7	254		18	0/ 0	Groundwater level measured in the monitoring well on 2 Nov. 2018.
			9	SS	29		8	253		15	0/ 0	
							9	252				
								251				

Continued Next Page

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

Ontario

RECORD OF BOREHOLE No. BH 6

wood.

G.W.P. _____ LOCATION Vicinity of north abutment, east end (N:4844697 E:277849) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 16 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
250.6												
10.1	grey **SAND AND SILT / SILT** trace to some clay, trace gravel compact to dense moist to wet		10	SS	33		11	250		18 1 16	0/ 0	- 2 83 15 LL=21, PL=18
			11	SS	15		12	249		13 10	0/ 0	8 37 48 7 LL=13, PL=12
			12	SS	14		14	248 247		22	0/ 0	
246.0												
14.7	grey **SANDY SILT TILL** trace to some clay, trace gravel very dense wet to moist		13	SS	50/150 mm		15	246		11	0/ 0	
			14	SS	50/150 mm		16	245 244		10	0/ 0	
	silt		15	SS	84		18	243 242		14 8 12	0/ 0	2 17 66 15 LL=18, PL=14
							19	241				

Continued Next Page

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

Ontario

wood.

RECORD OF BOREHOLE No. BH 6

G.W.P. _____ LOCATION Vicinity of north abutment, east end (N:4844697 E:277849) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 16 October 2018 - 17 October 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	DEPTH (m)	ELEVATION (m)	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING: COV/TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL
240.5			16	SS	72					11 ○	0/ 0	
20.3	**End of Borehole** 50 mm dia. monitoring well with flushmound protective casing installed (depth below ground surface): Concrete: 0.0 - 0.3 m Bentonite: 0.3 - 11.6 m Sand Filter: 11.6 - 15.2 m Screen: 12.2 - 15.2 m Bentonite: 15.2 - 20.1 m											

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

Ontario

RECORD OF BOREHOLE No. BH 7

wood.

1 OF 1

G.W.P. _____ LOCATION Vicinity of north approach (N:4844709 E:277835) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 200 mm diameter borehole (hollow stem) COMPILED BY SM

DATUM Geodetic DATE 1 November 2018 - 1 November 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.6												
0.0 / 259.4	200 mm Topsoil / Organic mixed soil											
0.2	brown **Clayey Silt / Silty Clay FILL** some sand, trace gravel		1	SS	9					27 ○ 14 ○	0/ 0	
259.0 / 0.7	brown/grey **CLAYEY SILT / SILTY CLAY TILL** trace to with sand, trace gravel very stiff to hard		2	SS	25		1	259		16 25 12 ○	0/ 0	3 27 50 20
			3	SS	33		2	258		13 ○	0/ 0	
			4	SS	26		3	257		10 ○	0/ 0	
			5	SS	16		4	256		14 21 11 ○	0/ 0	7 27 47 19 LL=21, PL=14
	-------- grey					▽						Inferred groundwater level based on change in soil colour.
			6	SS	17		5	255		10 ○	0/ 0	
			7	SS	32		6	254		15 ○	0/ 0	
			8	SS	63		7	253		15 ○	0/ 0	
			9	SS	50		8	252		18 23 18	0/ 0	0 3 80 17 LL=23, PL=18
249.9							9	251				
9.8	**End of Borehole**							250				

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

Ontario

RECORD OF BOREHOLE No. BH 8

wood.

1 OF 1

G.W.P. _____ LOCATION Vicinity of north approach (through existing berm) (N:4844722 E:277833) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 150 mm diameter borehole (Solid Stem) COMPILED BY SM

DATUM Geodetic DATE 14 November 2018 - 14 November 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
263.8												
263.7 / 0.1	100 mm Topsoil brown/grey **Clayey Silt / Silty Clay FILL** some sand, trace gravel		1	SS	10					20	0/ 0	
			2	SS	9		1	263		13	0/ 0	
			3	SS	18		2	262		14	0/ 0	
	-------- dark grey rootlets		4	SS	10		3	261		24	0/ 0	
259.7 / 4.1	brown/grey **SILTY CLAY TILL** with sand, trace gravel very stiff		5	SS	23		4	260		16 26 12	0/ 0	6 23 47 24
258.6							5	259				
5.2	**End of Borehole**											

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

Ontario

RECORD OF BOREHOLE No. BH 9

wood.

1 OF 1

G.W.P. _____ LOCATION Vicinity of north approach (through existing berm) (N:4844735 E:277807) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 150 mm diameter borehole (Solid Stem) COMPILED BY SM

DATUM Geodetic DATE 14 November 2018 - 14 November 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
265.3												
265.2 0.1	75 mm Topsoil											
	brown/grey **Clayey Silt / Silty Clay FILL** some to with sand, trace gravel		1	SS	9			265		15	0/ 0	
			2	SS	10		1			17	0/ 0	
								264				
			3	SS	9		2			12	0/ 0	
	-------- grey							263				
	rootlets		4	SS	24		3	262		23 36 28	0/ 0	3 23 46 28
261.2 4.0	brown/grey **CLAYEY SILT TILL** some sand, trace gravel hard		5	SS	36		4	261		14	0/ 0	
260.2 5.0	**End of Borehole**						5					

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

Ontario

RECORD OF BOREHOLE No. BH 10

wood.

1 OF 1

G.W.P. _____ LOCATION Vicinity of north approach (through existing berm) (N:4844754 E:277777) ORIGINATED BY MS

DIST Caledon HWY 410 / 10 BOREHOLE TYPE 150 mm diameter borehole (Solid Stem) COMPILED BY SM

DATUM Geodetic DATE 14 November 2018 - 14 November 2018 CHECKED BY SH

PROJECT Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON. JOB NO. TPB166090

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL WATER CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
267.0												
266.9 / 0.1	100 mm Topsoil											
	brown/grey **Clayey Silt / Silty Clay FILL** some to with sand, trace gravel		1	SS	8					20	40/ 0	
			2	SS	11		1	266		11	5/ 1	
			3	SS	10		2	265		815	0/ 0	9 28 44 19 LL=15, PL=8
	--------- grey		4	SS	13		3	264		11	0/ 0	
	mixed with black organic matter		5	SS	21		4	263		21	0/ 0	
261.4 / 5.6	brown/grey **CLAYEY SILT TILL** some sand, trace gravel very stiff		6	SS	27		5	262		15	0/ 0	
							6	261				
260.4 / 6.6	**End of Borehole**											

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

APPENDIX A

Overall Plan, Highway 410 Interchange, New Construction
(Sheet P1, prepared by Wood (formerly Amec Foster Wheeler)
And
Preliminary General Arrangement for E/W-N Ramp Flyover
(Proposed Bridge, dated November 2018, prepared by Wood)

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

amec foster wheeler

CONT No
GWP No

NEW CONSTRUCTION

HIGHWAY 410 INTERCHANGE
OVERALL PLAN

SHEET
P1

Valleywood Blvd.

Existing berm impacted by proposed improvements

Highway 410

Highway 10

Proposed Bridge

Off-ramp to Highway 10

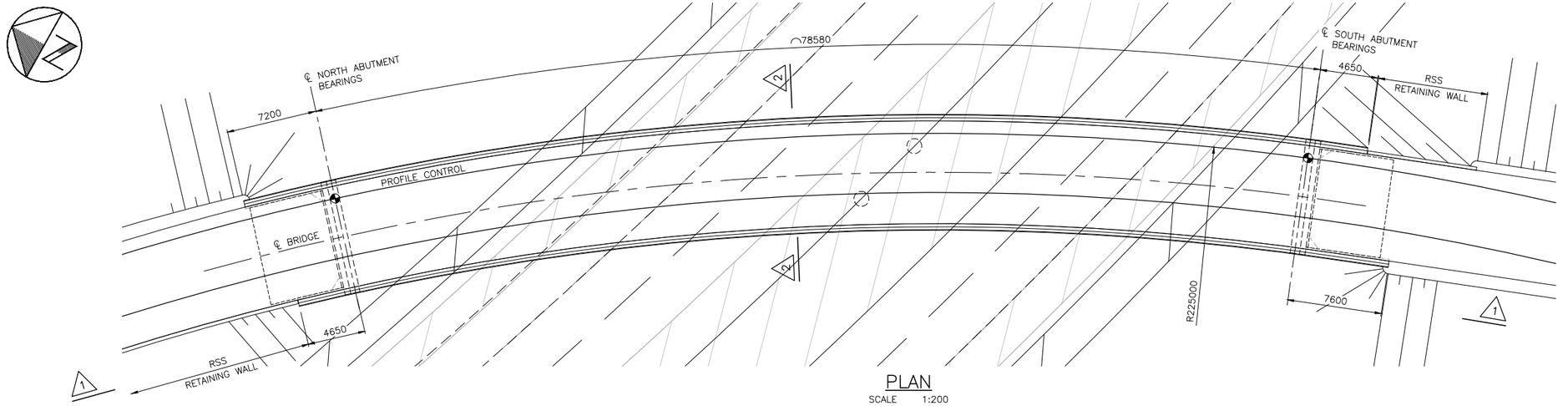
Highway 10

Future Spine Road

AMEC Foster Wheeler Environment & Infrastructure PR-#-### ##-##

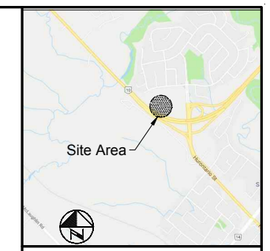
P:\2016\Projects\TPB166090 - Caledon McLaughlin Road\06_DES-ENG\01_CAD\02_DWGS\04_TRANS\01_PRO\VNC_1.dwg

May 04/18 - jason.stahl

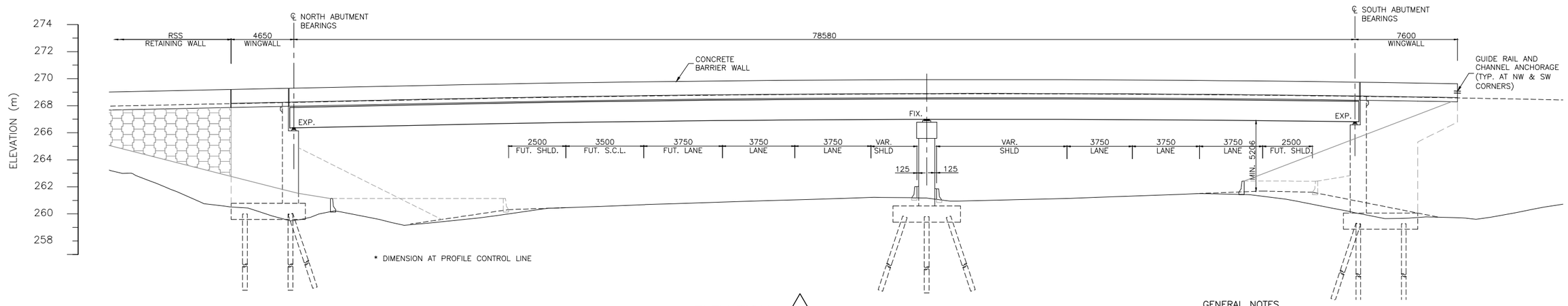


PLAN

SCALE 1:200

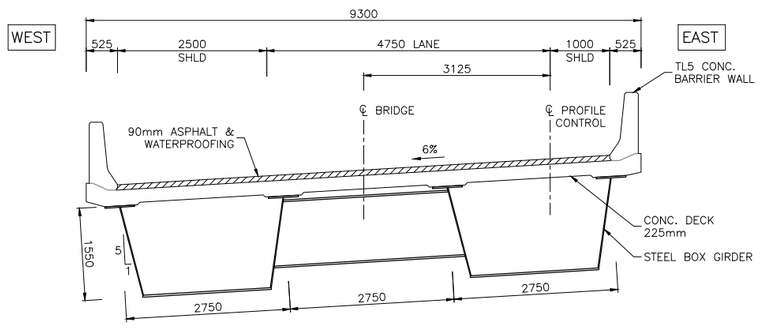


KEY PLAN



ELEVATION 1

SCALE 1:150



SECTION 2

SCALE 1:50

GENERAL NOTES

1. CONCRETE:
   - CONCRETE SHALL BE CLASS 30 MPa UNLESS NOTED OTHERWISE.
2. CLEAR COVER TO REINFORCING STEEL:
   - FOOTING 100 ± 25
   - ABUTMENTS & WINGWALLS 70 ± 20
   - DECK TOP 70 ± 20
   - DECK BOTTOM 40 ± 10
   - PIER CAPS 70 ± 20
   - REMAINDER 70 ± 20 UNLESS OTHERWISE NOTED
3. REINFORCING STEEL:
   - REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.
   - UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES FOR BLACK OR STAINLESS REINFORCING STEEL BARS SHALL BE CLASS B.
   - STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH OF 500 MPa, UNLESS OTHERWISE SPECIFIED.
   - BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
   - GLASS FIBRE REINFORCED POLYMER REINFORCING BARS SHALL BE GRADE III AS SPECIFIED IN THE CONTRACT DRAWINGS. THE NOMINAL DIAMETER, TENSILE MODULUS OF ELASTICITY AND GUARANTEED MINIMUM TENSILE STRENGTH SHALL BE AS SPECIFIED IN THE CONTRACT DOCUMENTS.
   - BAR MARKS WITH THE PREFIX GIII DENOTE GRADE III GLASS FIBRE REINFORCED POLYMER BARS.
   - BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1, UNLESS INDICATED OTHERWISE.

No	Date	Drawn	Appr'd	Revisions

APPROVALS

Design | Checked

Drawn | Checked

Scale: AS SHOWN

Date: NOVEMBER 2018

PRELIMINARY

NOT TO BE USED FOR CONSTRUCTION

McLAUGHLIN RD. & SPINE RD.
CLASS EA

E/W-N RAMP FLYOVER

GENERAL ARRANGEMENT

wood.

Contract No.

Consultant File No. TPB166090

Drawing No.

SHEET OF

Plotted: 2019-02-26
Last Saved: 2019-02-12
Plotted By: mariusz.eizenbart
Last Saved By: mariusz.eizenbart
Path: P:\2016\Projects\TPB166090 - Coledon McLaughlin Road\06_DES-ENG\01_CAD\02_DWGS\03_STRUC\02_CONT\TPB166090-S1.dwg

APPENDIX B

Site Photographs

SITE PHOTOGRAPHS

Photograph 1: View of Hwy 410 northbound lanes and existing berm, looking north (5 November 2018).

Photograph 2: View of from mid-slope of existing berm, looking north (5 November 2018).

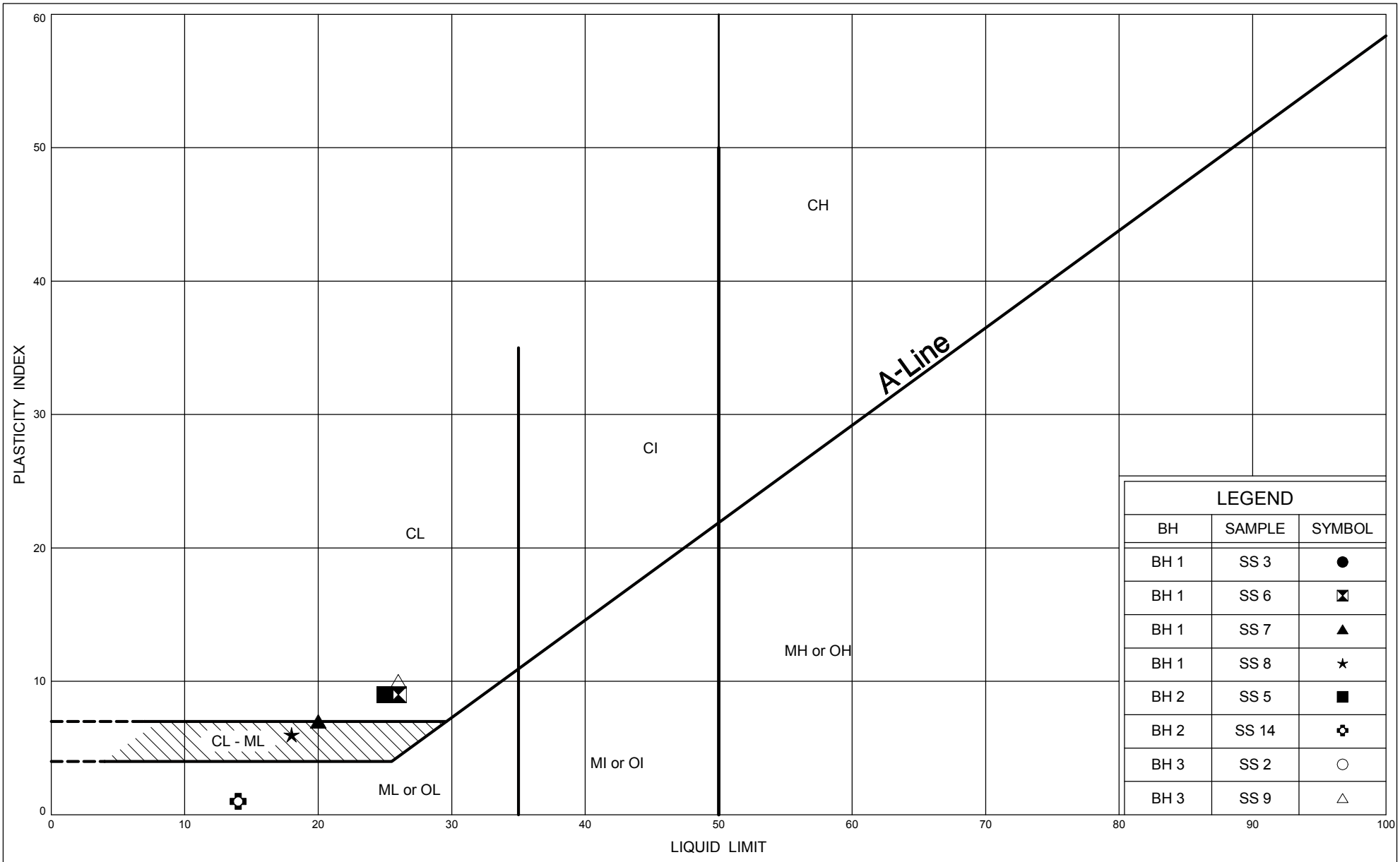
SITE PHOTOGRAPHS

Photograph 3: View of Hwy 410 northbound lanes and existing berm, looking south (5 November 2018).

Photograph 4: View of Hwy 410 southbound lanes, looking south – note exit ramp to Hwy 10 on the right end of the photo (5 November 2018).

APPENDIX C

Laboratory Test Results (Figure Nos. C1 to C9)



LEGEND		
BH	SAMPLE	SYMBOL
BH 1	SS 3	●
BH 1	SS 6	⊠
BH 1	SS 7	▲
BH 1	SS 8	★
BH 2	SS 5	■
BH 2	SS 14	✿
BH 3	SS 2	○
BH 3	SS 9	△

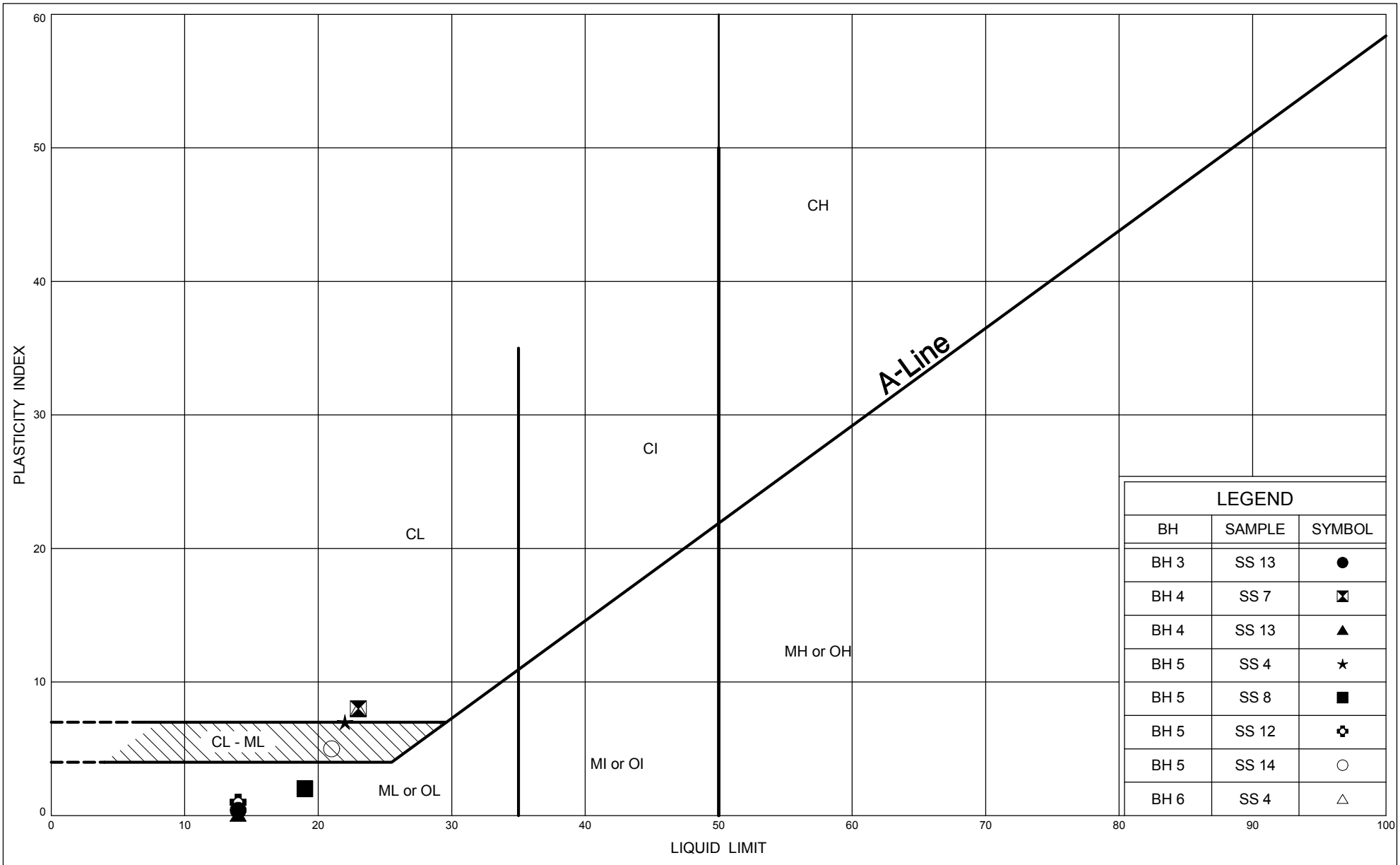
Ministry of Transportation
Ontario

PLASTICITY CHART

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C1



LEGEND		
BH	SAMPLE	SYMBOL
BH 3	SS 13	●
BH 4	SS 7	⊠
BH 4	SS 13	▲
BH 5	SS 4	★
BH 5	SS 8	■
BH 5	SS 12	✿
BH 5	SS 14	○
BH 6	SS 4	△

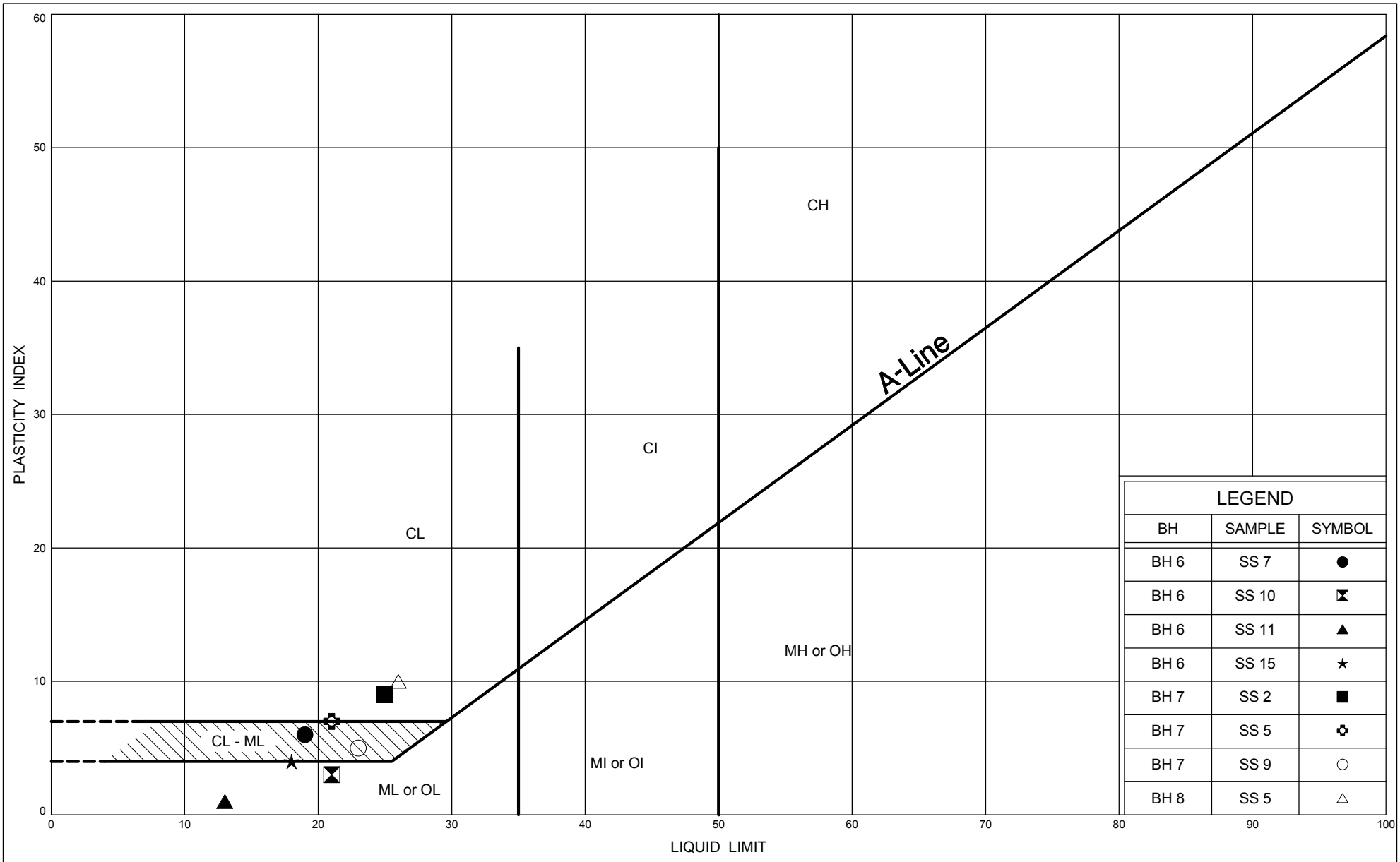
Ministry of Transportation
Ontario

PLASTICITY CHART

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C2



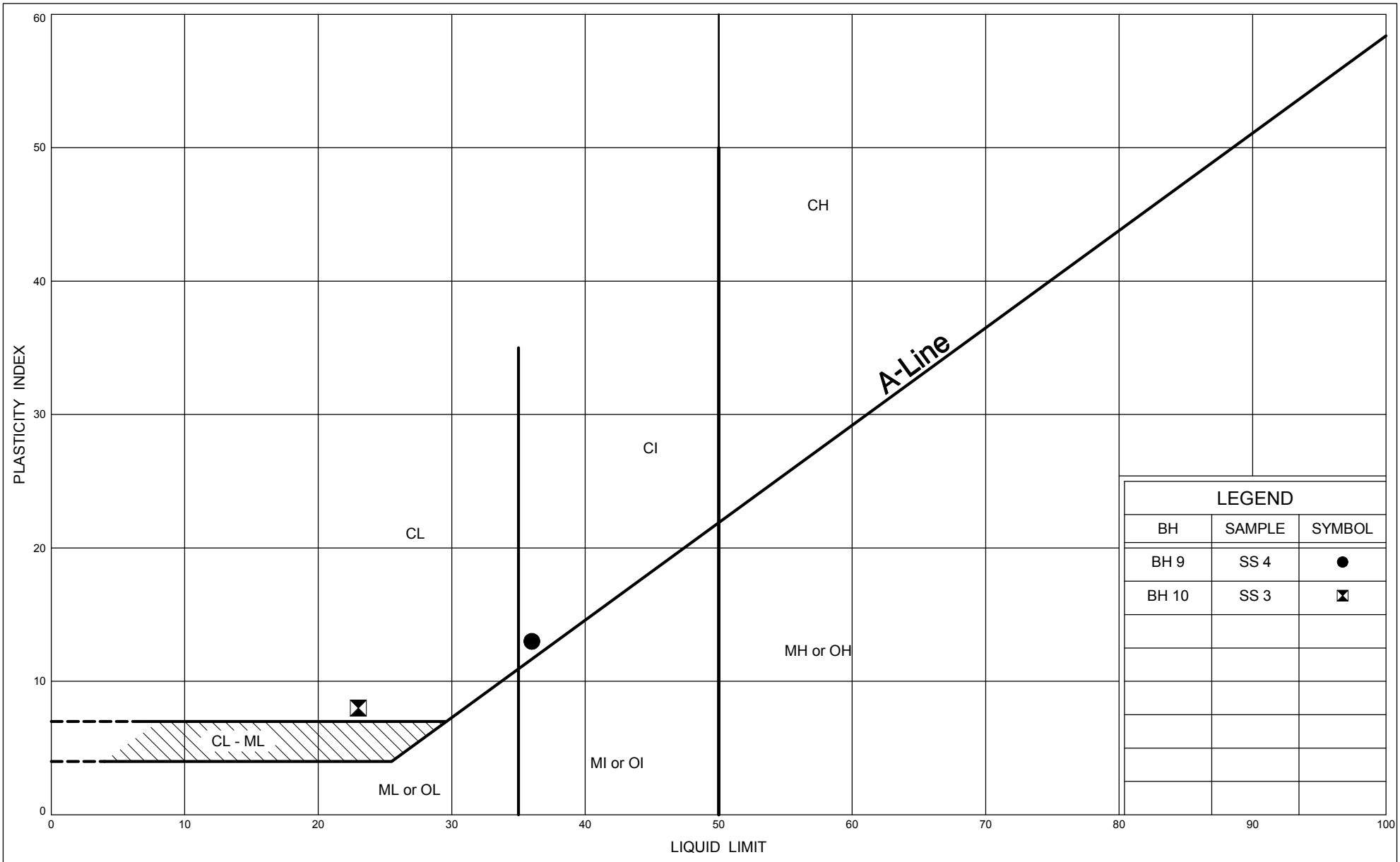
Ministry of Transportation
Ontario

PLASTICITY CHART

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C3



Ministry of Transportation
Ontario

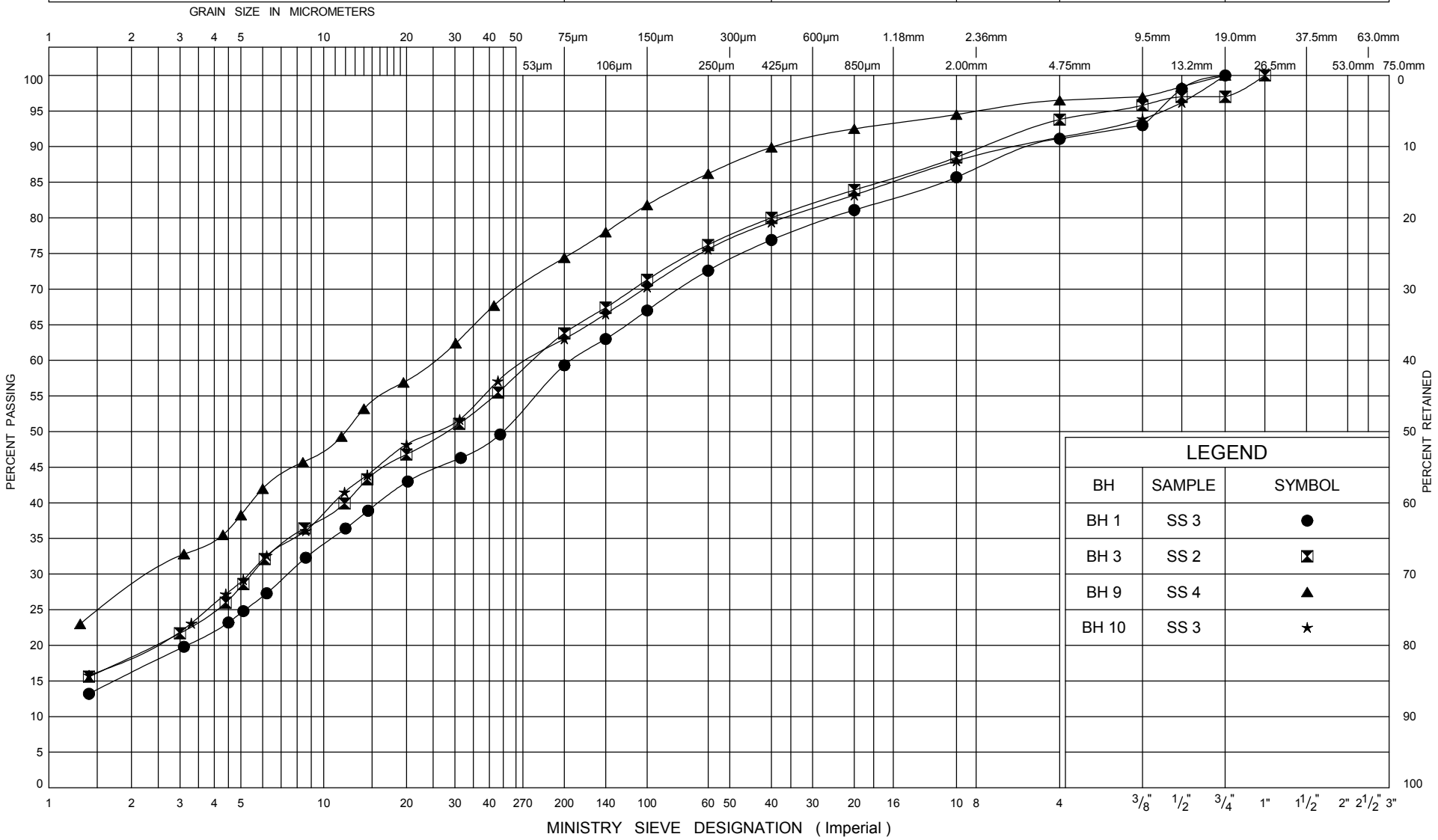
PLASTICITY CHART

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C4

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

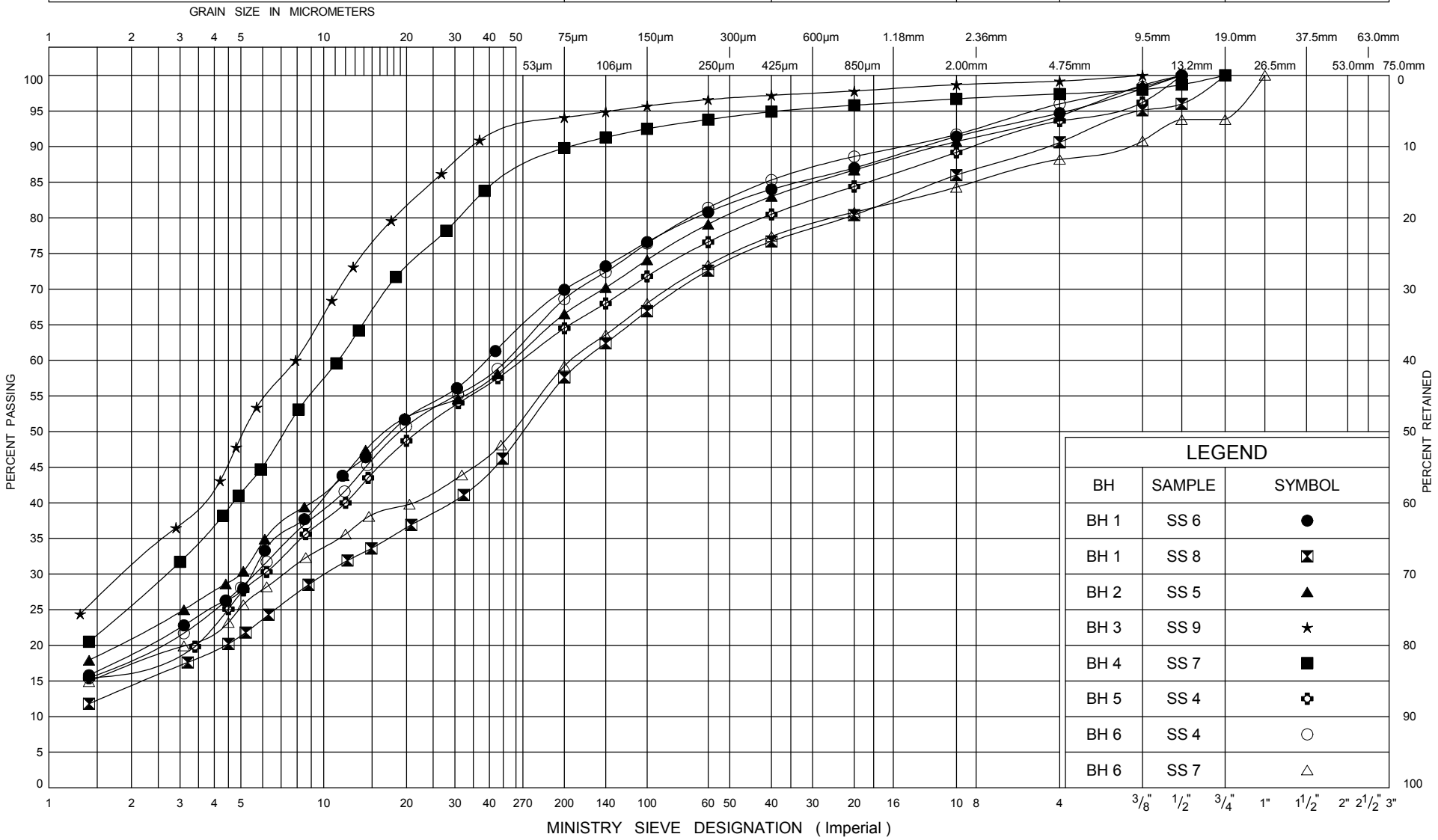
Clayey Silt / Silty Clay FILL

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C5

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

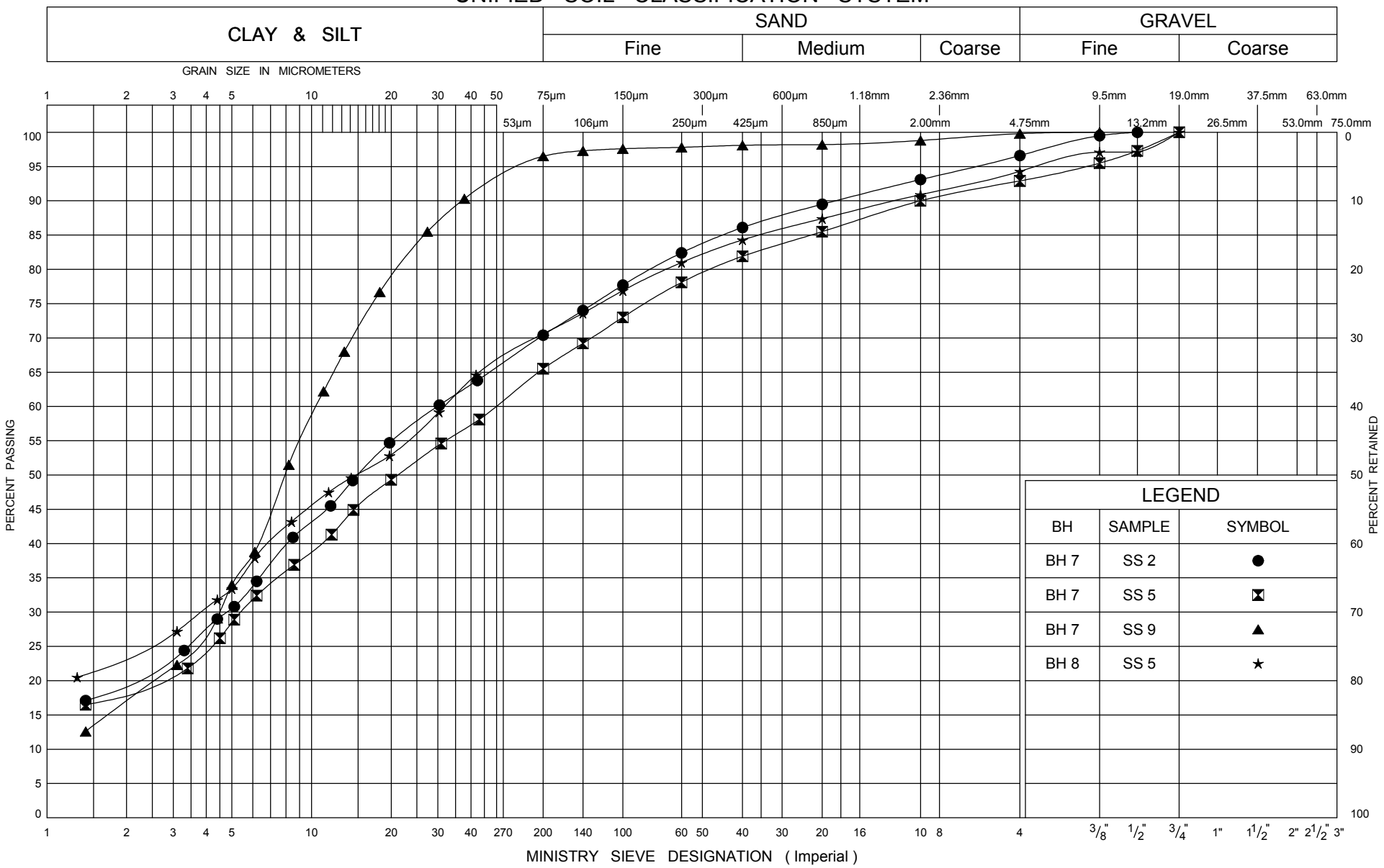
GRAIN SIZE DISTRIBUTION
CLAYEY SILT / SILTY CLAY TILL

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C6

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

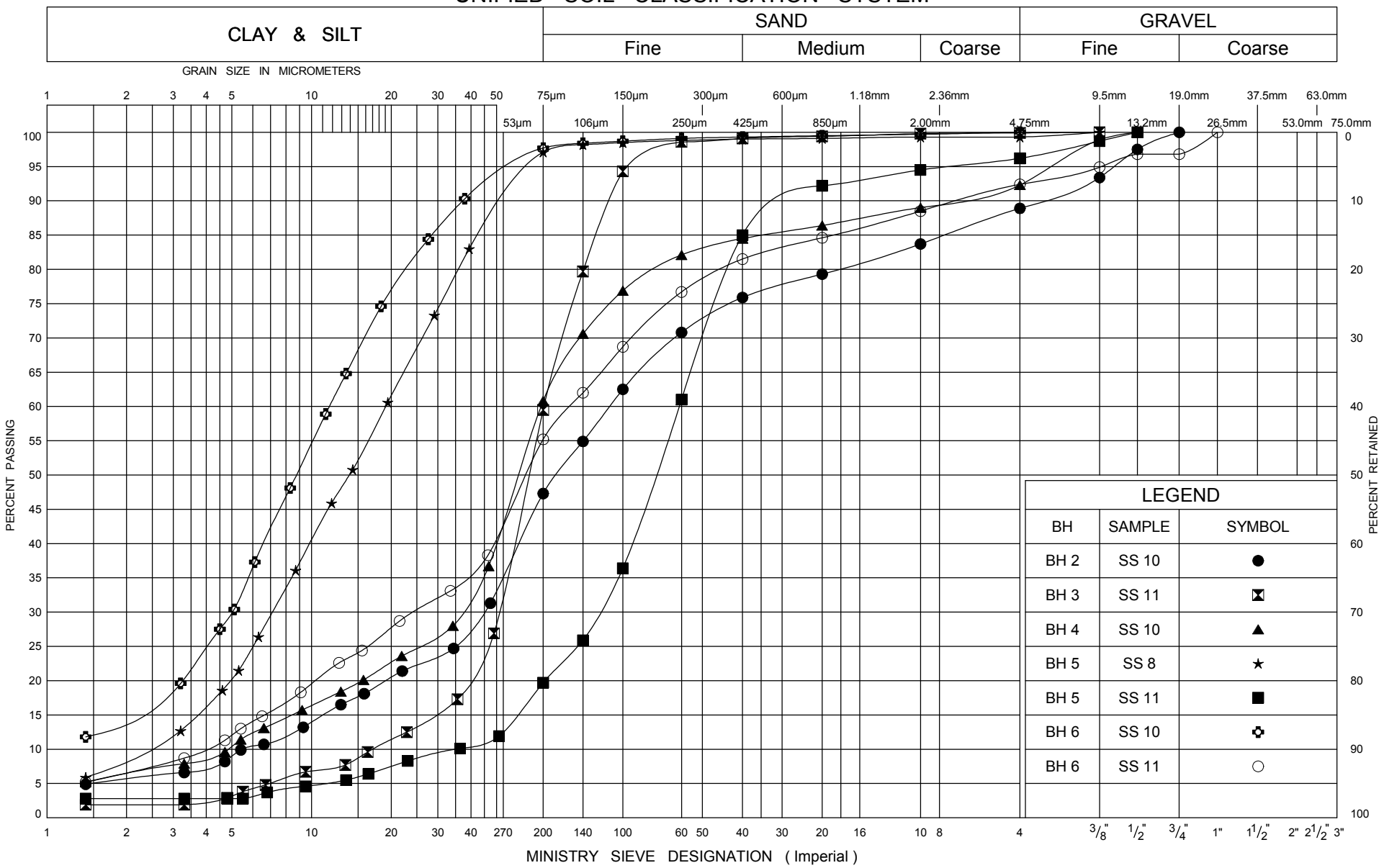
GRAIN SIZE DISTRIBUTION
CLAYEY SILT / SILTY CLAY TILL

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C7

UNIFIED SOIL CLASSIFICATION SYSTEM



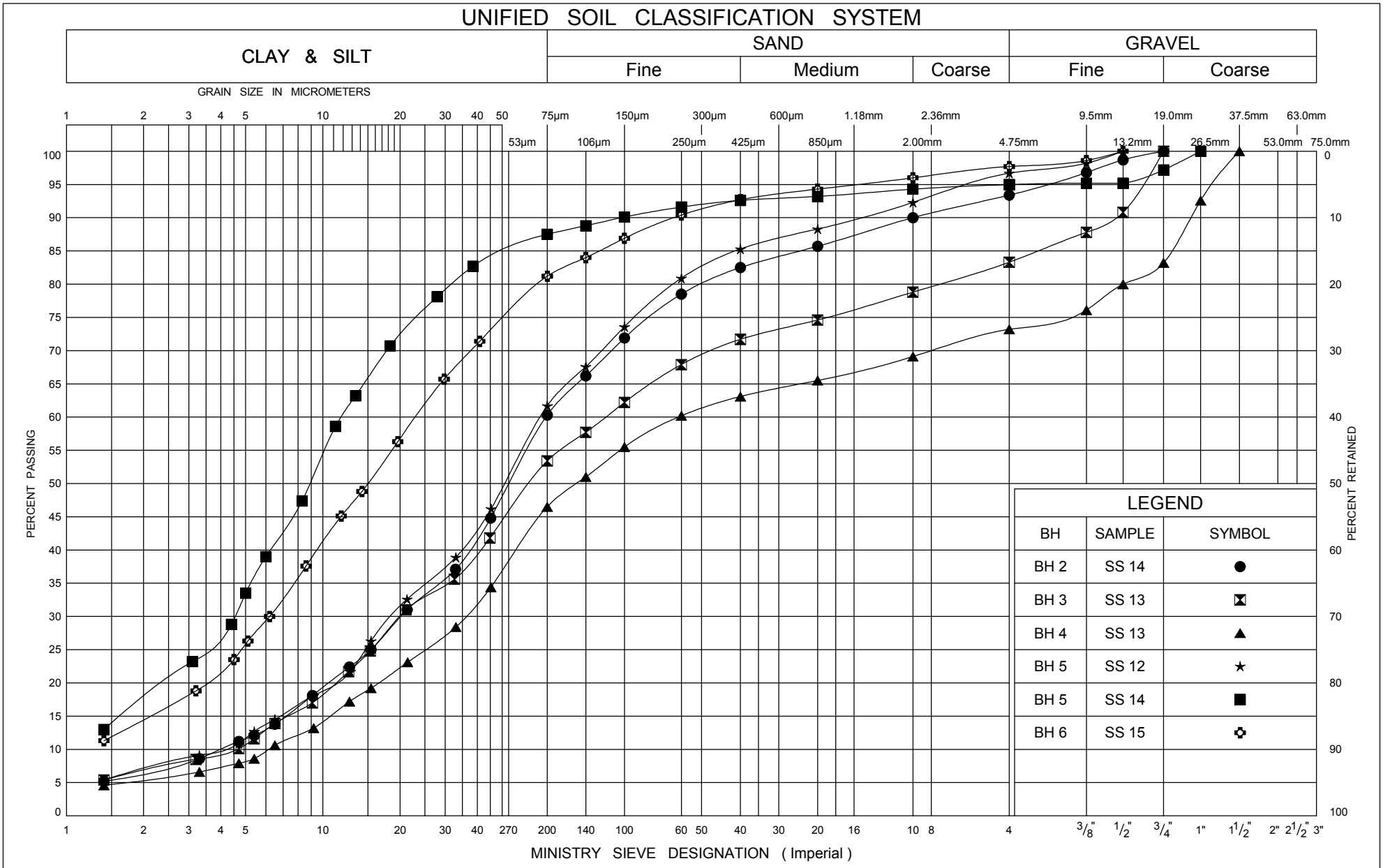
Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION
SAND AND SILT / SANDY SILT / SILT

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C8



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION
SANDY SILT TILL

Foundation Investigation, Bridge over Hwy 410 for Entry Ramp (Hwy 10 to NB Hwy 410), Caledon, ON.

Project No.: TPB166090

Figure No. C9

APPENDIX C

Analytical Results for Soil (Tables 1 to 4)

Table 1 - Analytical Results for Soil
Benzene, toluene, Ethylbenzene, and Xylene (BTEX), Petroleum Hydrocarbons (F1-F4)

Sample Location					Right shoulder of southbound Hwy 410 (west end of proposed abutment)		Right shoulder of northbound Hwy 410 (east end of proposed abutment)
Sample ID					**BH3 SS3**	**DUP 1**	**BH5 SS2**
Soil Type					**Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**	**Silty Sand and Gravel FILL**
Sample Depth (mbgs)					**1.5-2.1**	**1.5-2.1**	**0.8-1.2**
Sampling Date					**17-Oct-18**	**17-Oct-18**	**1-Nov-18**
Laboratory ID					**IBP028**	**IBP033**	**IFK541**
Certificate of Analysis No.					**B8R8406**	**B8R8406**	**B8T5664**
	Lower RDL	**Table 1 SCS**	**Table 2 SCS**	**Table 3 SCS**			
Benzene	0.02	0.02	0.32	0.32	< 0.020	< 0.020	< 0.020
Toluene	0.02	0.2	6.4	68	< 0.020	< 0.020	< 0.020
Ethylbenzene	0.02	0.05	1.1	9.5	< 0.020	< 0.020	< 0.020
m/p xylenes	0.04	NV	NV	NV	< 0.040	< 0.040	< 0.040
o xylene	0.02	NV	NV	NV	< 0.020	< 0.020	< 0.020
Total Xylenes	0.04	0.05	26	26	< 0.040	< 0.040	< 0.040
F1 (C6-C10)	10	25	55	55	< 10	< 10	< 10
F1 (C6-C10) - BTEX	10	25	55	55	< 10	< 10	< 10
F2 (C10-C16 Hydrocarbons)	10	10	230	230	< 10	< 10	< 10
F3 (C16-C34 Hydrocarbons)	50	240	1700	1700	< 50	< 50	< 50
F4 (C34-C50 Hydrocarbons)	50	120	3300	3300	< 50	< 50	< 50

Sample Location					Left shoulder of northbound Hwy 410	Mid-slope of existing berm	Mid-slope of existing berm
Sample ID					**BH7 SS1**	**BH9 SS2**	**BH10 SS5**
Soil Type					**Topsoil-Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**
Sample Depth (mbgs)					**0-0.6**	**0.1-0.6**	**4.6-5.0**
Sampling Date					**2-Nov-18**	**14-Nov-18**	**14-Nov-18**
Laboratory ID					**IFK543**	**IIA269**	**IIA271**
Certificate of Analysis No.					**B8T5664**	**B8U7525**	**B8U7525**
	Lower RDL	**Table 1 SCS**	**Table 2 SCS**	**Table 3 SCS**			
Benzene	0.02	0.02	0.32	0.32	< 0.020	< 0.020	< 0.020
Toluene	0.02	0.2	6.4	68	< 0.020	< 0.020	< 0.020
Ethylbenzene	0.02	0.05	1.1	9.5	< 0.020	< 0.020	< 0.020
m/p xylenes	0.04	NV	NV	NV	< 0.040	< 0.040	< 0.040
o xylene	0.02	NV	NV	NV	< 0.020	< 0.020	< 0.020
Total Xylenes	0.04	0.05	26	26	< 0.040	< 0.040	< 0.040
F1 (C6-C10)	10	25	55	55	< 10	< 10	< 10
F1 (C6-C10) - BTEX	10	25	55	55	< 10	< 10	< 10
F2 (C10-C16 Hydrocarbons)	10	10	230	230	< 10	< 10	< 10
F3 (C16-C34 Hydrocarbons)	50	240	1700	1700	< 50	< 50	< 50
F4 (C34-C50 Hydrocarbons)	50	120	3300	3300	< 50	< 50	< 50

Notes: Ontario Regulation 153/04, as amended, Table 1 Full Depth Background Site Condition Standards (SCS) for residential/parkland/institutional/industrial/commercial/community property use (Table 1 SCS), Table 2 Full Depth Generic SCS in a potable groundwater condition for /industrial/commercial/community property use (Table 2 SCS), Table 3 Full Depth Generic SCS in a non-potable groundwater condition for /industrial/commercial/community property use (Table 3 SCS), and coarse textured soils. All values reported in µg/g (ppm) dry weight basis, unless otherwise noted. Table 1 SCS exceedances indicated in SHADING. Table 2 SCS exceedances indicated in **BOLD**. Table 3 SCS exceedances indicated UNDERLINED. "RDL" means reportable detection limit. "<" indicates not detected above the RDL as shown. "ppm" means parts per million. Field vapour readings shown in ppm unless otherwise noted. "NV" means no value. "NA" means not applicable. "F" means fraction. * If F4 analysis by GC/FID did not reach baseline, F4 gravimetric analysis was conducted. Higher of two F4 values shown. "-" means not analyzed.

Table 2 - Analytical Results for Soil
Metals and Inorganic Parameters

Sample Location					Right shoulder of southbound Hwy 410 (west end of proposed abutment)		Right shoulder of northbound Hwy 410 (east end of proposed abutment)
Sample ID					**BH3 SS3**	**DUP 1**	**BH5 SS2**
Soil Type					**Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**	**Silty Sand and Gravel FILL**
Sample Depth (mbgs)					**1.5-2.1**	**1.5-2.1**	**0.8-1.2**
Sampling Date					**17-Oct-18**	**17-Oct-18**	**1-Nov-18**
Laboratory ID					**IBP028**	**IBP033**	**IFK541**
Certificate of Analysis No.					**B8R8406**	**B8R8406**	**B8T5664**
	Lower RDL	**Table 1 SCS**	**Table 2 SCS**	**Table 3 SCS**			
Antimony	0.2	1.3	40	40	<0.20	<0.20	<0.20
Arsenic	1	18	18	18	4.9	5	6.4
Barium	0.5	220	670	670	61	64	64
Beryllium	0.2	2.5	8	8	0.62	0.66	0.76
Boron (Hot Water Soluble)	0.05	NV	2	2	0.1	0.12	0.061
Cadmium	0.1	1.2	1.9	1.9	<0.10	<0.10	<0.10
Chromium	1	70	160	160	26	22	20
Chromium VI	0.2	0.66	8	8	<0.2	<0.2	<0.2
Cobalt	0.1	21	80	80	11	11	13
Copper	0.5	92	230	230	33	33	36
Lead	1	120	120	120	9.4	9.1	9.2
Mercury	0.05	0.27	3.9	3.9	<0.050	<0.050	<0.050
Molybdenum	0.5	2	40	40	<0.50	<0.50	<0.50
Nickel	0.5	82	270	270	23	23	27
Selenium	0.5	1.5	5.5	5.5	<0.50	<0.50	<0.50
Silver	0.2	0.5	40	40	<0.20	<0.20	<0.20
Thallium	0.05	1	3.3	3.3	0.11	0.11	0.14
Vanadium	5	86	86	86	29	29	27
Zinc	5	290	340	340	58	57	58
pH (pH Units)	NV	NV	NV	NV	7.68	7.73	7.69
Conductivity (ms/cm)	0.002	0.57	1.4	1.4	0.33	0.34	0.19
Sodium Adsorption Ratio	NV	2.4	12	12	1.5	1.1	0.24
Cyanide, Free	0.01	0.051	0.051	0.051	<0.01	<0.01	<0.01
Boron (Total)	5	36	120	120	8.1	8.1	9.4
Uranium	0.05	2.5	33	33	0.59	0.52	0.47

Notes: Ontario Regulation 153/04, as amended, Table 1 Full Depth Background Site Condition Standards (SCS) for residential/parkland/institutional/industrial/commercial/community property use (Table 1 SCS), Table 2 Full Depth Generic SCS in a potable groundwater condition for /industrial/commercial/community property use (Table 2 SCS), Table 3 Full Depth Generic SCS in a non-potable groundwater condition for /industrial/commercial/community property use (Table 3 SCS), and coarse textured soils. All values reported in µg/g (ppm) dry weight basis, unless otherwise noted. Table 1 SCS exceedances indicated in SHADING. Table 2 SCS exceedances indicated in BOLD. Table 3 SCS exceedances indicated UNDERLINED. "<" indicates not detected above the RDL as shown. "ppm" means parts per million. Field vapour readings shown in ppm unless otherwise noted. Field vapour readings shown as combustible organic vapour (COV) / total organic vapour (TOV). "NV" means no value. *To apply generic SCS, pH of soil is to be between 5 and 9 for surface soil (<1.5 mbg) and between 5 and 11 for subsurface soil (>1.5 mbg). "-" means not analyzed.

Table 2 - Analytical Results for Soil
Metals and Inorganic Parameters

Sample Location					Left shoulder of northbound Hwy 410	Mid-slope of existing berm	Mid-slope of existing berm
Sample ID					**BH7 SS1**	**BH9 SS2**	**BH10 SS5**
Soil Type					**Topsoil-Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**
Sample Depth (mbgs)					**0-0.6**	**0.1-0.6**	**4.6-5.0**
Sampling Date					**2-Nov-18**	**14-Nov-18**	**14-Nov-18**
Laboratory ID					**IFK543**	**IIA269**	**IIA271**
Certificate of Analysis No.					**B8T5664**	**B8U7525**	**B8U7525**
	Lower RDL	**Table 1 SCS**	**Table 2 SCS**	**Table 3 SCS**			
Antimony	0.2	1.3	40	40	<0.20	<0.20	<0.20
Arsenic	1	18	18	18	5.3	4.5	3.5
Barium	0.5	220	670	670	60	59	52
Beryllium	0.2	2.5	8	8	0.63	0.6	0.52
Boron (Hot Water Soluble)	0.05	NV	2	2	0.064	0.092	0.27
Cadmium	0.1	1.2	1.9	1.9	<0.10	<0.10	0.17
Chromium	1	70	160	160	19	19	17
Chromium VI	0.2	0.66	8	8	<0.2	<0.2	<0.2
Cobalt	0.1	21	80	80	11	10	9.1
Copper	0.5	92	230	230	30	31	23
Lead	1	120	120	120	9.2	9	9.5
Mercury	0.05	0.27	3.9	3.9	<0.050	<0.050	<0.050
Molybdenum	0.5	2	40	40	<0.50	<0.50	<0.50
Nickel	0.5	82	270	270	24	22	17
Selenium	0.5	1.5	5.5	5.5	<0.50	<0.50	<0.50
Silver	0.2	0.5	40	40	<0.20	<0.20	<0.20
Thallium	0.05	1	3.3	3.3	0.14	0.12	0.1
Vanadium	5	86	86	86	26	27	25
Zinc	5	290	340	340	54	54	50
pH (pH Units)	NV	NV	NV	NV	7.55	7.72	7.33
Conductivity (ms/cm)	0.002	0.57	1.4	1.4	0.83	0.26	0.59
Sodium Adsorption Ratio	NV	2.4	12	12	13	1.1	0.49
Cyanide, Free	0.01	0.051	0.051	0.051	<0.01	<0.01	<0.01
Boron (Total)	5	36	120	120	8.4	7.8	<5.0
Uranium	0.05	2.5	33	33	0.57	0.57	0.48

Notes: Ontario Regulation 153/04, as amended, Table 1 Full Depth Background Site Condition Standards (SCS) for residential/parkland/institutional/industrial/commercial/community property use (Table 1 SCS), Table 2 Full Depth Generic SCS in a potable groundwater condition for /industrial/commercial/community property use (Table 2 SCS), Table 3 Full Depth Generic SCS in a non-potable groundwater condition for /industrial/commercial/community property use (Table 3 SCS), and coarse textured soils. All values reported in µg/g (ppm) dry weight basis, unless otherwise noted. Table 1 SCS exceedances indicated in SHADING. Table 2 SCS exceedances indicated in BOLD. Table 3 SCS exceedances indicated UNDERLINED. "<" indicates not detected above the RDL as shown. "ppm" means parts per million. Field vapour readings shown in ppm unless otherwise noted. Field vapour readings shown as combustible organic vapour (COV) / total organic vapour (TOV). "NV" means no value. *To apply generic SCS, pH of soil is to be between 5 and 9 for surface soil (<1.5 mbg) and between 5 and 11 for subsurface soil (>1.5 mbg). "-" means not analyzed.

Table 3 - Analytical Results for Soil
Polycyclic Aromatic Hydrocarbons

Sample Location					Right shoulder of southbound Hwy 410 (west end of proposed abutment)		Right shoulder of northbound Hwy 410 (east end of proposed abutment)
Sample ID					**BH3 SS3**	**DUP 1**	**BH5 SS2**
Soil Type					**Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**	**Silty Sand and Gravel FILL**
Sample Depth (mbgs)					**1.5-2.1**	**1.5-2.1**	**0.8-1.2**
Sampling Date					**17-Oct-18**	**17-Oct-18**	**1-Nov-18**
Laboratory ID					**IBP028**	**IBP033**	**IFK541**
Certificate of Analysis No.					**B8R8406**	**B8R8406**	**B8T5664**
	Lower RDL	**Table 1 SCS**	**Table 2 SCS**	**Table 3 SCS**			
Acenaphthene	0.005	0.072	21	29	<0.0050	<0.0050	<0.0050
Acenaphthylene	0.005	0.093	0.15	0.17	<0.0050	<0.0050	<0.0050
Anthracene	0.005	0.16	0.67	0.74	<0.0050	<0.0050	<0.0050
Benzo(a)anthracene	0.005	0.36	0.96	0.63	<0.0050	<0.0050	<0.0050
Benzo(a)pyrene	0.005	0.3	0.3	0.3	<0.0050	<0.0050	<0.0050
Benzo(b/j)fluoranthene	0.005	0.47	0.78	0.78	<0.0050	<0.0050	<0.0050
Benzo(ghi)perylene	0.005	0.68	7.8	7.8	<0.0050	<0.0050	<0.0050
Benzo(k)fluoranthene	0.005	0.48	0.78	0.78	<0.0050	<0.0050	<0.0050
Chrysene	0.005	2.8	7.8	7.8	<0.0050	<0.0050	<0.0050
Dibenzo(a,h)anthracene	0.005	0.1	0.1	0.1	<0.0050	<0.0050	<0.0050
Fluoranthene	0.005	0.56	0.69	0.69	<0.0050	<0.0050	<0.0050
Fluorene	0.005	0.12	69	69	<0.0050	<0.0050	<0.0050
Indeno(1,2,3-cd)pyrene	0.005	0.23	0.48	0.48	<0.0050	<0.0050	<0.0050
1-Methylnaphthalene	0.005	0.59	3.4	3.4	<0.0050	0.0074	<0.0050
2-Methylnaphthalene	0.005	0.59	3.4	3.4	<0.0050	0.0068	<0.0050
Naphthalene	0.005	0.09	0.75	0.75	<0.0050	<0.0050	<0.0050
Phenanthrene	0.005	0.69	7.8	7.8	<0.0050	0.0071	<0.0050
Pyrene	0.005	1	78	78	<0.0050	<0.0050	<0.0050
Methylnaphthalene, 2-(1-)	0.0071	0.59	3.4	3.4	<0.0071	0.014	<0.0071

Notes: Ontario Regulation 153/04, as amended, Table 1 Full Depth Background Site Condition Standards (SCS) for residential/parkland/institutional/industrial/commercial/community property use (Table 1 SCS), Table 2 Full Depth Generic SCS in a potable groundwater condition for /industrial/commercial/community property use (Table 2 SCS), Table 3 Full Depth Generic SCS in a non-potable groundwater condition for /industrial/commercial/community property use (Table 3 SCS), and coarse textured soils. All values reported in µg/g (ppm) dry weight basis, unless otherwise noted. Table 1 SCS exceedances indicated in SHADING. Table 2 SCS exceedances indicated in BOLD. Table 3 SCS exceedances indicated UNDERLINED. "RDL" means reportable detection limit. "<" indicates not detected above the RDL as shown. "ppm" means parts per million. Field vapour readings shown in ppm unless otherwise noted. "NV" means no value.

Table 3 - Analytical Results for Soil
Polycyclic Aromatic Hydrocarbons

Sample Location					Left shoulder of northbound Hwy 410	Mid-slope of existing berm
Sample ID					**BH7 SS1**	**BH9 SS2**
Soil Type					**Topsoil-Clayey Silt/Silty Clay FILL**	**Clayey Silt/Silty Clay FILL**
Sample Depth (mbgs)					**0-0.6**	**0.1-0.6**
Sampling Date					**2-Nov-18**	**14-Nov-18**
Laboratory ID					**IFK543**	**IIA269**
Certificate of Analysis No.					**B8T5664**	**B8U7525**
	Lower RDL	**Table 1 SCS**	**Table 2 SCS**	**Table 3 SCS**		
Acenaphthene	0.005	0.072	21	29	<0.0050	<0.0050
Acenaphthylene	0.005	0.093	0.15	0.17	<0.0050	<0.0050
Anthracene	0.005	0.16	0.67	0.74	<0.0050	<0.0050
Benzo(a)anthracene	0.005	0.36	0.96	0.63	<0.0050	<0.0050
Benzo(a)pyrene	0.005	0.3	0.3	0.3	<0.0050	<0.0050
Benzo(b/j)fluoranthene	0.005	0.47	0.78	0.78	<0.0050	0.0075
Benzo(ghi)perylene	0.005	0.68	7.8	7.8	<0.0050	0.0057
Benzo(k)fluoranthene	0.005	0.48	0.78	0.78	<0.0050	<0.0050
Chrysene	0.005	2.8	7.8	7.8	<0.0050	<0.0050
Dibenzo(a,h)anthracene	0.005	0.1	0.1	0.1	<0.0050	<0.0050
Fluoranthene	0.005	0.56	0.69	0.69	<0.0050	0.0075
Fluorene	0.005	0.12	69	69	<0.0050	<0.0050
Indeno(1,2,3-cd)pyrene	0.005	0.23	0.48	0.48	<0.0050	<0.0050
1-Methylnaphthalene	0.005	0.59	3.4	3.4	<0.0050	<0.0050
2-Methylnaphthalene	0.005	0.59	3.4	3.4	<0.0050	<0.0050
Naphthalene	0.005	0.09	0.75	0.75	<0.0050	<0.0050
Phenanthrene	0.005	0.69	7.8	7.8	<0.0050	<0.0050
Pyrene	0.005	1	78	78	<0.0050	0.0062
Methylnaphthalene, 2-(1-)	0.0071	0.59	3.4	3.4	<0.0071	<0.0071

Notes: Ontario Regulation 153/04, as amended, Table 1 Full Depth Background Site Condition Standards (SCS) for residential/parkland/institutional/industrial/commercial/community property use (Table 1 SCS), Table 2 Full Depth Generic SCS in a potable groundwater condition for /industrial/commercial/community property use (Table 2 SCS), Table 3 Full Depth Generic SCS in a non-potable groundwater condition for /industrial/commercial/community property use (Table 3 SCS), and coarse textured soils. All values reported in µg/g (ppm) dry weight basis, unless otherwise noted. Table 1 SCS exceedances indicated in SHADING. Table 2 SCS exceedances indicated in BOLD. Table 3 SCS exceedances indicated UNDERLINED. "RDL" means reportable detection limit. "<" indicates not detected above the RDL as shown. "ppm" means parts per million. Field vapour readings shown in ppm unless otherwise noted. "NV" means no value.

Table 4 - Ontario Regulation 347/90, as amended, for Leachate Analyses Waste Classification

Sample Location			**Southbound and northbound off-ramp to Hwy 10 and mid-slope of existing berm**
Laboratory ID			**IIL061**
Sample ID			**TCLP-410/10**
Sampling Date			**14-Nov-18**
TCLP Leachate	**RDL**	**Schedule 4 Leachate Criteria (mg/L)** **Criteria**	
Leachable Fluoride (F-)	0.1	150.0	0.22
Leachable Free Cyanide	0.01	20.0	<0.01
Leachable Nitrate + Nitrite	1	1000.0	< 1.0
Leachable Arsenic (As)	0.2	2.5	< 0.2
Leachable Barium (Ba)	0.2	100.0	0.5
Leachable Boron (B)	0.1	500.0	0.1
Leachable Cadmium (Cd)	0.05	0.5	< 0.05
Leachable Chromium (Cr)	0.1	5.0	< 0.1
Leachable Lead (Pb)	0.1	5.0	< 0.1
Leachable Mercury (Hg)	0.001	0.1	<0.001
Leachable Selenium (Se)	0.1	1.0	< 0.1
Leachable Silver (Ag)	0.01	5.0	< 0.01
Leachable Uranium (U)	0.01	10.0	< 0.01
Leachable Vinyl Chloride	0.020	0.2	<0.020
Leachable 1,1-Dichloroethylene	0.020	1.4	<0.020
Leachable Methylene Chloride(Dichloromethane)	0.2	5.0	< 0.2
Leachable Methyl Ethyl Ketone (2-Butanone)	1.0	200.0	< 1.0
Leachable Chloroform	0.020	10.0	<0.020
Leachable 1,2-Dichloroethane	0.05	0.5	<0.050
Leachable Carbon Tetrachloride	0.020	0.5	<0.020
Leachable Benzene	0.020	0.5	<0.020
Leachable Trichloroethylene	0.020	5.0	<0.020
Leachable Tetrachloroethylene	0.02	3.0	<0.020
Leachable Chlorobenzene	0.02	8.0	<0.020
Leachable 1,2-Dichlorobenzene	0.05	20.0	<0.050
Leachable 1,4-Dichlorobenzene	0.05	0.5	<0.050
Leachate Benzo(a)pyrene	0.0001	0.001	0.0001
Leachate PCB	0.0030	0.3	< 0.003
Ignitability	NA	NA	NI/NF

Notes: Ontario Regulation 558/00, Schedule 4 Leachate Criteria. All results reported in mg/L except for Ignitability and flammability which have no units. "RDL" means reportable detection limit. "<" indicates not detected above RDL as shown. Schedule 4 exceedances indicated in **BOLD underlined**. "NV" means no value. "NA" means not applicable / not analyzed. "NI/NF means Not Ignitable/Not Flammable.

APPENDIX E

Certificates of Analyses for Soil Chemical Analysis

Maxxam
A Bureau Veritas Group Company

Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/12
Report #: R5480468
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8R8406
Received: 2018/10/19, 14:50

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Methylnaphthalene Sum	2	N/A	2018/11/07	CAM SOP-00301	EPA 8270D m
Hot Water Extractable Boron	2	2018/11/06	2018/11/06	CAM SOP-00408	R153 Ana. Prot. 2011
Chloride (20:1 extract)	2	N/A	2018/10/25	CAM SOP-00463	EPA 325.2 m
Free (WAD) Cyanide	2	2018/11/06	2018/11/07	CAM SOP-00457	OMOE E3015 m
Conductivity	2	N/A	2018/10/24	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	2	2018/11/07	2018/11/08	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	1	2018/11/06	2018/11/08	CAM SOP-00436	EPA 3060/7199 m
Hexavalent Chromium in Soil by IC (1)	1	2018/11/06	2018/11/09	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydro. CCME F1 & BTEX in Soil (2)	2	N/A	2018/11/06	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (3)	2	2018/11/06	2018/11/07	CAM SOP-00316	CCME CWS m
Strong Acid Leachable Metals by ICPMS	2	2018/11/06	2018/11/07	CAM SOP-00447	EPA 6020B m
Moisture	2	N/A	2018/11/05	CAM SOP-00445	Carter 2nd ed 51.2 m
PAH Compounds in Soil by GC/MS (SIM)	2	2018/11/06	2018/11/07	CAM SOP-00318	EPA 8270D m
pH CaCl2 EXTRACT	2	2018/10/23	2018/10/23	CAM SOP-00413	EPA 9045 D m
pH CaCl2 EXTRACT	2	2018/11/07	2018/11/07	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2018/10/22	2018/10/24	CAM SOP-00414	SM 23 2510 m
Sodium Adsorption Ratio (SAR)	2	N/A	2018/11/09	CAM SOP-00102	EPA 6010C
Sulphate (20:1 Extract)	2	N/A	2018/10/25	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/12
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Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B8R8406
Received: 2018/10/19, 14:50

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Soils are reported on a dry weight basis unless otherwise specified.
(2) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

O.REG 153 METALS & INORGANICS PKG (SOIL)

Maxxam ID		IBP028		IBP033		
Sampling Date		2018/10/17 14:10		2018/10/17		
COC Number		n/a		n/a		
	UNITS	BH3 SS3	QC Batch	DUP 1	RDL	QC Batch
Calculated Parameters						
Sodium Adsorption Ratio	N/A	1.5	5820005	1.1		5820005
Inorganics						
Conductivity	mS/cm	0.33	5822965	0.34	0.002	5822965
Moisture	%	14	5821117	14	1.0	5821117
Available (CaCl2) pH	pH	7.68	5823079	7.73		5823079
WAD Cyanide (Free)	ug/g	<0.01	5822752	<0.01	0.01	5822752
Chromium (VI)	ug/g	<0.2	5821915	<0.2	0.2	5822736
Metals						
Hot Water Ext. Boron (B)	ug/g	0.10	5822766	0.12	0.050	5822766
Acid Extractable Antimony (Sb)	ug/g	<0.20	5822906	<0.20	0.20	5822906
Acid Extractable Arsenic (As)	ug/g	4.9	5822906	5.0	1.0	5822906
Acid Extractable Barium (Ba)	ug/g	61	5822906	64	0.50	5822906
Acid Extractable Beryllium (Be)	ug/g	0.62	5822906	0.66	0.20	5822906
Acid Extractable Boron (B)	ug/g	8.1	5822906	8.1	5.0	5822906
Acid Extractable Cadmium (Cd)	ug/g	<0.10	5822906	<0.10	0.10	5822906
Acid Extractable Chromium (Cr)	ug/g	26	5822906	22	1.0	5822906
Acid Extractable Cobalt (Co)	ug/g	11	5822906	11	0.10	5822906
Acid Extractable Copper (Cu)	ug/g	33	5822906	33	0.50	5822906
Acid Extractable Lead (Pb)	ug/g	9.4	5822906	9.1	1.0	5822906
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	5822906	<0.50	0.50	5822906
Acid Extractable Nickel (Ni)	ug/g	23	5822906	23	0.50	5822906
Acid Extractable Selenium (Se)	ug/g	<0.50	5822906	<0.50	0.50	5822906
Acid Extractable Silver (Ag)	ug/g	<0.20	5822906	<0.20	0.20	5822906
Acid Extractable Thallium (Tl)	ug/g	0.11	5822906	0.11	0.050	5822906
Acid Extractable Uranium (U)	ug/g	0.59	5822906	0.52	0.050	5822906
Acid Extractable Vanadium (V)	ug/g	29	5822906	29	5.0	5822906
Acid Extractable Zinc (Zn)	ug/g	58	5822906	57	5.0	5822906
Acid Extractable Mercury (Hg)	ug/g	<0.050	5822906	<0.050	0.050	5822906

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

O.REG 153 PAHS (SOIL)

Maxxam ID		IBP028	IBP033		
Sampling Date		2018/10/17 14:10	2018/10/17		
COC Number		n/a	n/a		
	UNITS	BH3 SS3	DUP 1	RDL	QC Batch
Calculated Parameters					
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	0.014	0.0071	5819935
Polyaromatic Hydrocarbons					
Acenaphthene	ug/g	<0.0050	<0.0050	0.0050	5823654
Acenaphthylene	ug/g	<0.0050	<0.0050	0.0050	5823654
Anthracene	ug/g	<0.0050	<0.0050	0.0050	5823654
Benzo(a)anthracene	ug/g	<0.0050	<0.0050	0.0050	5823654
Benzo(a)pyrene	ug/g	<0.0050	<0.0050	0.0050	5823654
Benzo(b/j)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5823654
Benzo(g,h,i)perylene	ug/g	<0.0050	<0.0050	0.0050	5823654
Benzo(k)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5823654
Chrysene	ug/g	<0.0050	<0.0050	0.0050	5823654
Dibenz(a,h)anthracene	ug/g	<0.0050	<0.0050	0.0050	5823654
Fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5823654
Fluorene	ug/g	<0.0050	<0.0050	0.0050	5823654
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	<0.0050	0.0050	5823654
1-Methylnaphthalene	ug/g	<0.0050	0.0074	0.0050	5823654
2-Methylnaphthalene	ug/g	<0.0050	0.0068	0.0050	5823654
Naphthalene	ug/g	<0.0050	<0.0050	0.0050	5823654
Phenanthrene	ug/g	<0.0050	0.0071	0.0050	5823654
Pyrene	ug/g	<0.0050	<0.0050	0.0050	5823654
Surrogate Recovery (%)					
D10-Anthracene	%	97	94		5823654
D14-Terphenyl (FS)	%	82	84		5823654
D8-Acenaphthylene	%	99	94		5823654

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

O.REG 153 PETROLEUM HYDROCARBONS (SOIL)

Maxxam ID		IBP028	IBP033		
Sampling Date		2018/10/17 14:10	2018/10/17		
COC Number		n/a	n/a		
	UNITS	BH3 SS3	DUP 1	RDL	QC Batch
BTEX & F1 Hydrocarbons					
Benzene	ug/g	<0.020	<0.020	0.020	5821697
Toluene	ug/g	<0.020	<0.020	0.020	5821697
Ethylbenzene	ug/g	<0.020	<0.020	0.020	5821697
o-Xylene	ug/g	<0.020	<0.020	0.020	5821697
p+m-Xylene	ug/g	<0.040	<0.040	0.040	5821697
Total Xylenes	ug/g	<0.040	<0.040	0.040	5821697
F1 (C6-C10)	ug/g	<10	<10	10	5821697
F1 (C6-C10) - BTEX	ug/g	<10	<10	10	5821697
F2-F4 Hydrocarbons					
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	10	5823651
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	50	5823651
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	50	5823651
Reached Baseline at C50	ug/g	Yes	Yes		5823651
Surrogate Recovery (%)					
1,4-Difluorobenzene	%	102	102		5821697
4-Bromofluorobenzene	%	99	96		5821697
D10-Ethylbenzene	%	87	89		5821697
D4-1,2-Dichloroethane	%	114	110		5821697
o-Terphenyl	%	97	95		5823651

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IBP036	IBP037		
Sampling Date		2018/10/16	2018/10/17		
COC Number		n/a	n/a		
	UNITS	BH6 SS4	BH2 SS11	RDL	QC Batch
Calculated Parameters					
Resistivity	ohm-cm	5700	7200		5796016
Inorganics					
Soluble (20:1) Chloride (Cl-)	ug/g	24	<20	20	5799805
Conductivity	umho/cm	176	138	2	5800015
Available (CaCl2) pH	pH	7.84	8.01		5797839
Soluble (20:1) Sulphate (SO4)	ug/g	38	33	20	5799807

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

TEST SUMMARY

Maxxam ID: IBP028
Sample ID: BH3 SS3
Matrix: Soil

Collected: 2018/10/17
Shipped:
Received: 2018/10/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	5819935	N/A	2018/11/07	Automated Statchk
Hot Water Extractable Boron	ICP	5822766	2018/11/06	2018/11/06	Suban Kanapathippllai
Free (WAD) Cyanide	TECH	5822752	2018/11/06	2018/11/07	Louise Harding
Conductivity	AT	5822965	2018/11/07	2018/11/08	Barbara Kalbasi Esfahani
Hexavalent Chromium in Soil by IC	IC/SPEC	5821915	2018/11/06	2018/11/08	Sally Norouz
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5821697	N/A	2018/11/06	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5823651	2018/11/06	2018/11/07	Zhiyue (Frank) Zhu
Strong Acid Leachable Metals by ICPMS	ICP/MS	5822906	2018/11/06	2018/11/07	Daniel Teclu
Moisture	BAL	5821117	N/A	2018/11/05	Min Yang
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	5823654	2018/11/06	2018/11/07	Mitesh Raj
pH CaCl2 EXTRACT	AT	5823079	2018/11/07	2018/11/07	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5820005	N/A	2018/11/09	Automated Statchk

Maxxam ID: IBP033
Sample ID: DUP 1
Matrix: Soil

Collected: 2018/10/17
Shipped:
Received: 2018/10/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	5819935	N/A	2018/11/07	Automated Statchk
Hot Water Extractable Boron	ICP	5822766	2018/11/06	2018/11/06	Suban Kanapathippllai
Free (WAD) Cyanide	TECH	5822752	2018/11/06	2018/11/07	Louise Harding
Conductivity	AT	5822965	2018/11/07	2018/11/08	Barbara Kalbasi Esfahani
Hexavalent Chromium in Soil by IC	IC/SPEC	5822736	2018/11/06	2018/11/09	Sally Norouz
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5821697	N/A	2018/11/06	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5823651	2018/11/06	2018/11/07	Zhiyue (Frank) Zhu
Strong Acid Leachable Metals by ICPMS	ICP/MS	5822906	2018/11/06	2018/11/07	Daniel Teclu
Moisture	BAL	5821117	N/A	2018/11/05	Min Yang
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	5823654	2018/11/06	2018/11/07	Mitesh Raj
pH CaCl2 EXTRACT	AT	5823079	2018/11/07	2018/11/07	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5820005	N/A	2018/11/09	Automated Statchk

Maxxam ID: IBP036
Sample ID: BH6 SS4
Matrix: Soil

Collected: 2018/10/16
Shipped:
Received: 2018/10/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5799805	N/A	2018/10/25	Alina Dobreanu
Conductivity	AT	5800015	N/A	2018/10/24	Barbara Kalbasi Esfahani
pH CaCl2 EXTRACT	AT	5797839	2018/10/23	2018/10/23	Gnana Thomas
Resistivity of Soil		5796016	2018/10/24	2018/10/24	Anastassia Hamanov
Sulphate (20:1 Extract)	KONE/EC	5799807	N/A	2018/10/25	Alina Dobreanu

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Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

TEST SUMMARY

Maxxam ID: IBP037
Sample ID: BH2 SS11
Matrix: Soil

Collected: 2018/10/17
Shipped:
Received: 2018/10/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5799805	N/A	2018/10/25	Alina Dobreanu
Conductivity	AT	5800015	N/A	2018/10/24	Barbara Kalbasi Esfahani
pH CaCl2 EXTRACT	AT	5797839	2018/10/23	2018/10/23	Gnana Thomas
Resistivity of Soil		5796016	2018/10/24	2018/10/24	Anastassia Hamanov
Sulphate (20:1 Extract)	KONE/EC	5799807	N/A	2018/10/25	Alina Dobreanu

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Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	2.7°C

Revised Report (2018/11/12): Metals/Inorganics, PAH and PHC analysis have been included in this report.

BTEX/F1-F4, Free Cyanide Analysis: Samples analyzed past hold time. Analysis performed with client's consent.

Results relate only to the items tested.

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Maxxam Job #: B8R8406
Report Date: 2018/11/12

QUALITY ASSURANCE REPORT

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5821697	1,4-Difluorobenzene	2018/11/06	103	60 - 140	104	60 - 140	101	%		
5821697	4-Bromofluorobenzene	2018/11/06	97	60 - 140	99	60 - 140	98	%		
5821697	D10-Ethylbenzene	2018/11/06	91	60 - 140	102	60 - 140	80	%		
5821697	D4-1,2-Dichloroethane	2018/11/06	112	60 - 140	116	60 - 140	112	%		
5823651	o-Terphenyl	2018/11/06	98	60 - 130	95	60 - 130	96	%		
5823654	D10-Anthracene	2018/11/06	92	50 - 130	96	50 - 130	95	%		
5823654	D14-Terphenyl (FS)	2018/11/06	83	50 - 130	97	50 - 130	86	%		
5823654	D8-Acenaphthylene	2018/11/06	91	50 - 130	97	50 - 130	93	%		
5797839	Available (CaCl2) pH	2018/10/23			100	97 - 103			0.33 (1)	N/A
5799805	Soluble (20:1) Chloride (Cl-)	2018/10/25	NC	70 - 130	106	70 - 130	<20	ug/g	7.9 (1)	35
5799807	Soluble (20:1) Sulphate (SO4)	2018/10/25	115	70 - 130	105	70 - 130	<20	ug/g	NC (1)	35
5800015	Conductivity	2018/10/24			104	90 - 110	<2	umho/cm	9.1 (1)	10
5821117	Moisture	2018/11/05							2.6 (1)	20
5821697	Benzene	2018/11/06	79	60 - 140	99	60 - 140	<0.020	ug/g	NC (1)	50
5821697	Ethylbenzene	2018/11/06	90	60 - 140	100	60 - 140	<0.020	ug/g	NC (1)	50
5821697	F1 (C6-C10) - BTEX	2018/11/06					<10	ug/g	NC (1)	30
5821697	F1 (C6-C10)	2018/11/06	84	60 - 140	99	80 - 120	<10	ug/g	NC (1)	30
5821697	o-Xylene	2018/11/06	89	60 - 140	98	60 - 140	<0.020	ug/g	NC (1)	50
5821697	p+m-Xylene	2018/11/06	90	60 - 140	101	60 - 140	<0.040	ug/g	NC (1)	50
5821697	Toluene	2018/11/06	86	60 - 140	99	60 - 140	<0.020	ug/g	NC (1)	50
5821697	Total Xylenes	2018/11/06					<0.040	ug/g	NC (1)	50
5821915	Chromium (VI)	2018/11/08	82	70 - 130	96	80 - 120	<0.2	ug/g	6.7 (1)	35
5822736	Chromium (VI)	2018/11/09	78	70 - 130	84	80 - 120	<0.2	ug/g	NC (1)	35
5822752	WAD Cyanide (Free)	2018/11/07	94	75 - 125	94	80 - 120	<0.01	ug/g	NC (1)	35
5822766	Hot Water Ext. Boron (B)	2018/11/06	100	75 - 125	96	75 - 125	<0.050	ug/g	35 (1)	40
5822906	Acid Extractable Antimony (Sb)	2018/11/06	101	75 - 125	108	80 - 120	<0.20	ug/g	19 (1)	30
5822906	Acid Extractable Arsenic (As)	2018/11/06	99	75 - 125	100	80 - 120	<1.0	ug/g	9.5 (1)	30
5822906	Acid Extractable Barium (Ba)	2018/11/06	104	75 - 125	98	80 - 120	<0.50	ug/g	9.8 (1)	30
5822906	Acid Extractable Beryllium (Be)	2018/11/06	99	75 - 125	101	80 - 120	<0.20	ug/g	1.1 (1)	30
5822906	Acid Extractable Boron (B)	2018/11/06	91	75 - 125	100	80 - 120	<5.0	ug/g	0.97 (1)	30

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5822906	Acid Extractable Cadmium (Cd)	2018/11/06	99	75 - 125	102	80 - 120	<0.10	ug/g	11 (1)	30
5822906	Acid Extractable Chromium (Cr)	2018/11/06	98	75 - 125	102	80 - 120	<1.0	ug/g	10 (1)	30
5822906	Acid Extractable Cobalt (Co)	2018/11/06	99	75 - 125	102	80 - 120	<0.10	ug/g	4.8 (1)	30
5822906	Acid Extractable Copper (Cu)	2018/11/06	104	75 - 125	101	80 - 120	<0.50	ug/g	6.3 (1)	30
5822906	Acid Extractable Lead (Pb)	2018/11/06	101	75 - 125	102	80 - 120	<1.0	ug/g	4.3 (1)	30
5822906	Acid Extractable Mercury (Hg)	2018/11/06	92	75 - 125	96	80 - 120	<0.050	ug/g	NC (1)	30
5822906	Acid Extractable Molybdenum (Mo)	2018/11/06	104	75 - 125	101	80 - 120	<0.50	ug/g	7.5 (1)	30
5822906	Acid Extractable Nickel (Ni)	2018/11/06	98	75 - 125	106	80 - 120	<0.50	ug/g	5.7 (1)	30
5822906	Acid Extractable Selenium (Se)	2018/11/06	98	75 - 125	101	80 - 120	<0.50	ug/g	NC (1)	30
5822906	Acid Extractable Silver (Ag)	2018/11/06	99	75 - 125	104	80 - 120	<0.20	ug/g	NC (1)	30
5822906	Acid Extractable Thallium (Tl)	2018/11/06	100	75 - 125	103	80 - 120	<0.050	ug/g	11 (1)	30
5822906	Acid Extractable Uranium (U)	2018/11/06	100	75 - 125	101	80 - 120	<0.050	ug/g	5.5 (1)	30
5822906	Acid Extractable Vanadium (V)	2018/11/06	102	75 - 125	98	80 - 120	<5.0	ug/g	1.5 (1)	30
5822906	Acid Extractable Zinc (Zn)	2018/11/06	NC	75 - 125	101	80 - 120	<5.0	ug/g	3.1 (1)	30
5822965	Conductivity	2018/11/08			104	90 - 110	<0.002	mS/cm	1.3 (1)	10
5823079	Available (CaCl2) pH	2018/11/07			100	97 - 103			1.0 (1)	N/A
5823651	F2 (C10-C16 Hydrocarbons)	2018/11/07	100	50 - 130	98	80 - 120	<10	ug/g	NC (1)	30
5823651	F3 (C16-C34 Hydrocarbons)	2018/11/07	101	50 - 130	96	80 - 120	<50	ug/g	NC (1)	30
5823651	F4 (C34-C50 Hydrocarbons)	2018/11/07	96	50 - 130	91	80 - 120	<50	ug/g	NC (1)	30
5823654	1-Methylnaphthalene	2018/11/07	91	50 - 130	98	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	2-Methylnaphthalene	2018/11/07	82	50 - 130	89	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Acenaphthene	2018/11/07	86	50 - 130	93	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Acenaphthylene	2018/11/07	84	50 - 130	87	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Anthracene	2018/11/07	85	50 - 130	90	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Benzo(a)anthracene	2018/11/07	96	50 - 130	99	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Benzo(a)pyrene	2018/11/07	84	50 - 130	94	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Benzo(b/j)fluoranthene	2018/11/07	82	50 - 130	94	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Benzo(g,h,i)perylene	2018/11/07	81	50 - 130	82	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Benzo(k)fluoranthene	2018/11/07	78	50 - 130	86	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Chrysene	2018/11/07	91	50 - 130	96	50 - 130	<0.0050	ug/g	NC (1)	40

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5823654	Dibenz(a,h)anthracene	2018/11/07	80	50 - 130	79	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Fluoranthene	2018/11/07	84	50 - 130	95	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Fluorene	2018/11/07	85	50 - 130	91	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Indeno(1,2,3-cd)pyrene	2018/11/07	84	50 - 130	83	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Naphthalene	2018/11/07	76	50 - 130	82	50 - 130	<0.0050	ug/g	NC (1)	40
5823654	Phenanthrene	2018/11/07	84	50 - 130	92	50 - 130	<0.0050	ug/g	1.2 (1)	40
5823654	Pyrene	2018/11/07	83	50 - 130	96	50 - 130	<0.0050	ug/g	NC (1)	40

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Duplicate Parent ID

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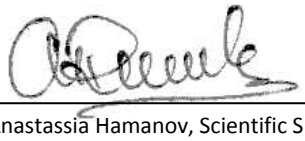
Maxxam Job #: B8R8406
Report Date: 2018/11/12

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required
Company Name:	Wood	Company Name:		Quotation #:	B61973	X Regular TAT (5-7 days) Most analyses
Contact Name:	Accounts Payable	Contact Name:	Alessandro Pellerito	P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	50 Vogell road, Units 3 and 4 , Richmond Hill, L4B 3N6	Address:		Project #:	TPB166090.6000	Rush TAT (Surcharges will be applied)
Phone:	905-415-2632 Fax:	Phone:	Fax:	Site Location:	Highway 410	1 Day 2 Days 3-4 Days
Email:	AP_GTAEAST@woodplc.com	Email:	a.pellerito@woodplc.com; shami.malla@woodplc.com	Site #:		Date Required:
				Sampled By:	Mohammad Safarpanah	Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153: Table 1, Table 2, Table 3, Table ____, Res/Park, Ind/Comm, Agri/ Other, Med/ Fine, Coarse
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations: CCME, MISA, PWQO, Other (Specify), Sanitary Sewer Bylaw, Storm Sewer Bylaw, Region, REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	PAHs	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	HOLD- DO NOT ANALYZE
1	BH1 SS4	10/16/2018	3:50pm	Soil	4								X
2	BH2 SS4	10/17/2018	9:00am	Soil	4								X
3	BH2 SS10	10/17/2018	10:40	Soil	4								X
4	BH3 SS3	10/17/2018	2:10pm	Soil	4								X
5	BH3 SS11	10/17/2018	4:45pm	Soil	4								X
6	BH6 SS2	10/16/2018		Soil	4								X
7	BH6 SS3	10/16/2018		Soil	4								X
8	BH6 SS11	10/16/2018		Soil	4								X
9	DUP1	10/17/2018	-	Soil	4								X
10													

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
Y	Y	2,3,3

COOLING MEDIA PRESENT: Y / N

COMMENTS

19-Oct-18 14:50
Gina Baybayan
B8R8406
VMK ENV-1167

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Alessandro Pellerito	2018/10/19	9:20		2018/10/19	14:50

MW# 33069

Maxxam

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Page 2 of 2

Invoice Information
Company Name: Wood
Contact Name: Accounts Payable
Address: 50 Vogell road, Units 3 and 4 , Richmond Hill, L4B 3N6
Phone: 905-415-2632 Fax:
Email: AP_GTAEAST@woodplc.com

Report Information (if differs from invoice)
Company Name:
Contact Name: Alessandro Pellerito
Address:
Phone: Fax:
Email: a.pellerito@woodplc.com; shami.malla@woodplc.com

Project Information (where applicable)
Quotation #: 861973
P.O. #/ AFE#:
Project #: TP8166090.6000
Site Location: Highway 410
Site #:
Sampled By: Mohammad Safarpanah

Turnaround Time (TAT) Required
[X] Regular TAT (5-7 days) Most analyses
PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Rush TAT (Surcharges will be applied)
[ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Date Required:
Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153
[ ] Table 1 [ ] Res/Park [ ] Med/ Fine
[ ] Table 2 [ ] Ind/Comm [ ] Coarse
[ ] Table 3 [ ] Agri/ Other
[ ] Table ____
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations
[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] MISA [ ] Storm Sewer Bylaw
[ ] PWQO Region
[ ] Other (Specify)
[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	BOLD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	PAHs	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	CORROSIVITY	HOLD- DO NOT ANALYZE
1	BH4 SS2	10/18/2018	9:30am	SOIL	4									
2	BH4 SS10	10/18/2018	11:10am		4									X
3	BH6 SS4	10/18/2018											X	X
4	BH2 SS11	10/17/2018		✓									X	
5														
6														
7														
8														
9														
10														

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	

COOLING MEDIA PRESENT: Y / N

COMMENTS

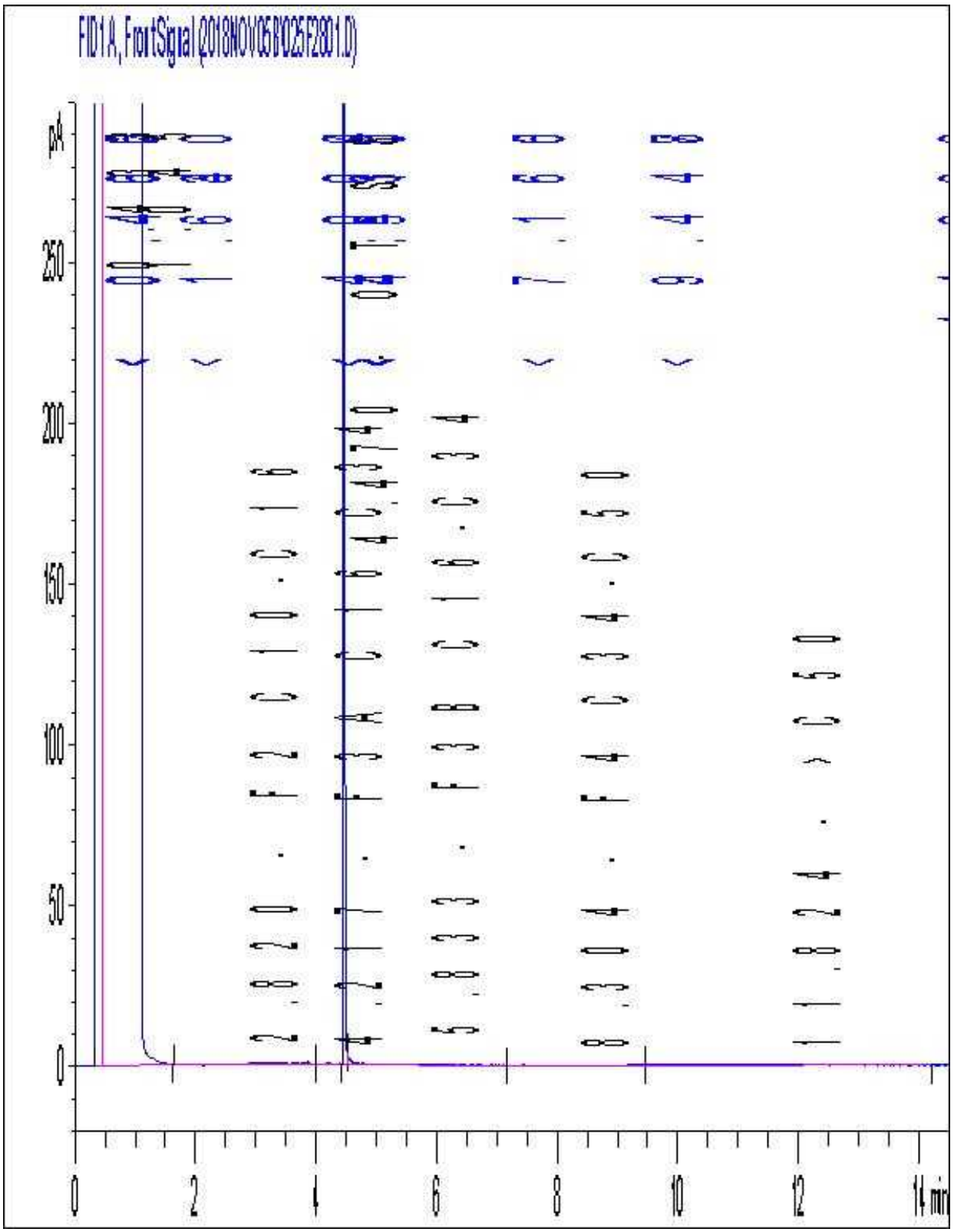
RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Alessandro Pellerito	2018/10/19	9:20	See Page 1		

MAXXAM JOB #

Maxxam Job #: B8R8406
Report Date: 2018/11/12
Maxxam Sample: IBP028

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Project name: HIGHWAY 410
Client ID: BH3 SS3

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

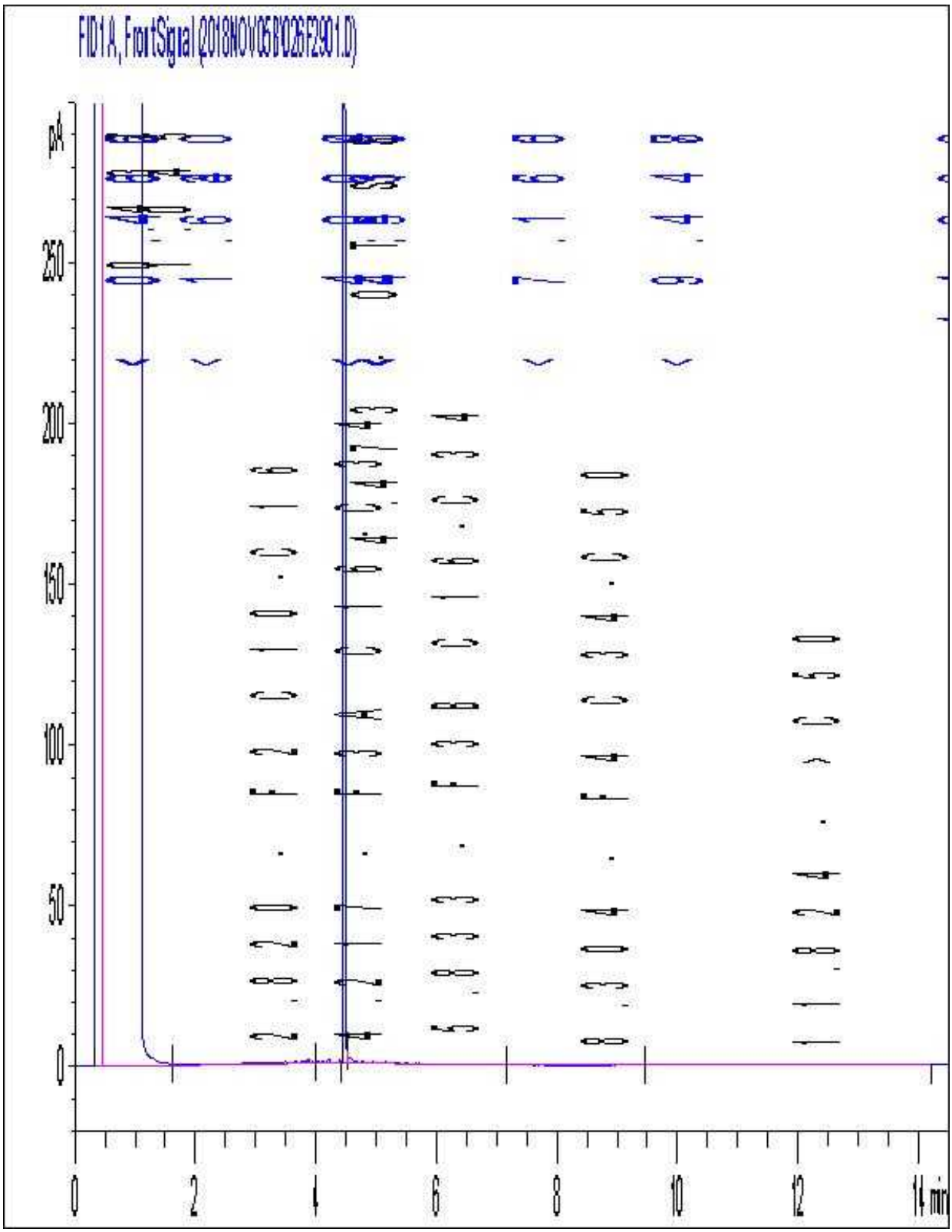


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B8R8406
Report Date: 2018/11/12
Maxxam Sample: IBP033

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Project name: HIGHWAY 410
Client ID: DUP 1

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: TPB166090.600
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/15
Report #: R5485890
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T5664
Received: 2018/11/06, 14:48

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Methylnaphthalene Sum	2	N/A	2018/11/15	CAM SOP-00301	EPA 8270D m
Hot Water Extractable Boron	2	2018/11/12	2018/11/12	CAM SOP-00408	R153 Ana. Prot. 2011
Free (WAD) Cyanide	2	2018/11/12	2018/11/13	CAM SOP-00457	OMOE E3015 m
Conductivity	2	2018/11/14	2018/11/14	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	2	2018/11/10	2018/11/14	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydro. CCME F1 & BTEX in Soil (2)	2	N/A	2018/11/13	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (3)	2	2018/11/13	2018/11/13	CAM SOP-00316	CCME CWS m
Strong Acid Leachable Metals by ICPMS	2	2018/11/10	2018/11/12	CAM SOP-00447	EPA 6020B m
Moisture	2	N/A	2018/11/08	CAM SOP-00445	Carter 2nd ed 51.2 m
PAH Compounds in Soil by GC/MS (SIM)	2	2018/11/13	2018/11/14	CAM SOP-00318	EPA 8270D m
pH CaCl2 EXTRACT	2	2018/11/13	2018/11/13	CAM SOP-00413	EPA 9045 D m
Sodium Adsorption Ratio (SAR)	2	N/A	2018/11/15	CAM SOP-00102	EPA 6010C

Sample Matrix: Solid
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Asbestos by PLM - 0.5 RDL (4)	2	N/A	2018/11/09	COR3SOP-00002	EPA 600R-93/116

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report.

Your Project #: TPB166090.600
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/15
Report #: R5485890
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T5664
Received: 2018/11/06, 14:48

Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Maxxam Analytics' Asbestos Laboratory is accredited by NVLAP for bulk asbestos analysis by polarized light microscopy, NVLAP Code 600136-0.

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Maxxam Analytics' scope of accreditation includes EPA-600/M4-82-020: "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" and EPA-600/R-93/116: "Method for the Determination of Asbestos in Bulk Building Materials".

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Soils are reported on a dry weight basis unless otherwise specified.
(2) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.
(4) P.O.B. - Percent of Bulk

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

O.REG 153 METALS & INORGANICS PKG (SOIL)

Maxxam ID		IFK541	IFK543		
Sampling Date		2018/11/01 09:40	2018/11/02 08:30		
COC Number		n/a	n/a		
	UNITS	**BH5 SS2**	**BH7 SS1**	**RDL**	**QC Batch**
Calculated Parameters					
Sodium Adsorption Ratio	N/A	0.24	13		5826989
Inorganics					
Conductivity	mS/cm	0.19	0.83	0.002	5833105
Moisture	%	10	23	1.0	5828411
Available (CaCl2) pH	pH	7.69	7.55		5832549
WAD Cyanide (Free)	ug/g	<0.01	<0.01	0.01	5832936
Chromium (VI)	ug/g	<0.2	<0.2	0.2	5831518
Metals					
Hot Water Ext. Boron (B)	ug/g	0.061	0.064	0.050	5832167
Acid Extractable Antimony (Sb)	ug/g	<0.20	<0.20	0.20	5831332
Acid Extractable Arsenic (As)	ug/g	6.4	5.3	1.0	5831332
Acid Extractable Barium (Ba)	ug/g	64	60	0.50	5831332
Acid Extractable Beryllium (Be)	ug/g	0.76	0.63	0.20	5831332
Acid Extractable Boron (B)	ug/g	9.4	8.4	5.0	5831332
Acid Extractable Cadmium (Cd)	ug/g	<0.10	<0.10	0.10	5831332
Acid Extractable Chromium (Cr)	ug/g	20	19	1.0	5831332
Acid Extractable Cobalt (Co)	ug/g	13	11	0.10	5831332
Acid Extractable Copper (Cu)	ug/g	36	30	0.50	5831332
Acid Extractable Lead (Pb)	ug/g	9.2	9.2	1.0	5831332
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	<0.50	0.50	5831332
Acid Extractable Nickel (Ni)	ug/g	27	24	0.50	5831332
Acid Extractable Selenium (Se)	ug/g	<0.50	<0.50	0.50	5831332
Acid Extractable Silver (Ag)	ug/g	<0.20	<0.20	0.20	5831332
Acid Extractable Thallium (Tl)	ug/g	0.14	0.14	0.050	5831332
Acid Extractable Uranium (U)	ug/g	0.47	0.57	0.050	5831332
Acid Extractable Vanadium (V)	ug/g	27	26	5.0	5831332
Acid Extractable Zinc (Zn)	ug/g	58	54	5.0	5831332
Acid Extractable Mercury (Hg)	ug/g	<0.050	<0.050	0.050	5831332

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

O.REG 153 PAHS (SOIL)

Maxxam ID		IFK541	IFK543		
Sampling Date		2018/11/01 09:40	2018/11/02 08:30		
COC Number		n/a	n/a		
	UNITS	BH5 SS2	BH7 SS1	RDL	QC Batch
Calculated Parameters					
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	<0.0071	0.0071	5826988
Polyaromatic Hydrocarbons					
Acenaphthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Acenaphthylene	ug/g	<0.0050	<0.0050	0.0050	5833853
Anthracene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(a)anthracene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(a)pyrene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(b/j)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(g,h,i)perylene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(k)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Chrysene	ug/g	<0.0050	<0.0050	0.0050	5833853
Dibenz(a,h)anthracene	ug/g	<0.0050	<0.0050	0.0050	5833853
Fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Fluorene	ug/g	<0.0050	<0.0050	0.0050	5833853
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	<0.0050	0.0050	5833853
1-Methylnaphthalene	ug/g	<0.0050	<0.0050	0.0050	5833853
2-Methylnaphthalene	ug/g	<0.0050	<0.0050	0.0050	5833853
Naphthalene	ug/g	<0.0050	<0.0050	0.0050	5833853
Phenanthrene	ug/g	<0.0050	<0.0050	0.0050	5833853
Pyrene	ug/g	<0.0050	<0.0050	0.0050	5833853
Surrogate Recovery (%)					
D10-Anthracene	%	88	85		5833853
D14-Terphenyl (FS)	%	82	79		5833853
D8-Acenaphthylene	%	82	80		5833853

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

O.REG 153 PETROLEUM HYDROCARBONS (SOIL)

Maxxam ID		IFK541	IFK543		
Sampling Date		2018/11/01 09:40	2018/11/02 08:30		
COC Number		n/a	n/a		
	UNITS	BH5 SS2	BH7 SS1	RDL	QC Batch
BTEX & F1 Hydrocarbons					
Benzene	ug/g	<0.020	<0.020	0.020	5834644
Toluene	ug/g	<0.020	<0.020	0.020	5834644
Ethylbenzene	ug/g	<0.020	<0.020	0.020	5834644
o-Xylene	ug/g	<0.020	<0.020	0.020	5834644
p+m-Xylene	ug/g	<0.040	<0.040	0.040	5834644
Total Xylenes	ug/g	<0.040	<0.040	0.040	5834644
F1 (C6-C10)	ug/g	<10	<10	10	5834644
F1 (C6-C10) - BTEX	ug/g	<10	<10	10	5834644
F2-F4 Hydrocarbons					
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	10	5833889
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	50	5833889
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	50	5833889
Reached Baseline at C50	ug/g	Yes	Yes		5833889
Surrogate Recovery (%)					
1,4-Difluorobenzene	%	102	102		5834644
4-Bromofluorobenzene	%	98	97		5834644
D10-Ethylbenzene	%	88	90		5834644
D4-1,2-Dichloroethane	%	99	99		5834644
o-Terphenyl	%	91	91		5833889

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

Asbestos Analytical Results

EPA/600R-93/116 by Polarized Light Microscopy

BH 4

Maxxam ID: IFK546 Date Analyzed: 2018/11/09

	P.O.B	Sample Morphology	Asbestos	Other Fibres	Particulate
Layer 1	100	Homogeneous grey asphalt	Not Detected		Tar Non-Fibrous

BH 6

Maxxam ID: IFK547 Date Analyzed: 2018/11/09

	P.O.B	Sample Morphology	Asbestos	Other Fibres	Particulate
Layer 1	100	Homogeneous black asphalt	Not Detected		Tar Non-Fibrous

The limit of quantitation is 0.50%, although asbestos may be qualitatively detected at concentrations less than 0.50%. Samples for which asbestos is detected at <0.50% are reported as trace, "<0.50%". "Not Detected" indicates that no asbestos fibres were observed.

Calibrated Visual Estimate (%)
Date Format : yyyy/mm/dd

Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

TEST SUMMARY

Maxxam ID: IFK541
Sample ID: BH5 SS2
Matrix: Soil

Collected: 2018/11/01
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	5826988	N/A	2018/11/15	Automated Statchk
Hot Water Extractable Boron	ICP	5832167	2018/11/12	2018/11/12	Suban Kanapathippllai
Free (WAD) Cyanide	TECH	5832936	2018/11/12	2018/11/13	Louise Harding
Conductivity	AT	5833105	2018/11/14	2018/11/14	Barbara Kalbasi Esfahani
Hexavalent Chromium in Soil by IC	IC/SPEC	5831518	2018/11/10	2018/11/14	Rupinder Sihota
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5834644	N/A	2018/11/13	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5833889	2018/11/13	2018/11/13	Anna Stuglik Rolland
Strong Acid Leachable Metals by ICPMS	ICP/MS	5831332	2018/11/10	2018/11/12	Daniel Teclu
Moisture	BAL	5828411	N/A	2018/11/08	Min Yang
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	5833853	2018/11/13	2018/11/14	Mitesh Raj
pH CaCl2 EXTRACT	AT	5832549	2018/11/13	2018/11/13	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5826989	N/A	2018/11/15	Automated Statchk

Maxxam ID: IFK543
Sample ID: BH7 SS1
Matrix: Soil

Collected: 2018/11/02
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	5826988	N/A	2018/11/15	Automated Statchk
Hot Water Extractable Boron	ICP	5832167	2018/11/12	2018/11/12	Suban Kanapathippllai
Free (WAD) Cyanide	TECH	5832936	2018/11/12	2018/11/13	Louise Harding
Conductivity	AT	5833105	2018/11/14	2018/11/14	Barbara Kalbasi Esfahani
Hexavalent Chromium in Soil by IC	IC/SPEC	5831518	2018/11/10	2018/11/14	Rupinder Sihota
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5834644	N/A	2018/11/13	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5833889	2018/11/13	2018/11/13	Anna Stuglik Rolland
Strong Acid Leachable Metals by ICPMS	ICP/MS	5831332	2018/11/10	2018/11/12	Daniel Teclu
Moisture	BAL	5828411	N/A	2018/11/08	Min Yang
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	5833853	2018/11/13	2018/11/14	Mitesh Raj
pH CaCl2 EXTRACT	AT	5832549	2018/11/13	2018/11/13	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5826989	N/A	2018/11/15	Automated Statchk

Maxxam ID: IFK546
Sample ID: BH 4
Matrix: Solid

Collected: 2018/10/18
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Asbestos by PLM - 0.5 RDL	MIC	5827918	N/A	2018/11/09	Romeo Samson

Maxxam ID: IFK546 Dup
Sample ID: BH 4
Matrix: Solid

Collected: 2018/10/18
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Asbestos by PLM - 0.5 RDL	MIC	5827918	N/A	2018/11/09	Romeo Samson

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

TEST SUMMARY

Maxxam ID: IFK547
Sample ID: BH 6
Matrix: Solid

Collected: 2018/11/01
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Asbestos by PLM - 0.5 RDL	MIC	5827918	N/A	2018/11/09	Romeo Samson

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.0°C
Package 2	20.0°C

Results relate only to the items tested.

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

QUALITY ASSURANCE REPORT

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5833853	D10-Anthracene	2018/11/13	84	50 - 130	86	50 - 130	86	%		
5833853	D14-Terphenyl (FS)	2018/11/13	79	50 - 130	81	50 - 130	80	%		
5833853	D8-Acenaphthylene	2018/11/13	83	50 - 130	84	50 - 130	80	%		
5833889	o-Terphenyl	2018/11/13	91	60 - 130	89	60 - 130	92	%		
5834644	1,4-Difluorobenzene	2018/11/13	101	60 - 140	102	60 - 140	102	%		
5834644	4-Bromofluorobenzene	2018/11/13	98	60 - 140	100	60 - 140	97	%		
5834644	D10-Ethylbenzene	2018/11/13	87	60 - 140	102	60 - 140	83	%		
5834644	D4-1,2-Dichloroethane	2018/11/13	99	60 - 140	99	60 - 140	98	%		
5828411	Moisture	2018/11/08							1.5 (1)	20
5831332	Acid Extractable Antimony (Sb)	2018/11/12	90	75 - 125	103	80 - 120	<0.20	ug/g	4.0 (1)	30
5831332	Acid Extractable Arsenic (As)	2018/11/12	94	75 - 125	104	80 - 120	<1.0	ug/g	2.2 (1)	30
5831332	Acid Extractable Barium (Ba)	2018/11/12	NC	75 - 125	99	80 - 120	<0.50	ug/g	1.2 (1)	30
5831332	Acid Extractable Beryllium (Be)	2018/11/12	95	75 - 125	101	80 - 120	<0.20	ug/g	3.3 (1)	30
5831332	Acid Extractable Boron (B)	2018/11/12	88	75 - 125	98	80 - 120	<5.0	ug/g	3.3 (1)	30
5831332	Acid Extractable Cadmium (Cd)	2018/11/12	94	75 - 125	100	80 - 120	<0.10	ug/g	NC (1)	30
5831332	Acid Extractable Chromium (Cr)	2018/11/12	NC	75 - 125	104	80 - 120	<1.0	ug/g	4.2 (1)	30
5831332	Acid Extractable Cobalt (Co)	2018/11/12	99	75 - 125	103	80 - 120	<0.10	ug/g	2.6 (1)	30
5831332	Acid Extractable Copper (Cu)	2018/11/12	95	75 - 125	101	80 - 120	<0.50	ug/g	0.83 (1)	30
5831332	Acid Extractable Lead (Pb)	2018/11/12	91	75 - 125	103	80 - 120	<1.0	ug/g	3.4 (1)	30
5831332	Acid Extractable Mercury (Hg)	2018/11/12	93	75 - 125	105	80 - 120	<0.050	ug/g	NC (1)	30
5831332	Acid Extractable Molybdenum (Mo)	2018/11/12	97	75 - 125	103	80 - 120	<0.50	ug/g	NC (1)	30
5831332	Acid Extractable Nickel (Ni)	2018/11/12	92	75 - 125	102	80 - 120	<0.50	ug/g	3.0 (1)	30
5831332	Acid Extractable Selenium (Se)	2018/11/12	93	75 - 125	104	80 - 120	<0.50	ug/g	NC (1)	30
5831332	Acid Extractable Silver (Ag)	2018/11/12	94	75 - 125	98	80 - 120	<0.20	ug/g	NC (1)	30
5831332	Acid Extractable Thallium (Tl)	2018/11/12	92	75 - 125	101	80 - 120	<0.050	ug/g	2.2 (1)	30
5831332	Acid Extractable Uranium (U)	2018/11/12	95	75 - 125	103	80 - 120	<0.050	ug/g	3.3 (1)	30
5831332	Acid Extractable Vanadium (V)	2018/11/12	NC	75 - 125	100	80 - 120	<5.0	ug/g	5.5 (1)	30
5831332	Acid Extractable Zinc (Zn)	2018/11/12	NC	75 - 125	106	80 - 120	<5.0	ug/g	1.0 (1)	30
5831518	Chromium (VI)	2018/11/14	41 (2)	70 - 130	87	80 - 120	<0.2	ug/g	NC (1)	35
5832167	Hot Water Ext. Boron (B)	2018/11/12	97	75 - 125	101	75 - 125	<0.050	ug/g	NC (1)	40

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A Bureau Veritas Group Company

Maxxam Job #: B8T5664
Report Date: 2018/11/15

QUALITY ASSURANCE REPORT(CONT'D)

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5832549	Available (CaCl2) pH	2018/11/13			100	97 - 103			0.76 (1)	N/A
5832936	WAD Cyanide (Free)	2018/11/13	85	75 - 125	94	80 - 120	<0.01	ug/g	2.2 (1)	35
5833105	Conductivity	2018/11/14			104	90 - 110	<0.002	mS/cm	0.35 (1)	10
5833853	1-Methylnaphthalene	2018/11/13	108	50 - 130	109	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	2-Methylnaphthalene	2018/11/13	97	50 - 130	95	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Acenaphthene	2018/11/13	87	50 - 130	87	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Acenaphthylene	2018/11/13	78	50 - 130	78	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Anthracene	2018/11/13	81	50 - 130	80	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(a)anthracene	2018/11/13	90	50 - 130	87	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(a)pyrene	2018/11/13	85	50 - 130	85	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(b/j)fluoranthene	2018/11/13	89	50 - 130	92	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(g,h,i)perylene	2018/11/13	81	50 - 130	79	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(k)fluoranthene	2018/11/13	91	50 - 130	91	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Chrysene	2018/11/13	89	50 - 130	89	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Dibenz(a,h)anthracene	2018/11/13	85	50 - 130	82	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Fluoranthene	2018/11/13	88	50 - 130	90	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Fluorene	2018/11/13	95	50 - 130	93	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Indeno(1,2,3-cd)pyrene	2018/11/13	84	50 - 130	83	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Naphthalene	2018/11/13	84	50 - 130	83	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Phenanthrene	2018/11/13	85	50 - 130	85	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Pyrene	2018/11/13	84	50 - 130	85	50 - 130	<0.0050	ug/g	NC (1)	40
5833889	F2 (C10-C16 Hydrocarbons)	2018/11/13	100	50 - 130	99	80 - 120	<10	ug/g	7.6 (1)	30
5833889	F3 (C16-C34 Hydrocarbons)	2018/11/13	95	50 - 130	94	80 - 120	<50	ug/g	NC (1)	30
5833889	F4 (C34-C50 Hydrocarbons)	2018/11/13	94	50 - 130	92	80 - 120	<50	ug/g	NC (1)	30
5834644	Benzene	2018/11/13	73	60 - 140	104	60 - 140	<0.020	ug/g	NC (1)	50
5834644	Ethylbenzene	2018/11/13	77	60 - 140	104	60 - 140	<0.020	ug/g	NC (1)	50
5834644	F1 (C6-C10) - BTEX	2018/11/13					<10	ug/g	NC (1)	30
5834644	F1 (C6-C10)	2018/11/13	86	60 - 140	101	80 - 120	<10	ug/g	NC (1)	30
5834644	o-Xylene	2018/11/13	76	60 - 140	101	60 - 140	<0.020	ug/g	NC (1)	50
5834644	p+m-Xylene	2018/11/13	77	60 - 140	103	60 - 140	<0.040	ug/g	NC (1)	50

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5834644	Toluene	2018/11/13	80	60 - 140	109	60 - 140	<0.020	ug/g	NC (1)	50
5834644	Total Xylenes	2018/11/13					<0.040	ug/g	NC (1)	50

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Duplicate Parent ID

(2) The matrix spike recovery was below the lower control limit. This may be due in part to the reducing environment of the sample. The sample was reanalyzed with the same results.

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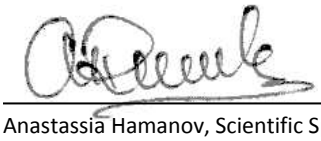
Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

Banu Gurgen-Keough, Supervisor

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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IMMEDIATE

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14031P

SIGNATURE

CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Page _____ of _____

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: Wood.	Company Name:	Quotation #: B61973	[X] Regular TAT (5-7 days) Most analyses
Contact Name: Accounts Payable	Contact Name: Alessandro Pellerito	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 50 Vogell road, Units 3 and 4 , Richmond Hill, L4B 3N6	Address:	Project #: TPB166090.6000	Rush TAT (Surcharges will be applied) [ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Phone: 905-415-2632 Fax:	Phone: Fax:	Site Location: Highway 410	Date Required:
Email: AP_GTAEAST@woodplc.com	Email: a.pellerito@woodplc.com; shami.malla@woodplc.com	Site #:	Rush Confirmation #:
		Sampled By: Mohammad Safarpanah	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153	Other Regulations
[ ] Table 1 [ ] Res/Park [ ] Med/ Fine	[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] Table 2 [ ] Ind/Comm [ ] Coarse	[ ] MISA [ ] Storm Sewer Bylaw
[ ] Table 3 [ ] Agri/ Other	[ ] PWQO Region
[ ] Table _____	[ ] Other (Specify)
FOR RSC (PLEASE CIRCLE) Y / N	[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	PAHs	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	Asbestos	HOLD- DO NOT ANALYZE	COMMENTS
1	BH5 SS2	11/1/2018	9:40	Soil	4										
2	BH5 SS9	11/1/2018	1:00	Soil	4									X	
3	BH7 SS1	11/2/2018	8:30	Soil	4									X	
4	BH7 SS7	11/2/2018	9:40	Soil	4									X	
5	TCLP	11/2/2018	NA	Soil	2									X	
6	BH 4	10/18/2018	9:00	Asphalt	1								X	X	
7	BH 6	11/1/2018	9:00	Asphalt	4								X		
8															
9															
10															

Analysis Requested

LABORATORY USE ONLY		
CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
Y	Y	1 1 1 1
N	N	20/20/20 No Cooling Media

COOLING MEDIA PRESENT: (Y) / N

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Alessandro Pellerito	2018/11/05	11:20	Dipak Singh DIPAK SINGH	2018/11/06	14:48

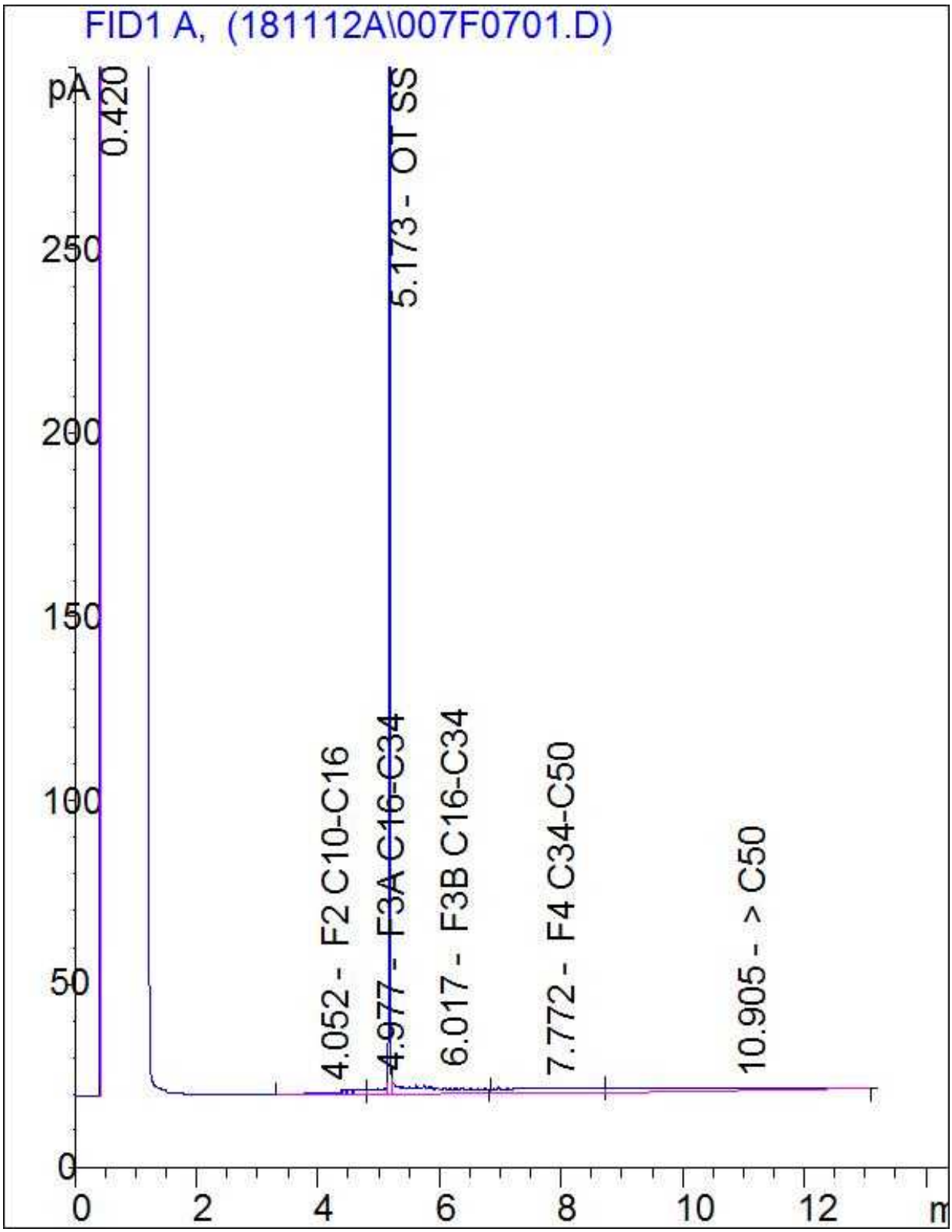
06-Nov-18 14:48
Gina Baybayan
B8T5664
GID ENV-1127

LB#36719

Maxxam Job #: B8T5664
Report Date: 2018/11/15
Maxxam Sample: IFK541

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Project name: HIGHWAY 410
Client ID: BH5 SS2

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

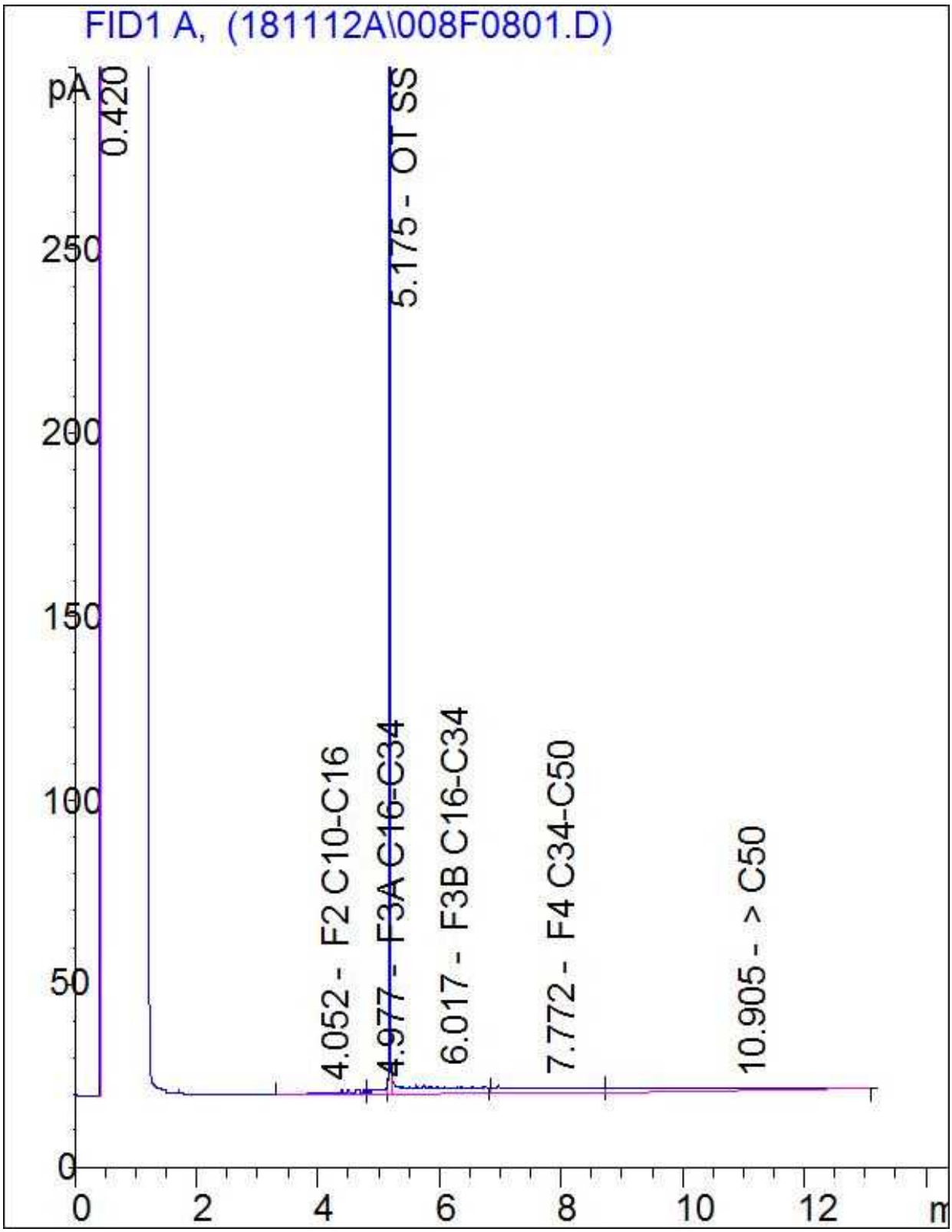


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B8T5664
Report Date: 2018/11/15
Maxxam Sample: IFK543

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Project name: HIGHWAY 410
Client ID: BH7 SS1

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

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Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/26
Report #: R5499575
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8U7525
Received: 2018/11/16, 15:16

Sample Matrix: Soil
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Methylnaphthalene Sum	1	N/A	2018/11/23	CAM SOP-00301	EPA 8270D m
Hot Water Extractable Boron	2	2018/11/21	2018/11/22	CAM SOP-00408	R153 Ana. Prot. 2011
Free (WAD) Cyanide	2	2018/11/21	2018/11/22	CAM SOP-00457	OMOE E3015 m
Conductivity	2	2018/11/22	2018/11/22	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	2	2018/11/20	2018/11/23	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydro. CCME F1 & BTEX in Soil (2)	2	N/A	2018/11/22	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (3)	1	2018/11/20	2018/11/21	CAM SOP-00316	CCME CWS m
Petroleum Hydrocarbons F2-F4 in Soil (3)	1	2018/11/22	2018/11/23	CAM SOP-00316	CCME CWS m
Temporary Hold - 1 Day Fridge	8	N/A	2018/11/16		
Strong Acid Leachable Metals by ICPMS	2	2018/11/21	2018/11/21	CAM SOP-00447	EPA 6020B m
Moisture	2	N/A	2018/11/21	CAM SOP-00445	Carter 2nd ed 51.2 m
PAH Compounds in Soil by GC/MS (SIM)	1	2018/11/22	2018/11/22	CAM SOP-00318	EPA 8270D m
pH CaCl2 EXTRACT	2	2018/11/22	2018/11/22	CAM SOP-00413	EPA 9045 D m
Sodium Adsorption Ratio (SAR)	2	N/A	2018/11/26	CAM SOP-00102	EPA 6010C

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

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Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/26
Report #: R5499575
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8U7525
Received: 2018/11/16, 15:16

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Soils are reported on a dry weight basis unless otherwise specified.
(2) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B8U7525
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

O.REG 153 METALS & INORGANICS PKG (SOIL)

Maxxam ID		IIA269		IIA271		
Sampling Date		2018/11/14 12:15		2018/11/14 10:55		
COC Number		n/a		n/a		
	UNITS	BH9 SS2	QC Batch	BH10 SS5	RDL	QC Batch
Calculated Parameters						
Sodium Adsorption Ratio	N/A	1.1	5846330	0.49		5844278
Inorganics						
Conductivity	mS/cm	0.26	5849832	0.59	0.002	5849832
Moisture	%	13	5848748	17	1.0	5848748
Available (CaCl2) pH	pH	7.72	5849649	7.33		5849649
WAD Cyanide (Free)	ug/g	<0.01	5849074	<0.01	0.01	5849074
Chromium (VI)	ug/g	<0.2	5847575	<0.2	0.2	5847575
Metals						
Hot Water Ext. Boron (B)	ug/g	0.092	5848803	0.27	0.050	5848803
Acid Extractable Antimony (Sb)	ug/g	<0.20	5849039	<0.20	0.20	5849039
Acid Extractable Arsenic (As)	ug/g	4.5	5849039	3.5	1.0	5849039
Acid Extractable Barium (Ba)	ug/g	59	5849039	52	0.50	5849039
Acid Extractable Beryllium (Be)	ug/g	0.60	5849039	0.52	0.20	5849039
Acid Extractable Boron (B)	ug/g	7.8	5849039	<5.0	5.0	5849039
Acid Extractable Cadmium (Cd)	ug/g	<0.10	5849039	0.17	0.10	5849039
Acid Extractable Chromium (Cr)	ug/g	19	5849039	17	1.0	5849039
Acid Extractable Cobalt (Co)	ug/g	10	5849039	9.1	0.10	5849039
Acid Extractable Copper (Cu)	ug/g	31	5849039	23	0.50	5849039
Acid Extractable Lead (Pb)	ug/g	9.0	5849039	9.5	1.0	5849039
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	5849039	<0.50	0.50	5849039
Acid Extractable Nickel (Ni)	ug/g	22	5849039	17	0.50	5849039
Acid Extractable Selenium (Se)	ug/g	<0.50	5849039	<0.50	0.50	5849039
Acid Extractable Silver (Ag)	ug/g	<0.20	5849039	<0.20	0.20	5849039
Acid Extractable Thallium (Tl)	ug/g	0.12	5849039	0.10	0.050	5849039
Acid Extractable Uranium (U)	ug/g	0.57	5849039	0.48	0.050	5849039
Acid Extractable Vanadium (V)	ug/g	27	5849039	25	5.0	5849039
Acid Extractable Zinc (Zn)	ug/g	54	5849039	50	5.0	5849039
Acid Extractable Mercury (Hg)	ug/g	<0.050	5849039	<0.050	0.050	5849039

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8U7525
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

O.REG 153 PAHS (SOIL)

Maxxam ID		IIA269		
Sampling Date		2018/11/14 12:15		
COC Number		n/a		
	UNITS	BH9 SS2	RDL	QC Batch
Calculated Parameters				
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	0.0071	5846329
Polyaromatic Hydrocarbons				
Acenaphthene	ug/g	<0.0050	0.0050	5851504
Acenaphthylene	ug/g	<0.0050	0.0050	5851504
Anthracene	ug/g	<0.0050	0.0050	5851504
Benzo(a)anthracene	ug/g	<0.0050	0.0050	5851504
Benzo(a)pyrene	ug/g	<0.0050	0.0050	5851504
Benzo(b/j)fluoranthene	ug/g	0.0075	0.0050	5851504
Benzo(g,h,i)perylene	ug/g	0.0057	0.0050	5851504
Benzo(k)fluoranthene	ug/g	<0.0050	0.0050	5851504
Chrysene	ug/g	<0.0050	0.0050	5851504
Dibenz(a,h)anthracene	ug/g	<0.0050	0.0050	5851504
Fluoranthene	ug/g	0.0075	0.0050	5851504
Fluorene	ug/g	<0.0050	0.0050	5851504
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	0.0050	5851504
1-Methylnaphthalene	ug/g	<0.0050	0.0050	5851504
2-Methylnaphthalene	ug/g	<0.0050	0.0050	5851504
Naphthalene	ug/g	<0.0050	0.0050	5851504
Phenanthrene	ug/g	<0.0050	0.0050	5851504
Pyrene	ug/g	0.0062	0.0050	5851504
Surrogate Recovery (%)				
D10-Anthracene	%	93		5851504
D14-Terphenyl (FS)	%	94		5851504
D8-Acenaphthylene	%	89		5851504

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B8U7525
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

O.REG 153 PETROLEUM HYDROCARBONS (SOIL)

Maxxam ID		IIA269		IIA271		
Sampling Date		2018/11/14 12:15		2018/11/14 10:55		
COC Number		n/a		n/a		
	UNITS	BH9 SS2	QC Batch	BH10 SS5	RDL	QC Batch
BTEX & F1 Hydrocarbons						
Benzene	ug/g	<0.020	5850968	<0.020	0.020	5850968
Toluene	ug/g	<0.020	5850968	<0.020	0.020	5850968
Ethylbenzene	ug/g	<0.020	5850968	<0.020	0.020	5850968
o-Xylene	ug/g	<0.020	5850968	<0.020	0.020	5850968
p+m-Xylene	ug/g	<0.040	5850968	<0.040	0.040	5850968
Total Xylenes	ug/g	<0.040	5850968	<0.040	0.040	5850968
F1 (C6-C10)	ug/g	<10	5850968	<10	10	5850968
F1 (C6-C10) - BTEX	ug/g	<10	5850968	<10	10	5850968
F2-F4 Hydrocarbons						
F2 (C10-C16 Hydrocarbons)	ug/g	<10	5851518	<10	10	5846823
F3 (C16-C34 Hydrocarbons)	ug/g	<50	5851518	<50	50	5846823
F4 (C34-C50 Hydrocarbons)	ug/g	<50	5851518	<50	50	5846823
Reached Baseline at C50	ug/g	Yes	5851518	Yes		5846823
Surrogate Recovery (%)						
1,4-Difluorobenzene	%	100	5850968	100		5850968
4-Bromofluorobenzene	%	109	5850968	109		5850968
D10-Ethylbenzene	%	95	5850968	97		5850968
D4-1,2-Dichloroethane	%	94	5850968	94		5850968
o-Terphenyl	%	101	5851518	96		5846823

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8U7525
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

TEST SUMMARY

Maxxam ID: IIA268 **Collected:** 2018/11/14
Sample ID: BH8 SS4 **Shipped:**
Matrix: Soil **Received:** 2018/11/16

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Temporary Hold - 1 Day Fridge		0			Isha Chugh

Maxxam ID: IIA269 **Collected:** 2018/11/14
Sample ID: BH9 SS2 **Shipped:**
Matrix: Soil **Received:** 2018/11/16

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	5846329	N/A	2018/11/23	Automated Statchk
Hot Water Extractable Boron	ICP	5848803	2018/11/21	2018/11/22	Archana Patel
Free (WAD) Cyanide	TECH	5849074	2018/11/21	2018/11/22	Louise Harding
Conductivity	AT	5849832	2018/11/22	2018/11/22	Kazzandra Adeva
Hexavalent Chromium in Soil by IC	IC/SPEC	5847575	2018/11/20	2018/11/23	Sally Norouz
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5850968	N/A	2018/11/22	Joe Paino
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5851518	2018/11/22	2018/11/23	Zhiyue (Frank) Zhu
Strong Acid Leachable Metals by ICPMS	ICP/MS	5849039	2018/11/21	2018/11/21	Matthew Ritenburg
Moisture	BAL	5848748	N/A	2018/11/21	Prgya Panchal
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	5851504	2018/11/22	2018/11/22	Mitesh Raj
pH CaCl2 EXTRACT	AT	5849649	2018/11/22	2018/11/22	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5846330	N/A	2018/11/26	Automated Statchk

Maxxam ID: IIA270 **Collected:** 2018/11/14
Sample ID: BH10 SS2 **Shipped:**
Matrix: Soil **Received:** 2018/11/16

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Temporary Hold - 1 Day Fridge		0			Isha Chugh

Maxxam ID: IIA271 **Collected:** 2018/11/14
Sample ID: BH10 SS5 **Shipped:**
Matrix: Soil **Received:** 2018/11/16

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	5848803	2018/11/21	2018/11/22	Archana Patel
Free (WAD) Cyanide	TECH	5849074	2018/11/21	2018/11/22	Louise Harding
Conductivity	AT	5849832	2018/11/22	2018/11/22	Kazzandra Adeva
Hexavalent Chromium in Soil by IC	IC/SPEC	5847575	2018/11/20	2018/11/23	Sally Norouz
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5850968	N/A	2018/11/22	Joe Paino
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5846823	2018/11/20	2018/11/21	Zhiyue (Frank) Zhu
Strong Acid Leachable Metals by ICPMS	ICP/MS	5849039	2018/11/21	2018/11/21	Matthew Ritenburg
Moisture	BAL	5848748	N/A	2018/11/21	Prgya Panchal
pH CaCl2 EXTRACT	AT	5849649	2018/11/22	2018/11/22	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5844278	N/A	2018/11/26	Automated Statchk

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Maxxam Job #: B8U7525
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

TEST SUMMARY

Maxxam ID: IIA272
Sample ID: TCLP
Matrix: Soil

Collected: 2018/11/14
Shipped:
Received: 2018/11/16

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Temporary Hold - 1 Day Fridge		0			Isha Chugh

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Maxxam Job #: B8U7525
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.3°C

Results relate only to the items tested.

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Maxxam Job #: B8U7525
Report Date: 2018/11/26

QUALITY ASSURANCE REPORT

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5846823	o-Terphenyl	2018/11/21	105	60 - 130	107	60 - 130	101	%		
5850968	1,4-Difluorobenzene	2018/11/22	100	60 - 140	98	60 - 140	101	%		
5850968	4-Bromofluorobenzene	2018/11/22	109	60 - 140	110	60 - 140	109	%		
5850968	D10-Ethylbenzene	2018/11/22	95	60 - 140	104	60 - 140	92	%		
5850968	D4-1,2-Dichloroethane	2018/11/22	94	60 - 140	92	60 - 140	95	%		
5851504	D10-Anthracene	2018/11/22	93	50 - 130	96	50 - 130	103	%		
5851504	D14-Terphenyl (FS)	2018/11/22	92	50 - 130	95	50 - 130	97	%		
5851504	D8-Acenaphthylene	2018/11/22	88	50 - 130	91	50 - 130	91	%		
5851518	o-Terphenyl	2018/11/23	110	60 - 130	111	60 - 130	103	%		
5846823	F2 (C10-C16 Hydrocarbons)	2018/11/21	110	50 - 130	109	80 - 120	<10	ug/g	NC (1)	30
5846823	F3 (C16-C34 Hydrocarbons)	2018/11/21	104	50 - 130	103	80 - 120	<50	ug/g	NC (1)	30
5846823	F4 (C34-C50 Hydrocarbons)	2018/11/21	93	50 - 130	96	80 - 120	<50	ug/g	NC (1)	30
5847575	Chromium (VI)	2018/11/23	85	70 - 130	88	80 - 120	<0.2	ug/g	NC (1)	35
5848748	Moisture	2018/11/21							3.7 (1)	20
5848803	Hot Water Ext. Boron (B)	2018/11/22	101	75 - 125	101	75 - 125	<0.050	ug/g	4.5 (1)	40
5849039	Acid Extractable Antimony (Sb)	2018/11/21	103	75 - 125	102	80 - 120	<0.20	ug/g	NC (1)	30
5849039	Acid Extractable Arsenic (As)	2018/11/21	106	75 - 125	100	80 - 120	<1.0	ug/g	NC (1)	30
5849039	Acid Extractable Barium (Ba)	2018/11/21	102	75 - 125	95	80 - 120	<0.50	ug/g	16 (1)	30
5849039	Acid Extractable Beryllium (Be)	2018/11/21	103	75 - 125	98	80 - 120	<0.20	ug/g	NC (1)	30
5849039	Acid Extractable Boron (B)	2018/11/21	98	75 - 125	96	80 - 120	<5.0	ug/g	NC (1)	30
5849039	Acid Extractable Cadmium (Cd)	2018/11/21	103	75 - 125	98	80 - 120	<0.10	ug/g	NC (1)	30
5849039	Acid Extractable Chromium (Cr)	2018/11/21	106	75 - 125	99	80 - 120	<1.0	ug/g	11 (1)	30
5849039	Acid Extractable Cobalt (Co)	2018/11/21	105	75 - 125	99	80 - 120	<0.10	ug/g	7.5 (1)	30
5849039	Acid Extractable Copper (Cu)	2018/11/21	104	75 - 125	98	80 - 120	<0.50	ug/g	6.5 (1)	30
5849039	Acid Extractable Lead (Pb)	2018/11/21	102	75 - 125	100	80 - 120	<1.0	ug/g	5.8 (1)	30
5849039	Acid Extractable Mercury (Hg)	2018/11/21	96	75 - 125	93	80 - 120	<0.050	ug/g	NC (1)	30
5849039	Acid Extractable Molybdenum (Mo)	2018/11/21	103	75 - 125	99	80 - 120	<0.50	ug/g	NC (1)	30
5849039	Acid Extractable Nickel (Ni)	2018/11/21	103	75 - 125	102	80 - 120	<0.50	ug/g	16 (1)	30
5849039	Acid Extractable Selenium (Se)	2018/11/21	106	75 - 125	101	80 - 120	<0.50	ug/g	NC (1)	30
5849039	Acid Extractable Silver (Ag)	2018/11/21	103	75 - 125	100	80 - 120	<0.20	ug/g	NC (1)	30

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5849039	Acid Extractable Thallium (Tl)	2018/11/21	102	75 - 125	102	80 - 120	<0.050	ug/g	NC (1)	30
5849039	Acid Extractable Uranium (U)	2018/11/21	104	75 - 125	99	80 - 120	<0.050	ug/g	1.0 (1)	30
5849039	Acid Extractable Vanadium (V)	2018/11/21	102	75 - 125	100	80 - 120	<5.0	ug/g	12 (1)	30
5849039	Acid Extractable Zinc (Zn)	2018/11/21	113	75 - 125	103	80 - 120	<5.0	ug/g	27 (1)	30
5849074	WAD Cyanide (Free)	2018/11/22	93	75 - 125	99	80 - 120	<0.01	ug/g	NC (1)	35
5849649	Available (CaCl2) pH	2018/11/22			100	97 - 103			0.46 (1)	N/A
5849832	Conductivity	2018/11/22			102	90 - 110	<0.002	mS/cm	0.33 (1)	10
5850968	Benzene	2018/11/22	79	60 - 140	97	60 - 140	<0.020	ug/g		
5850968	Ethylbenzene	2018/11/22	88	60 - 140	102	60 - 140	<0.020	ug/g		
5850968	F1 (C6-C10) - BTEX	2018/11/22					<10	ug/g	NC (1)	30
5850968	F1 (C6-C10)	2018/11/22	106	60 - 140	105	80 - 120	<10	ug/g	NC (1)	30
5850968	o-Xylene	2018/11/22	88	60 - 140	100	60 - 140	<0.020	ug/g		
5850968	p+m-Xylene	2018/11/22	94	60 - 140	106	60 - 140	<0.040	ug/g		
5850968	Toluene	2018/11/22	86	60 - 140	99	60 - 140	<0.020	ug/g		
5850968	Total Xylenes	2018/11/22					<0.040	ug/g		
5851504	1-Methylnaphthalene	2018/11/22	122	50 - 130	122	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	2-Methylnaphthalene	2018/11/22	109	50 - 130	108	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Acenaphthene	2018/11/22	96	50 - 130	96	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Acenaphthylene	2018/11/22	92	50 - 130	92	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Anthracene	2018/11/22	93	50 - 130	90	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Benzo(a)anthracene	2018/11/22	101	50 - 130	97	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Benzo(a)pyrene	2018/11/22	95	50 - 130	94	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Benzo(b/j)fluoranthene	2018/11/22	95	50 - 130	99	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Benzo(g,h,i)perylene	2018/11/22	85	50 - 130	84	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Benzo(k)fluoranthene	2018/11/22	102	50 - 130	98	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Chrysene	2018/11/22	97	50 - 130	97	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Dibenz(a,h)anthracene	2018/11/22	95	50 - 130	89	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Fluoranthene	2018/11/22	101	50 - 130	102	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Fluorene	2018/11/22	104	50 - 130	104	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Indeno(1,2,3-cd)pyrene	2018/11/22	92	50 - 130	89	50 - 130	<0.0050	ug/g	NC (1)	40

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Maxxam Job #: B8U7525
Report Date: 2018/11/26

QUALITY ASSURANCE REPORT(CONT'D)

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5851504	Naphthalene	2018/11/22	93	50 - 130	92	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Phenanthrene	2018/11/22	93	50 - 130	94	50 - 130	<0.0050	ug/g	NC (1)	40
5851504	Pyrene	2018/11/22	96	50 - 130	97	50 - 130	<0.0050	ug/g	NC (1)	40
5851518	F2 (C10-C16 Hydrocarbons)	2018/11/23	109	50 - 130	109	80 - 120	<10	ug/g	NC (1)	30
5851518	F3 (C16-C34 Hydrocarbons)	2018/11/23	108	50 - 130	107	80 - 120	<50	ug/g	NC (1)	30
5851518	F4 (C34-C50 Hydrocarbons)	2018/11/23	109	50 - 130	107	80 - 120	<50	ug/g	NC (1)	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Duplicate Parent ID

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Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Page ____ of ____

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required
Company Name:	Wood	Company Name:		Quotation #:	B61973	[X] Regular TAT (5-7 days) Most analyses
Contact Name:	Accounts Payable	Contact Name:	Alessandro Pellerito	P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	50 Vogell road, Units 3 and 4 , Richmond Hill, L4B 3N6	Address:		Project #:	TPB166090.6000	Rush TAT (Surcharges will be applied) [ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Phone:	905-415-2632 Fax:	Phone:	Fax:	Site Location:	Highway 410	
Email:	AP_GTAEAST@woodplc.com	Email:	a.pellerito@woodplc.com; shami.malla@woodplc.com	Site #:		Date Required:
				Sampled By:	Mohammad Safarpanah	Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153: [ ] Table 1 [ ] Res/Park [ ] Med/ Fine; [ ] Table 2 [ ] Ind/Comm [ ] Coarse; [ ] Table 3 [ ] Agri/ Other; [ ] Table ____
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations: [ ] CCME [ ] Sanitary Sewer Bylaw; [ ] MISA [ ] Storm Sewer Bylaw; [ ] PWQO Region ____; [ ] Other (Specify) ____; [ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

LABORATORY USE ONLY

CUSTODY SEAL Y / N: Present ✓, Intact ✓ — COOLER TEMPERATURES: 1/0/0

COOLING MEDIA PRESENT: (Y) / N

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	PAHs	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	Asbestos	HOLD. DO NOT ANALYZE	COMMENTS
1	BH8 SS4	11/14/2018	2:45	Soil	4									X	
2	BH9 SS2	11/14/2018	12:15	Soil	4									X	
3	BH10 SS2	11/14/2018	10:05	Soil	2									X	
4	BH10 SS5	11/14/2018	10:55	Soil	4		X	X		X					
5	TCLP	11/14/2018	NA	Soil	2									X	

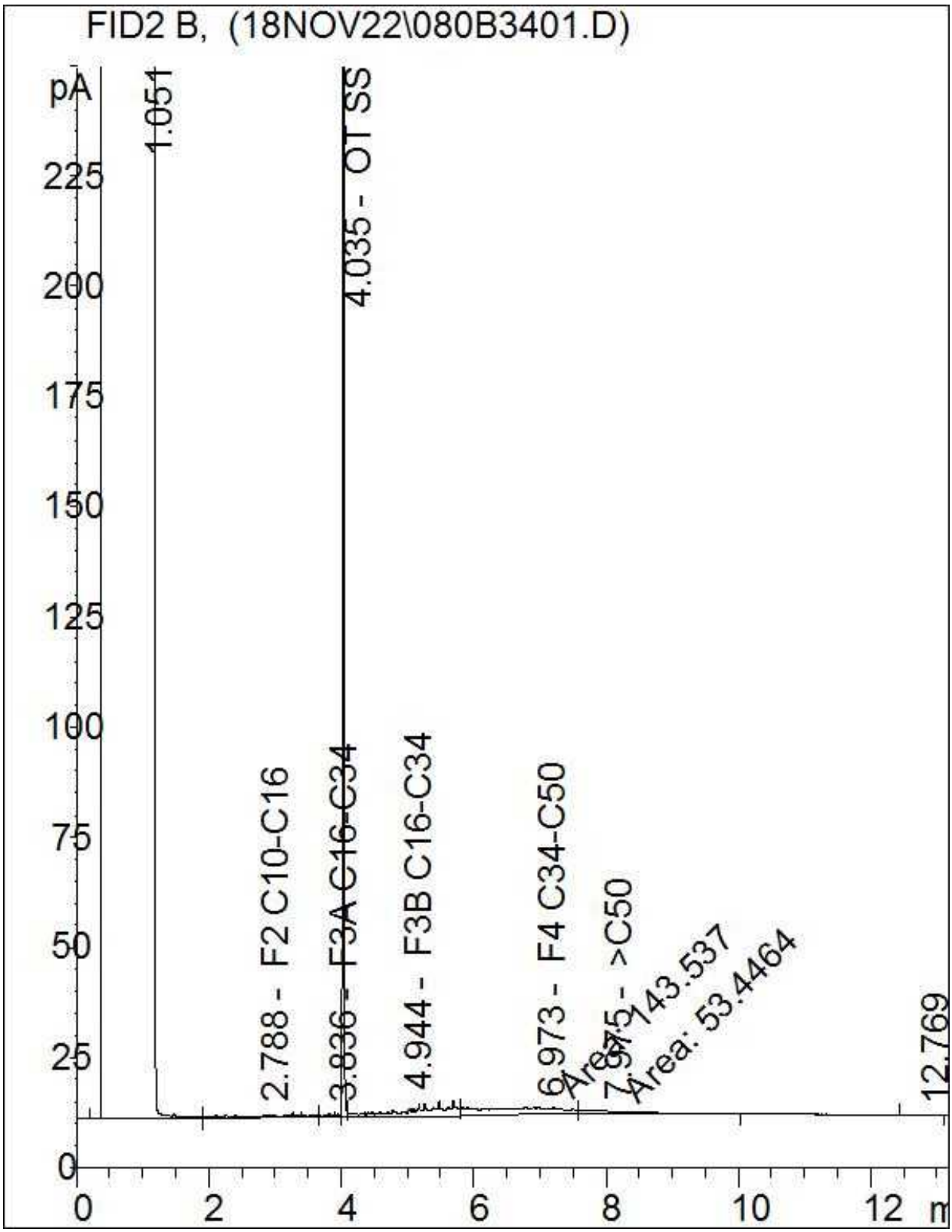
RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:M...
o Pellerito	11/15/2018	2:02		2018/11/16	15:16

16-Nov-18 15:16
Gina Baybayan
B8U7525
ECN ENV-701

Maxxam Job #: B8U7525
Report Date: 2018/11/26
Maxxam Sample: IIA269

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Project name: HIGHWAY 410
Client ID: BH9 SS2

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

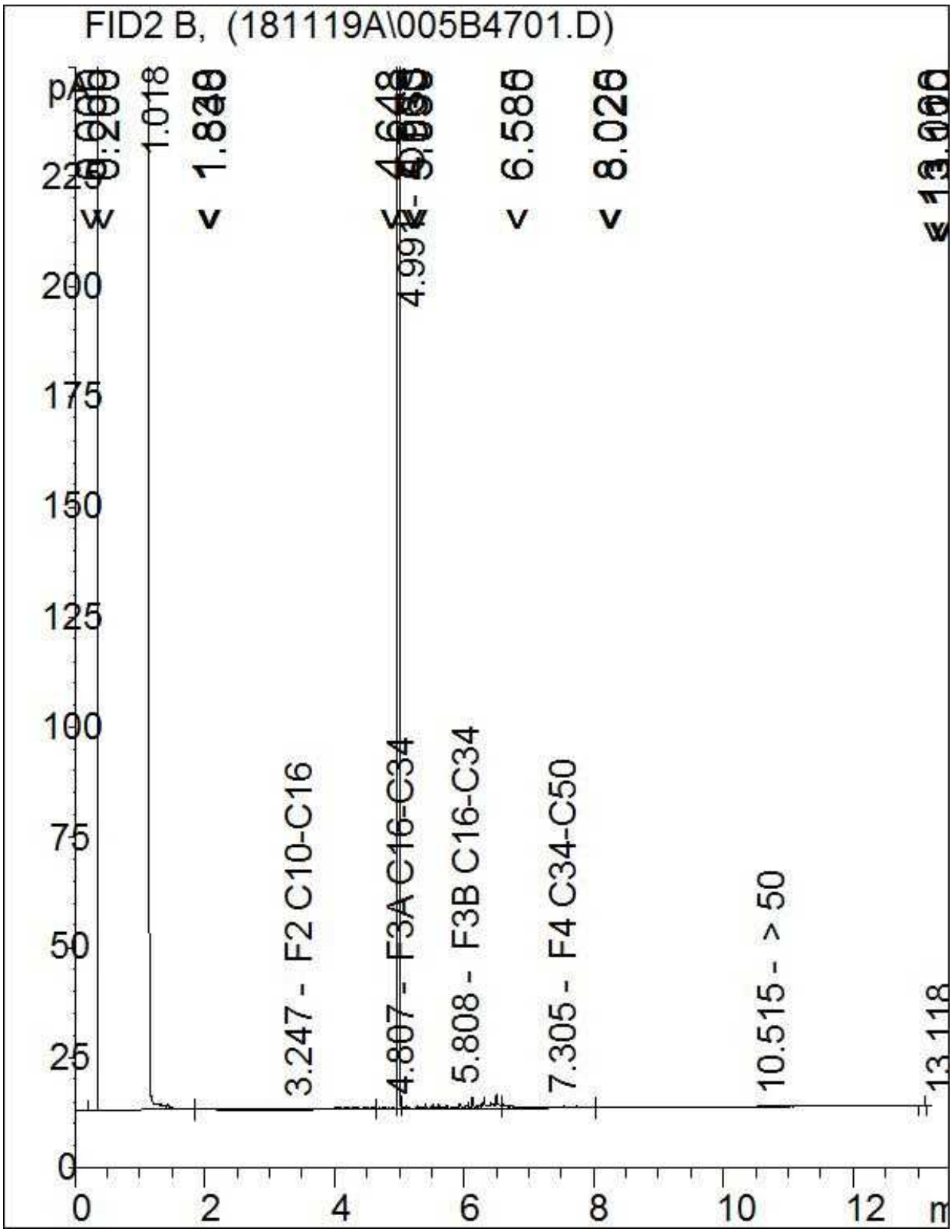


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B8U7525
Report Date: 2018/11/26
Maxxam Sample: IIA271

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Project name: HIGHWAY 410
Client ID: BH10 SS5

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam
A Bureau Veritas Group Company

Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: na

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/26
Report #: R5499833
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8U9258
Received: 2018/11/20, 10:28

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Cyanide (WAD) in Leachates	1	N/A	2018/11/22	CAM SOP-00457	OMOE 3015 m
Fluoride by ISE in Leachates	1	2018/11/22	2018/11/22	CAM SOP-00449	SM 23 4500-F- C m
Mercury (TCLP Leachable) (mg/L)	1	N/A	2018/11/22	CAM SOP-00453	EPA 7470A m
Total Metals in TCLP Leachate by ICPMS	1	2018/11/22	2018/11/23	CAM SOP-00447	EPA 6020B m
Ignitability of a Sample	1	2018/11/23	2018/11/23	CAM SOP-00432	EPA 1030 Rev. 1 m
Nitrate(NO3) + Nitrite(NO2) in Leachate	1	N/A	2018/11/23	CAM SOP-00440	SM 23 4500-NO3I/NO2B
PAH Compounds in Leachate by GC/MS (SIM)	1	2018/11/22	2018/11/23	CAM SOP-00318	EPA 8270D m
Polychlorinated Biphenyl in Leachate	1	2018/11/23	2018/11/23	CAM SOP-00309	EPA 8082A m
TCLP - % Solids	1	2018/11/21	2018/11/22	CAM SOP-00401	EPA 1311 Update I m
TCLP - Extraction Fluid	1	N/A	2018/11/22	CAM SOP-00401	EPA 1311 Update I m
TCLP - Initial and final pH	1	N/A	2018/11/22	CAM SOP-00401	EPA 1311 Update I m
TCLP Zero Headspace Extraction	1	2018/11/22	2018/11/23	CAM SOP-00430	EPA 1311 m
VOCs in ZHE Leachates	1	2018/11/23	2018/11/23	CAM SOP-00228	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: na

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/26
Report #: R5499833
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8U9258
Received: 2018/11/20, 10:28

dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B8U9258
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

O.REG 558 TCLP BENZO(A)PYRENE

Maxxam ID		IIL061		
Sampling Date		2018/11/14		
COC Number		na		
	UNITS	TCLP-410/10	RDL	QC Batch
Polyaromatic Hydrocarbons				
Leachable Benzo(a)pyrene	ug/L	<0.10	0.10	5852052
Surrogate Recovery (%)				
Leachable D10-Anthracene	%	115		5852052
Leachable D14-Terphenyl (FS)	%	115		5852052
Leachable D8-Acenaphthylene	%	118		5852052

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8U9258
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

O.REG 558 TCLP INORGANICS PACKAGE (SOIL)

Maxxam ID		IIL061		
Sampling Date		2018/11/14		
COC Number		na		
	UNITS	TCLP-410/10	RDL	QC Batch
Inorganics				
Leachable Fluoride (F-)	mg/L	0.22	0.10	5851376
Leachable WAD Cyanide (Free)	mg/L	<0.010	0.010	5851377
Leachable Nitrite (N)	mg/L	<0.10	0.10	5851391
Leachable Nitrate (N)	mg/L	<1.0	1.0	5851391
Leachable Nitrate + Nitrite (N)	mg/L	<1.0	1.0	5851391
Metals				
Leachable Mercury (Hg)	mg/L	<0.0010	0.0010	5851325
Leachable Arsenic (As)	mg/L	<0.2	0.2	5851243
Leachable Barium (Ba)	mg/L	0.5	0.2	5851243
Leachable Boron (B)	mg/L	0.1	0.1	5851243
Leachable Cadmium (Cd)	mg/L	<0.05	0.05	5851243
Leachable Chromium (Cr)	mg/L	<0.1	0.1	5851243
Leachable Lead (Pb)	mg/L	<0.1	0.1	5851243
Leachable Selenium (Se)	mg/L	<0.1	0.1	5851243
Leachable Silver (Ag)	mg/L	<0.01	0.01	5851243
Leachable Uranium (U)	mg/L	<0.01	0.01	5851243

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8U9258
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

O.REG 558 TCLP LEACHATE PREPARATION (SOIL)

Maxxam ID		IIL061		
Sampling Date		2018/11/14		
COC Number		na		
	UNITS	**TCLP-410/10**	**RDL**	**QC Batch**
Inorganics				
Final pH	pH	6.10		5849300
Initial pH	pH	9.13		5849300
TCLP - % Solids	%	100	0.2	5849296
TCLP Extraction Fluid	N/A	FLUID 1		5849299

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

O.REG 558 TCLP PCBS (SOIL)

Maxxam ID		IIL061		
Sampling Date		2018/11/14		
COC Number		na		
	UNITS	TCLP-410/10	RDL	QC Batch
PCBs				
Leachable Total PCB	ug/L	<3.0	3.0	5853257
Surrogate Recovery (%)				
Leachable Decachlorobiphenyl	%	88		5853257

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8U9258
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

O.REG 558 TCLP VOLATILE ORGANICS HS (SOIL)

Maxxam ID		IIL061		
Sampling Date		2018/11/14		
COC Number		na		
	UNITS	**TCLP-410/10**	**RDL**	**QC Batch**
Charge/Prep Analysis				
Amount Extracted (Wet Weight) (g)	N/A	25	N/A	5851005
Volatile Organics				
Leachable Benzene	mg/L	<0.020	0.020	5853235
Leachable Carbon Tetrachloride	mg/L	<0.020	0.020	5853235
Leachable Chlorobenzene	mg/L	<0.020	0.020	5853235
Leachable Chloroform	mg/L	<0.020	0.020	5853235
Leachable 1,2-Dichlorobenzene	mg/L	<0.050	0.050	5853235
Leachable 1,4-Dichlorobenzene	mg/L	<0.050	0.050	5853235
Leachable 1,2-Dichloroethane	mg/L	<0.050	0.050	5853235
Leachable 1,1-Dichloroethylene	mg/L	<0.020	0.020	5853235
Leachable Methylene Chloride(Dichloromethane)	mg/L	<0.20	0.20	5853235
Leachable Methyl Ethyl Ketone (2-Butanone)	mg/L	<1.0	1.0	5853235
Leachable Tetrachloroethylene	mg/L	<0.020	0.020	5853235
Leachable Trichloroethylene	mg/L	<0.020	0.020	5853235
Leachable Vinyl Chloride	mg/L	<0.020	0.020	5853235
Surrogate Recovery (%)				
Leachable 4-Bromofluorobenzene	%	74		5853235
Leachable D4-1,2-Dichloroethane	%	102		5853235
Leachable D8-Toluene	%	95		5853235

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B8U9258
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

MISCELLANEOUS (SOIL)

Maxxam ID		IIL061	
Sampling Date		2018/11/14	
COC Number		na	
	UNITS	**TCLP-410/10**	**QC Batch**
Inorganics			
Ignitability	N/A	NF/NI	5853480
QC Batch = Quality Control Batch			

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Maxxam Job #: B8U9258
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

TEST SUMMARY

Maxxam ID: IIL061
Sample ID: TCLP-410/10
Matrix: Soil

Collected: 2018/11/14
Shipped:
Received: 2018/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	5851377	N/A	2018/11/22	Xuanhong Qiu
Fluoride by ISE in Leachates	ISE	5851376	2018/11/22	2018/11/22	Surinder Rai
Mercury (TCLP Leachable) (mg/L)	CV/AA	5851325	N/A	2018/11/22	Medhat Nasr
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	5851243	2018/11/22	2018/11/23	Thao Nguyen
Ignitability of a Sample	BAL	5853480	2018/11/23	2018/11/23	Chun Yan
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	5851391	N/A	2018/11/23	Chandra Nandlal
PAH Compounds in Leachate by GC/MS (SIM)	GC/MS	5852052	2018/11/22	2018/11/23	Lingyun Feng
Polychlorinated Biphenyl in Leachate	GC/ECD	5853257	2018/11/23	2018/11/23	Sarah Huang
TCLP - % Solids	BAL	5849296	2018/11/21	2018/11/22	Jian (Ken) Wang
TCLP - Extraction Fluid		5849299	N/A	2018/11/22	Jian (Ken) Wang
TCLP - Initial and final pH	PH	5849300	N/A	2018/11/22	Jian (Ken) Wang
TCLP Zero Headspace Extraction		5851005	2018/11/22	2018/11/23	Walt Wang
VOCs in ZHE Leachates	GC/MS	5853235	2018/11/23	2018/11/23	Rebecca McClean

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GENERAL COMMENTS

Sample IIL061 [TCLP-410/10] : NF/NI = Non Flammable and Non Ignitable

Results relate only to the items tested.

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Maxxam Job #: B8U9258
Report Date: 2018/11/26

QUALITY ASSURANCE REPORT

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
5852052	Leachable D10-Anthracene	2018/11/23	109	50 - 130	106	50 - 130	97	%				
5852052	Leachable D14-Terphenyl (FS)	2018/11/23	113	50 - 130	111	50 - 130	103	%				
5852052	Leachable D8-Acenaphthylene	2018/11/23	113	50 - 130	108	50 - 130	100	%				
5853235	Leachable 4-Bromofluorobenzene	2018/11/23	94	70 - 130	93	70 - 130	90	%				
5853235	Leachable D4-1,2-Dichloroethane	2018/11/23	105	70 - 130	108	70 - 130	109	%				
5853235	Leachable D8-Toluene	2018/11/23	107	70 - 130	106	70 - 130	122	%				
5853257	Leachable Decachlorobiphenyl	2018/11/23	91	30 - 130	96	30 - 130	85	%				
5851243	Leachable Arsenic (As)	2018/11/23	103	80 - 120	101	80 - 120	<0.2	mg/L	NC (1)	35		
5851243	Leachable Barium (Ba)	2018/11/23	NC	80 - 120	101	80 - 120	<0.2	mg/L	14 (1)	35		
5851243	Leachable Boron (B)	2018/11/23	99	80 - 120	101	80 - 120	<0.1	mg/L	NC (1)	35		
5851243	Leachable Cadmium (Cd)	2018/11/23	100	80 - 120	97	80 - 120	<0.05	mg/L	NC (1)	35		
5851243	Leachable Chromium (Cr)	2018/11/23	104	80 - 120	100	80 - 120	<0.1	mg/L	NC (1)	35		
5851243	Leachable Lead (Pb)	2018/11/23	97	80 - 120	98	80 - 120	<0.1	mg/L	NC (1)	35		
5851243	Leachable Selenium (Se)	2018/11/23	101	80 - 120	102	80 - 120	<0.1	mg/L	NC (1)	35		
5851243	Leachable Silver (Ag)	2018/11/23	96	80 - 120	101	80 - 120	<0.01	mg/L	NC (1)	35		
5851243	Leachable Uranium (U)	2018/11/23	95	80 - 120	95	80 - 120	<0.01	mg/L	NC (1)	35		
5851325	Leachable Mercury (Hg)	2018/11/22	110	75 - 125	105	80 - 120	<0.0010	mg/L	NC (1)	25	<0.0010	mg/L
5851376	Leachable Fluoride (F-)	2018/11/22	98	80 - 120	104	80 - 120	<0.10	mg/L	NC (1)	25	<0.10	mg/L
5851377	Leachable WAD Cyanide (Free)	2018/11/22	98	80 - 120	98	80 - 120	<0.0020	mg/L	NC (1)	20	<0.010	mg/L
5851391	Leachable Nitrate (N)	2018/11/23	97	80 - 120	100	80 - 120	<1.0	mg/L	NC (1)	25	<1.0	mg/L
5851391	Leachable Nitrate + Nitrite (N)	2018/11/23	99	80 - 120	101	80 - 120	<1.0	mg/L	NC (1)	25	<1.0	mg/L
5851391	Leachable Nitrite (N)	2018/11/23	107	80 - 120	103	80 - 120	<0.10	mg/L	NC (1)	25	<0.10	mg/L
5852052	Leachable Benzo(a)pyrene	2018/11/23	100	50 - 130	95	50 - 130	<0.10	ug/L	NC (1)	40		
5853235	Leachable 1,1-Dichloroethylene	2018/11/23	108	70 - 130	101	70 - 130	<0.020	mg/L	NC (1)	30		
5853235	Leachable 1,2-Dichlorobenzene	2018/11/23	99	70 - 130	93	70 - 130	<0.050	mg/L	NC (1)	30		
5853235	Leachable 1,2-Dichloroethane	2018/11/23	104	70 - 130	100	70 - 130	<0.050	mg/L	NC (1)	30		
5853235	Leachable 1,4-Dichlorobenzene	2018/11/23	102	70 - 130	95	70 - 130	<0.050	mg/L	NC (1)	30		
5853235	Leachable Benzene	2018/11/23	96	70 - 130	91	70 - 130	<0.020	mg/L	NC (1)	30		
5853235	Leachable Carbon Tetrachloride	2018/11/23	95	70 - 130	89	70 - 130	<0.020	mg/L	NC (1)	30		
5853235	Leachable Chlorobenzene	2018/11/23	96	70 - 130	90	70 - 130	<0.020	mg/L	NC (1)	30		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
5853235	Leachable Chloroform	2018/11/23	98	70 - 130	93	70 - 130	<0.020	mg/L	NC (1)	30		
5853235	Leachable Methyl Ethyl Ketone (2-Butanone)	2018/11/23	105	60 - 140	102	60 - 140	<1.0	mg/L	NC (1)	30		
5853235	Leachable Methylene Chloride(Dichloromethane)	2018/11/23	91	70 - 130	88	70 - 130	<0.20	mg/L	NC (1)	30		
5853235	Leachable Tetrachloroethylene	2018/11/23	93	70 - 130	85	70 - 130	<0.020	mg/L	NC (1)	30		
5853235	Leachable Trichloroethylene	2018/11/23	91	70 - 130	86	70 - 130	<0.020	mg/L	NC (1)	30		
5853235	Leachable Vinyl Chloride	2018/11/23	104	70 - 130	99	70 - 130	<0.020	mg/L	NC (1)	30		
5853257	Leachable Total PCB	2018/11/23	109	30 - 130	119	30 - 130	<3.0	ug/L	NC (1)	40		

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Duplicate Parent ID

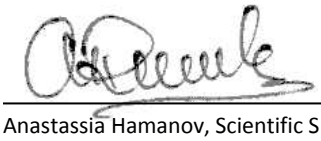
Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8U9258
Report Date: 2018/11/26

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam
A Bureau Veritas Group Company

Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/10/25
Report #: R5456129
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8R8406
Received: 2018/10/19, 14:50

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride (20:1 extract)	2	N/A	2018/10/25	CAM SOP-00463	EPA 325.2 m
Conductivity	2	N/A	2018/10/24	CAM SOP-00414	OMOE E3530 v1 m
pH CaCl2 EXTRACT	2	2018/10/23	2018/10/23	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	2	2018/10/22	2018/10/24	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	2	N/A	2018/10/25	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your Project #: TPB166090.6000
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/10/25
Report #: R5456129
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8R8406
Received: 2018/10/19, 14:50

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766

==========

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Maxxam Job #: B8R8406
Report Date: 2018/10/25

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IBP036	IBP037		
Sampling Date		2018/10/16	2018/10/17		
COC Number		n/a	n/a		
	UNITS	BH6 SS4	BH2 SS11	RDL	QC Batch
Calculated Parameters					
Resistivity	ohm-cm	5700	7200		5796016
Inorganics					
Soluble (20:1) Chloride (Cl-)	ug/g	24	<20	20	5799805
Conductivity	umho/cm	176	138	2	5800015
Available (CaCl2) pH	pH	7.84	8.01		5797839
Soluble (20:1) Sulphate (SO4)	ug/g	38	33	20	5799807

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8R8406
Report Date: 2018/10/25

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

TEST SUMMARY

Maxxam ID: IBP036
Sample ID: BH6 SS4
Matrix: Soil

Collected: 2018/10/16
Shipped:
Received: 2018/10/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5799805	N/A	2018/10/25	Alina Dobreanu
Conductivity	AT	5800015	N/A	2018/10/24	Barbara Kalbasi Esfahani
pH CaCl2 EXTRACT	AT	5797839	2018/10/23	2018/10/23	Gnana Thomas
Resistivity of Soil		5796016	2018/10/24	2018/10/24	Anastassia Hamanov
Sulphate (20:1 Extract)	KONE/EC	5799807	N/A	2018/10/25	Alina Dobreanu

Maxxam ID: IBP037
Sample ID: BH2 SS11
Matrix: Soil

Collected: 2018/10/17
Shipped:
Received: 2018/10/19

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	5799805	N/A	2018/10/25	Alina Dobreanu
Conductivity	AT	5800015	N/A	2018/10/24	Barbara Kalbasi Esfahani
pH CaCl2 EXTRACT	AT	5797839	2018/10/23	2018/10/23	Gnana Thomas
Resistivity of Soil		5796016	2018/10/24	2018/10/24	Anastassia Hamanov
Sulphate (20:1 Extract)	KONE/EC	5799807	N/A	2018/10/25	Alina Dobreanu

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Maxxam Job #: B8R8406
Report Date: 2018/10/25

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	2.7°C

Results relate only to the items tested.

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Maxxam Job #: B8R8406
Report Date: 2018/10/25

QUALITY ASSURANCE REPORT

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5797839	Available (CaCl2) pH	2018/10/23			100	97 - 103			0.33 (1)	N/A
5799805	Soluble (20:1) Chloride (Cl-)	2018/10/25	NC	70 - 130	106	70 - 130	<20	ug/g	7.9 (1)	35
5799807	Soluble (20:1) Sulphate (SO4)	2018/10/25	115	70 - 130	105	70 - 130	<20	ug/g	NC (1)	35
5800015	Conductivity	2018/10/24			104	90 - 110	<2	umho/cm	9.1 (1)	10

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Duplicate Parent ID

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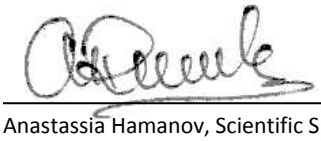
Maxxam Job #: B8R8406
Report Date: 2018/10/25

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.6000
Site Location: HIGHWAY 410
Sampler Initials: MS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

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6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: Wood	Company Name:	Quotation #: B61973	[X] Regular TAT (5-7 days) Most analyses
Contact Name: Accounts Payable	Contact Name: Alessandro Pellerito	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 50 Vogell road, Units 3 and 4 , Richmond Hill, L4B 3N6	Address:	Project #: TPB166090.6000	Rush TAT (Surcharges will be applied) [ ] 1 Day [X] 2 Days [ ] 3-4 Days
Phone: 905-415-2632 Fax:	Phone: Fax:	Site Location: Highway 410	
Email: AP_GTAEAST@woodplc.com	Email: a.pellerito@woodplc.com; shami.malla@woodplc.com	Site #:	Date Required:
		Sampled By: Mohammad Safarpanah	Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153
[ ] Table 1 [ ] Res/Park [ ] Med/ Fine
[ ] Table 2 [ ] Ind/Comm [ ] Coarse
[ ] Table 3 [ ] Agri/ Other
[ ] Table ____
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations
[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] MISA [ ] Storm Sewer Bylaw
[ ] PWQO Region
[ ] Other (Specify)
[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
Y	Y	2, 3, 3

COOLING MEDIA PRESENT: Y / N

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	PAHs	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)								HOLD- DO NOT ANALYZE	COMMENTS
1	BH1 SS4	10/16/2018	3:50pm	Soil	4															X	
2	BH2 SS4	10/17/2018	9:00am	Soil	4															X	
3	BH2 SS10	10/17/2018	10:40	Soil	4															X	
4	BH3 SS3	10/17/2018	2:10pm	Soil	4															X	
5	BH3 SS11	10/17/2018	4:45pm	Soil	4															X	
6	BH6 SS2	10/16/2018		Soil	4															X	
7	BH6 SS3	10/16/2018		Soil	4															X	
8	BH6 SS11	10/16/2018		Soil	4															X	
9	DUP1	10/17/2018	-	Soil	4															X	
10																					

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Alessandro Pellerito	2018/10/19	9:20	Gina Baybayan	2018/10/19	14:50

19-Oct-18 14:50
Gina Baybayan
B8R8406
VMK ENV-1167

MW# 33069

Maxxam

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Page 2 of 2

Invoice Information
Company Name: Wood
Contact Name: Accounts Payable
Address: 50 Vogell road, Units 3 and 4 , Richmond Hill, L4B 3N6
Phone: 905-415-2632 Fax:
Email: AP_GTAEAST@woodplc.com

Report Information (if differs from invoice)
Company Name:
Contact Name: Alessandro Pellerito
Address:
Phone: Fax:
Email: a.pellerito@woodplc.com; shami.malla@woodplc.com

Project Information (where applicable)
Quotation #: 861973
P.O. #/ AFE#:
Project #: TP8166090.6000
Site Location: Highway 410
Site #:
Sampled By: Mohammad Safarpanah

Turnaround Time (TAT) Required
[X] Regular TAT (5-7 days) Most analyses
PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Rush TAT (Surcharges will be applied)
[ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Date Required:
Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153
[ ] Table 1 [ ] Res/Park [ ] Med/ Fine
[ ] Table 2 [ ] Ind/Comm [ ] Coarse
[ ] Table 3 [ ] Agri/ Other
[ ] Table ____
FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations
[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] MISA [ ] Storm Sewer Bylaw
[ ] PWQO Region
[ ] Other (Specify)
[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	BOLD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	PAHs	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	CORROSIVITY								HOLD- DO NOT ANALYZE
1	BH4 SS2	10/18/2018	9:30am	SOIL	4																
2	BH4 SS10	10/18/2018	11:10am		4																X
3	BH6 SS4	10/16/2018											X								X
4	BH2 SS11	10/17/2018		✓									X								
5																					
6																					
7																					
8																					
9																					
10																					

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	

COOLING MEDIA PRESENT: Y / N

COMMENTS

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Alessandro Pellerito	2018/10/19	9:20	See Page 1		

MAXXAM JOB #

Your Project #: TPB166090.600
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/15
Report #: R5485890
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T5664
Received: 2018/11/06, 14:48

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Methylnaphthalene Sum	2	N/A	2018/11/15	CAM SOP-00301	EPA 8270D m
Hot Water Extractable Boron	2	2018/11/12	2018/11/12	CAM SOP-00408	R153 Ana. Prot. 2011
Free (WAD) Cyanide	2	2018/11/12	2018/11/13	CAM SOP-00457	OMOE E3015 m
Conductivity	2	2018/11/14	2018/11/14	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	2	2018/11/10	2018/11/14	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydro. CCME F1 & BTEX in Soil (2)	2	N/A	2018/11/13	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (3)	2	2018/11/13	2018/11/13	CAM SOP-00316	CCME CWS m
Strong Acid Leachable Metals by ICPMS	2	2018/11/10	2018/11/12	CAM SOP-00447	EPA 6020B m
Moisture	2	N/A	2018/11/08	CAM SOP-00445	Carter 2nd ed 51.2 m
PAH Compounds in Soil by GC/MS (SIM)	2	2018/11/13	2018/11/14	CAM SOP-00318	EPA 8270D m
pH CaCl2 EXTRACT	2	2018/11/13	2018/11/13	CAM SOP-00413	EPA 9045 D m
Sodium Adsorption Ratio (SAR)	2	N/A	2018/11/15	CAM SOP-00102	EPA 6010C

Sample Matrix: Solid
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Asbestos by PLM - 0.5 RDL (4)	2	N/A	2018/11/09	COR3SOP-00002	EPA 600R-93/116

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report.

Your Project #: TPB166090.600
Site Location: HIGHWAY 410
Your C.O.C. #: n/a

Attention: Allesandro Pellerito

Wood Environment & Infrastructure Solutions, a division of Wood
Canada Limited
50 Vogell Road
Units 3 and 4
Richmond Hill, ON
CANADA L4B 3N6

Report Date: 2018/11/15
Report #: R5485890
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8T5664
Received: 2018/11/06, 14:48

Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Maxxam Analytics' Asbestos Laboratory is accredited by NVLAP for bulk asbestos analysis by polarized light microscopy, NVLAP Code 600136-0.

This report may not be reproduced, except in full, without the written approval of Maxxam Analytics. This report may not be used by the client to claim product endorsement by NVLAP, NIST or any other agency of the U.S. Government.

Maxxam Analytics' scope of accreditation includes EPA-600/M4-82-020: "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" and EPA-600/R-93/116: "Method for the Determination of Asbestos in Bulk Building Materials".

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Soils are reported on a dry weight basis unless otherwise specified.
(2) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.
(4) P.O.B. - Percent of Bulk

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766

==========

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

O.REG 153 METALS & INORGANICS PKG (SOIL)

Maxxam ID		IFK541	IFK543		
Sampling Date		2018/11/01 09:40	2018/11/02 08:30		
COC Number		n/a	n/a		
	UNITS	**BH5 SS2**	**BH7 SS1**	**RDL**	**QC Batch**
Calculated Parameters					
Sodium Adsorption Ratio	N/A	0.24	13		5826989
Inorganics					
Conductivity	mS/cm	0.19	0.83	0.002	5833105
Moisture	%	10	23	1.0	5828411
Available (CaCl2) pH	pH	7.69	7.55		5832549
WAD Cyanide (Free)	ug/g	<0.01	<0.01	0.01	5832936
Chromium (VI)	ug/g	<0.2	<0.2	0.2	5831518
Metals					
Hot Water Ext. Boron (B)	ug/g	0.061	0.064	0.050	5832167
Acid Extractable Antimony (Sb)	ug/g	<0.20	<0.20	0.20	5831332
Acid Extractable Arsenic (As)	ug/g	6.4	5.3	1.0	5831332
Acid Extractable Barium (Ba)	ug/g	64	60	0.50	5831332
Acid Extractable Beryllium (Be)	ug/g	0.76	0.63	0.20	5831332
Acid Extractable Boron (B)	ug/g	9.4	8.4	5.0	5831332
Acid Extractable Cadmium (Cd)	ug/g	<0.10	<0.10	0.10	5831332
Acid Extractable Chromium (Cr)	ug/g	20	19	1.0	5831332
Acid Extractable Cobalt (Co)	ug/g	13	11	0.10	5831332
Acid Extractable Copper (Cu)	ug/g	36	30	0.50	5831332
Acid Extractable Lead (Pb)	ug/g	9.2	9.2	1.0	5831332
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	<0.50	0.50	5831332
Acid Extractable Nickel (Ni)	ug/g	27	24	0.50	5831332
Acid Extractable Selenium (Se)	ug/g	<0.50	<0.50	0.50	5831332
Acid Extractable Silver (Ag)	ug/g	<0.20	<0.20	0.20	5831332
Acid Extractable Thallium (Tl)	ug/g	0.14	0.14	0.050	5831332
Acid Extractable Uranium (U)	ug/g	0.47	0.57	0.050	5831332
Acid Extractable Vanadium (V)	ug/g	27	26	5.0	5831332
Acid Extractable Zinc (Zn)	ug/g	58	54	5.0	5831332
Acid Extractable Mercury (Hg)	ug/g	<0.050	<0.050	0.050	5831332

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

O.REG 153 PAHS (SOIL)

Maxxam ID		IFK541	IFK543		
Sampling Date		2018/11/01 09:40	2018/11/02 08:30		
COC Number		n/a	n/a		
	UNITS	BH5 SS2	BH7 SS1	RDL	QC Batch
Calculated Parameters					
Methylnaphthalene, 2-(1-)	ug/g	<0.0071	<0.0071	0.0071	5826988
Polyaromatic Hydrocarbons					
Acenaphthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Acenaphthylene	ug/g	<0.0050	<0.0050	0.0050	5833853
Anthracene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(a)anthracene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(a)pyrene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(b/j)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(g,h,i)perylene	ug/g	<0.0050	<0.0050	0.0050	5833853
Benzo(k)fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Chrysene	ug/g	<0.0050	<0.0050	0.0050	5833853
Dibenz(a,h)anthracene	ug/g	<0.0050	<0.0050	0.0050	5833853
Fluoranthene	ug/g	<0.0050	<0.0050	0.0050	5833853
Fluorene	ug/g	<0.0050	<0.0050	0.0050	5833853
Indeno(1,2,3-cd)pyrene	ug/g	<0.0050	<0.0050	0.0050	5833853
1-Methylnaphthalene	ug/g	<0.0050	<0.0050	0.0050	5833853
2-Methylnaphthalene	ug/g	<0.0050	<0.0050	0.0050	5833853
Naphthalene	ug/g	<0.0050	<0.0050	0.0050	5833853
Phenanthrene	ug/g	<0.0050	<0.0050	0.0050	5833853
Pyrene	ug/g	<0.0050	<0.0050	0.0050	5833853
Surrogate Recovery (%)					
D10-Anthracene	%	88	85		5833853
D14-Terphenyl (FS)	%	82	79		5833853
D8-Acenaphthylene	%	82	80		5833853

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

O.REG 153 PETROLEUM HYDROCARBONS (SOIL)

Maxxam ID		IFK541	IFK543		
Sampling Date		2018/11/01 09:40	2018/11/02 08:30		
COC Number		n/a	n/a		
	UNITS	BH5 SS2	BH7 SS1	RDL	QC Batch
BTEX & F1 Hydrocarbons					
Benzene	ug/g	<0.020	<0.020	0.020	5834644
Toluene	ug/g	<0.020	<0.020	0.020	5834644
Ethylbenzene	ug/g	<0.020	<0.020	0.020	5834644
o-Xylene	ug/g	<0.020	<0.020	0.020	5834644
p+m-Xylene	ug/g	<0.040	<0.040	0.040	5834644
Total Xylenes	ug/g	<0.040	<0.040	0.040	5834644
F1 (C6-C10)	ug/g	<10	<10	10	5834644
F1 (C6-C10) - BTEX	ug/g	<10	<10	10	5834644
F2-F4 Hydrocarbons					
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	10	5833889
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	50	5833889
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	50	5833889
Reached Baseline at C50	ug/g	Yes	Yes		5833889
Surrogate Recovery (%)					
1,4-Difluorobenzene	%	102	102		5834644
4-Bromofluorobenzene	%	98	97		5834644
D10-Ethylbenzene	%	88	90		5834644
D4-1,2-Dichloroethane	%	99	99		5834644
o-Terphenyl	%	91	91		5833889

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B8T5664
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Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

Asbestos Analytical Results

EPA/600R-93/116 by Polarized Light Microscopy

BH 4

Maxxam ID: IFK546 Date Analyzed: 2018/11/09

	P.O.B	Sample Morphology	Asbestos	Other Fibres	Particulate
Layer 1	100	Homogeneous grey asphalt	Not Detected		Tar Non-Fibrous

BH 6

Maxxam ID: IFK547 Date Analyzed: 2018/11/09

	P.O.B	Sample Morphology	Asbestos	Other Fibres	Particulate
Layer 1	100	Homogeneous black asphalt	Not Detected		Tar Non-Fibrous

The limit of quantitation is 0.50%, although asbestos may be qualitatively detected at concentrations less than 0.50%. Samples for which asbestos is detected at <0.50% are reported as trace, "<0.50%". "Not Detected" indicates that no asbestos fibres were observed.

Calibrated Visual Estimate (%)
Date Format : yyyy/mm/dd

Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

TEST SUMMARY

Maxxam ID: IFK541
Sample ID: BH5 SS2
Matrix: Soil

Collected: 2018/11/01
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	5826988	N/A	2018/11/15	Automated Statchk
Hot Water Extractable Boron	ICP	5832167	2018/11/12	2018/11/12	Suban Kanapathippllai
Free (WAD) Cyanide	TECH	5832936	2018/11/12	2018/11/13	Louise Harding
Conductivity	AT	5833105	2018/11/14	2018/11/14	Barbara Kalbasi Esfahani
Hexavalent Chromium in Soil by IC	IC/SPEC	5831518	2018/11/10	2018/11/14	Rupinder Sihota
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5834644	N/A	2018/11/13	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5833889	2018/11/13	2018/11/13	Anna Stuglik Rolland
Strong Acid Leachable Metals by ICPMS	ICP/MS	5831332	2018/11/10	2018/11/12	Daniel Teclu
Moisture	BAL	5828411	N/A	2018/11/08	Min Yang
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	5833853	2018/11/13	2018/11/14	Mitesh Raj
pH CaCl2 EXTRACT	AT	5832549	2018/11/13	2018/11/13	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5826989	N/A	2018/11/15	Automated Statchk

Maxxam ID: IFK543
Sample ID: BH7 SS1
Matrix: Soil

Collected: 2018/11/02
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Methylnaphthalene Sum	CALC	5826988	N/A	2018/11/15	Automated Statchk
Hot Water Extractable Boron	ICP	5832167	2018/11/12	2018/11/12	Suban Kanapathippllai
Free (WAD) Cyanide	TECH	5832936	2018/11/12	2018/11/13	Louise Harding
Conductivity	AT	5833105	2018/11/14	2018/11/14	Barbara Kalbasi Esfahani
Hexavalent Chromium in Soil by IC	IC/SPEC	5831518	2018/11/10	2018/11/14	Rupinder Sihota
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	5834644	N/A	2018/11/13	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5833889	2018/11/13	2018/11/13	Anna Stuglik Rolland
Strong Acid Leachable Metals by ICPMS	ICP/MS	5831332	2018/11/10	2018/11/12	Daniel Teclu
Moisture	BAL	5828411	N/A	2018/11/08	Min Yang
PAH Compounds in Soil by GC/MS (SIM)	GC/MS	5833853	2018/11/13	2018/11/14	Mitesh Raj
pH CaCl2 EXTRACT	AT	5832549	2018/11/13	2018/11/13	Gnana Thomas
Sodium Adsorption Ratio (SAR)	CALC/MET	5826989	N/A	2018/11/15	Automated Statchk

Maxxam ID: IFK546
Sample ID: BH 4
Matrix: Solid

Collected: 2018/10/18
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Asbestos by PLM - 0.5 RDL	MIC	5827918	N/A	2018/11/09	Romeo Samson

Maxxam ID: IFK546 Dup
Sample ID: BH 4
Matrix: Solid

Collected: 2018/10/18
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Asbestos by PLM - 0.5 RDL	MIC	5827918	N/A	2018/11/09	Romeo Samson

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

TEST SUMMARY

Maxxam ID: IFK547
Sample ID: BH 6
Matrix: Solid

Collected: 2018/11/01
Shipped:
Received: 2018/11/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Asbestos by PLM - 0.5 RDL	MIC	5827918	N/A	2018/11/09	Romeo Samson

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.0°C
Package 2	20.0°C

Results relate only to the items tested.

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

QUALITY ASSURANCE REPORT

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5833853	D10-Anthracene	2018/11/13	84	50 - 130	86	50 - 130	86	%		
5833853	D14-Terphenyl (FS)	2018/11/13	79	50 - 130	81	50 - 130	80	%		
5833853	D8-Acenaphthylene	2018/11/13	83	50 - 130	84	50 - 130	80	%		
5833889	o-Terphenyl	2018/11/13	91	60 - 130	89	60 - 130	92	%		
5834644	1,4-Difluorobenzene	2018/11/13	101	60 - 140	102	60 - 140	102	%		
5834644	4-Bromofluorobenzene	2018/11/13	98	60 - 140	100	60 - 140	97	%		
5834644	D10-Ethylbenzene	2018/11/13	87	60 - 140	102	60 - 140	83	%		
5834644	D4-1,2-Dichloroethane	2018/11/13	99	60 - 140	99	60 - 140	98	%		
5828411	Moisture	2018/11/08							1.5 (1)	20
5831332	Acid Extractable Antimony (Sb)	2018/11/12	90	75 - 125	103	80 - 120	<0.20	ug/g	4.0 (1)	30
5831332	Acid Extractable Arsenic (As)	2018/11/12	94	75 - 125	104	80 - 120	<1.0	ug/g	2.2 (1)	30
5831332	Acid Extractable Barium (Ba)	2018/11/12	NC	75 - 125	99	80 - 120	<0.50	ug/g	1.2 (1)	30
5831332	Acid Extractable Beryllium (Be)	2018/11/12	95	75 - 125	101	80 - 120	<0.20	ug/g	3.3 (1)	30
5831332	Acid Extractable Boron (B)	2018/11/12	88	75 - 125	98	80 - 120	<5.0	ug/g	3.3 (1)	30
5831332	Acid Extractable Cadmium (Cd)	2018/11/12	94	75 - 125	100	80 - 120	<0.10	ug/g	NC (1)	30
5831332	Acid Extractable Chromium (Cr)	2018/11/12	NC	75 - 125	104	80 - 120	<1.0	ug/g	4.2 (1)	30
5831332	Acid Extractable Cobalt (Co)	2018/11/12	99	75 - 125	103	80 - 120	<0.10	ug/g	2.6 (1)	30
5831332	Acid Extractable Copper (Cu)	2018/11/12	95	75 - 125	101	80 - 120	<0.50	ug/g	0.83 (1)	30
5831332	Acid Extractable Lead (Pb)	2018/11/12	91	75 - 125	103	80 - 120	<1.0	ug/g	3.4 (1)	30
5831332	Acid Extractable Mercury (Hg)	2018/11/12	93	75 - 125	105	80 - 120	<0.050	ug/g	NC (1)	30
5831332	Acid Extractable Molybdenum (Mo)	2018/11/12	97	75 - 125	103	80 - 120	<0.50	ug/g	NC (1)	30
5831332	Acid Extractable Nickel (Ni)	2018/11/12	92	75 - 125	102	80 - 120	<0.50	ug/g	3.0 (1)	30
5831332	Acid Extractable Selenium (Se)	2018/11/12	93	75 - 125	104	80 - 120	<0.50	ug/g	NC (1)	30
5831332	Acid Extractable Silver (Ag)	2018/11/12	94	75 - 125	98	80 - 120	<0.20	ug/g	NC (1)	30
5831332	Acid Extractable Thallium (Tl)	2018/11/12	92	75 - 125	101	80 - 120	<0.050	ug/g	2.2 (1)	30
5831332	Acid Extractable Uranium (U)	2018/11/12	95	75 - 125	103	80 - 120	<0.050	ug/g	3.3 (1)	30
5831332	Acid Extractable Vanadium (V)	2018/11/12	NC	75 - 125	100	80 - 120	<5.0	ug/g	5.5 (1)	30
5831332	Acid Extractable Zinc (Zn)	2018/11/12	NC	75 - 125	106	80 - 120	<5.0	ug/g	1.0 (1)	30
5831518	Chromium (VI)	2018/11/14	41 (2)	70 - 130	87	80 - 120	<0.2	ug/g	NC (1)	35
5832167	Hot Water Ext. Boron (B)	2018/11/12	97	75 - 125	101	75 - 125	<0.050	ug/g	NC (1)	40

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Maxxam Job #: B8T5664
Report Date: 2018/11/15

QUALITY ASSURANCE REPORT(CONT'D)

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5832549	Available (CaCl2) pH	2018/11/13			100	97 - 103			0.76 (1)	N/A
5832936	WAD Cyanide (Free)	2018/11/13	85	75 - 125	94	80 - 120	<0.01	ug/g	2.2 (1)	35
5833105	Conductivity	2018/11/14			104	90 - 110	<0.002	mS/cm	0.35 (1)	10
5833853	1-Methylnaphthalene	2018/11/13	108	50 - 130	109	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	2-Methylnaphthalene	2018/11/13	97	50 - 130	95	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Acenaphthene	2018/11/13	87	50 - 130	87	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Acenaphthylene	2018/11/13	78	50 - 130	78	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Anthracene	2018/11/13	81	50 - 130	80	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(a)anthracene	2018/11/13	90	50 - 130	87	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(a)pyrene	2018/11/13	85	50 - 130	85	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(b/j)fluoranthene	2018/11/13	89	50 - 130	92	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(g,h,i)perylene	2018/11/13	81	50 - 130	79	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Benzo(k)fluoranthene	2018/11/13	91	50 - 130	91	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Chrysene	2018/11/13	89	50 - 130	89	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Dibenz(a,h)anthracene	2018/11/13	85	50 - 130	82	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Fluoranthene	2018/11/13	88	50 - 130	90	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Fluorene	2018/11/13	95	50 - 130	93	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Indeno(1,2,3-cd)pyrene	2018/11/13	84	50 - 130	83	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Naphthalene	2018/11/13	84	50 - 130	83	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Phenanthrene	2018/11/13	85	50 - 130	85	50 - 130	<0.0050	ug/g	NC (1)	40
5833853	Pyrene	2018/11/13	84	50 - 130	85	50 - 130	<0.0050	ug/g	NC (1)	40
5833889	F2 (C10-C16 Hydrocarbons)	2018/11/13	100	50 - 130	99	80 - 120	<10	ug/g	7.6 (1)	30
5833889	F3 (C16-C34 Hydrocarbons)	2018/11/13	95	50 - 130	94	80 - 120	<50	ug/g	NC (1)	30
5833889	F4 (C34-C50 Hydrocarbons)	2018/11/13	94	50 - 130	92	80 - 120	<50	ug/g	NC (1)	30
5834644	Benzene	2018/11/13	73	60 - 140	104	60 - 140	<0.020	ug/g	NC (1)	50
5834644	Ethylbenzene	2018/11/13	77	60 - 140	104	60 - 140	<0.020	ug/g	NC (1)	50
5834644	F1 (C6-C10) - BTEX	2018/11/13					<10	ug/g	NC (1)	30
5834644	F1 (C6-C10)	2018/11/13	86	60 - 140	101	80 - 120	<10	ug/g	NC (1)	30
5834644	o-Xylene	2018/11/13	76	60 - 140	101	60 - 140	<0.020	ug/g	NC (1)	50
5834644	p+m-Xylene	2018/11/13	77	60 - 140	103	60 - 140	<0.040	ug/g	NC (1)	50

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5834644	Toluene	2018/11/13	80	60 - 140	109	60 - 140	<0.020	ug/g	NC (1)	50
5834644	Total Xylenes	2018/11/13					<0.040	ug/g	NC (1)	50

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Duplicate Parent ID

(2) The matrix spike recovery was below the lower control limit. This may be due in part to the reducing environment of the sample. The sample was reanalyzed with the same results.

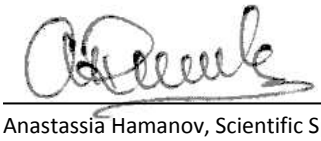
Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B8T5664
Report Date: 2018/11/15

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Site Location: HIGHWAY 410

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anastassia Hamanov, Scientific Specialist

Banu Gurgen-Keough, Supervisor

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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IMMEDIATE

Maxxam
A Bureau Veritas Group Company

14031P

SIGNATURE

CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

Page _____ of _____

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: Wood.	Company Name:	Quotation #: B61973	[X] Regular TAT (5-7 days) Most analyses
Contact Name: Accounts Payable	Contact Name: Alessandro Pellerito	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: 50 Vogell road, Units 3 and 4 , Richmond Hill, L4B 3N6	Address:	Project #: TPB166090.6000	Rush TAT (Surcharges will be applied) [ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Phone: 905-415-2632 Fax:	Phone: Fax:	Site Location: Highway 410	Date Required:
Email: AP_GTAEAST@woodplc.com	Email: a.pellerito@woodplc.com; shami.malla@woodplc.com	Site #:	Rush Confirmation #:
		Sampled By: Mohammad Safarpanah	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153	Other Regulations
[ ] Table 1 [ ] Res/Park [ ] Med/ Fine	[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] Table 2 [ ] Ind/Comm [ ] Coarse	[ ] MISA [ ] Storm Sewer Bylaw
[ ] Table 3 [ ] Agri/ Other	[ ] PWQO Region
[ ] Table _____	[ ] Other (Specify)
FOR RSC (PLEASE CIRCLE) Y / N	[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	PAHs	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	Asbestos	HOLD- DO NOT ANALYZE	COMMENTS
1	BH5 SS2	11/1/2018	9:40	Soil	4										
2	BH5 SS9	11/1/2018	1:00	Soil	4									X	
3	BH7 SS1	11/2/2018	8:30	Soil	4									X	
4	BH7 SS7	11/2/2018	9:40	Soil	4									X	
5	TCLP	11/2/2018	NA	Soil	2									X	
6	BH 4	10/18/2018	9:00	Asphalt	1								X	X	
7	BH 6	11/1/2018	9:00	Asphalt	4								X		
8															
9															
10															

Analysis Requested

LABORATORY USE ONLY		
CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
Y	Y	1 1 1 1
N	N	20/20/20 No Cooling Media

COOLING MEDIA PRESENT: (Y) / N

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Alessandro Pellerito	2018/11/05	11:20	Dipak Singh DIPAK SINGH	2018/11/06	14:48

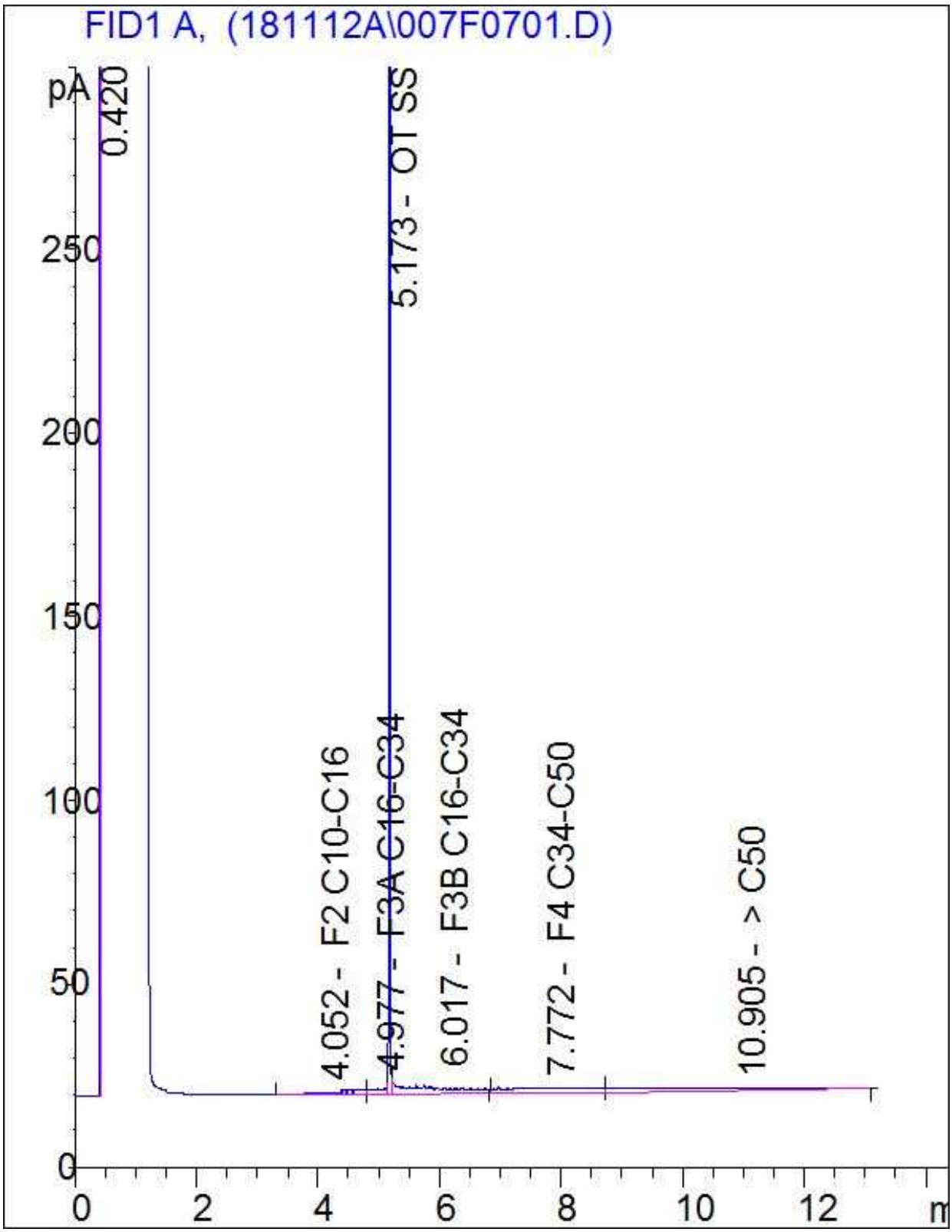
06-Nov-18 14:48
Gina Baybayan
B8T5664
GID ENV-1127

LB#36719

Maxxam Job #: B8T5664
Report Date: 2018/11/15
Maxxam Sample: IFK541

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Project name: HIGHWAY 410
Client ID: BH5 SS2

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram

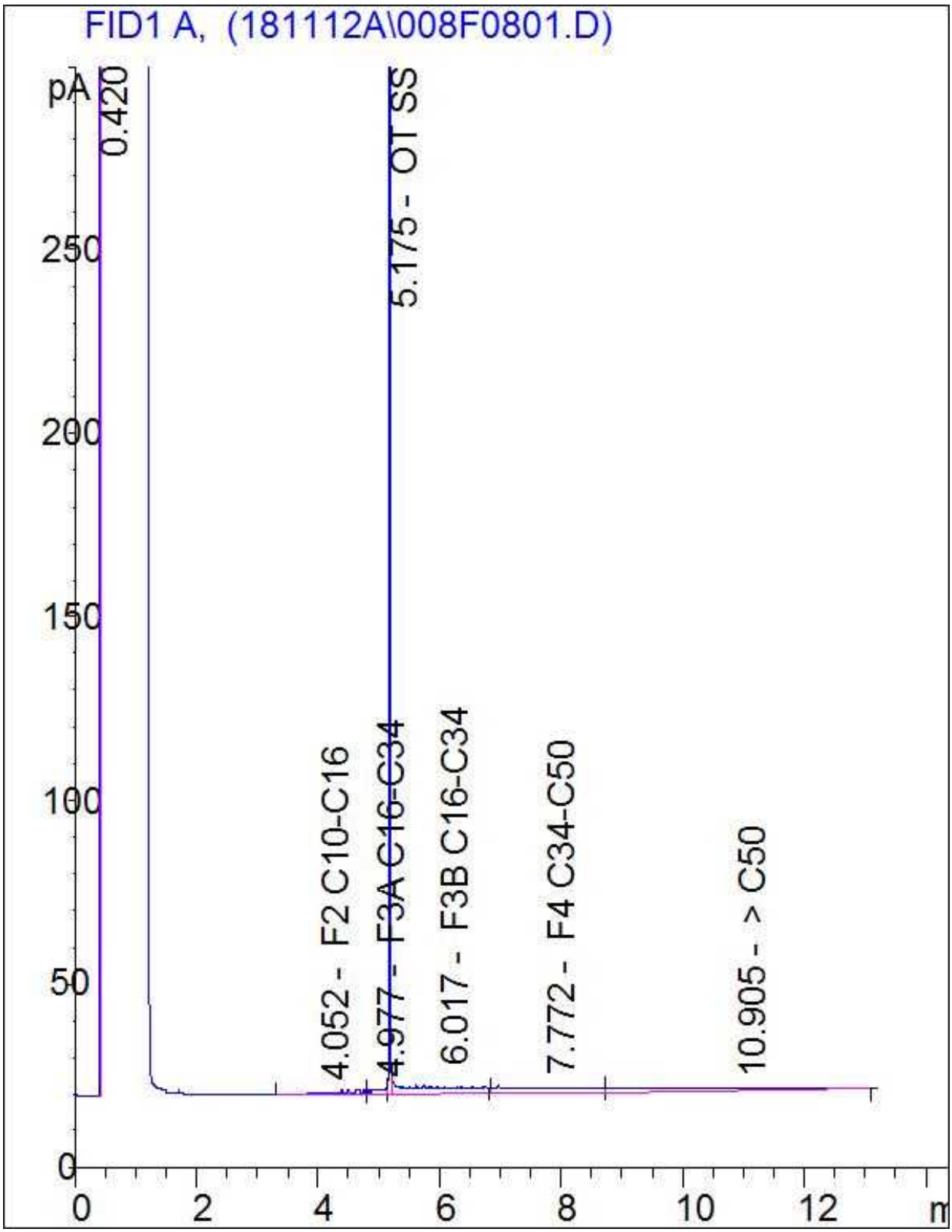


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B8T5664
Report Date: 2018/11/15
Maxxam Sample: IFK543

Wood Environment & Infrastructure Solutions, a division of Wood Canada Limited
Client Project #: TPB166090.600
Project name: HIGHWAY 410
Client ID: BH7 SS1

Petroleum Hydrocarbons F2-F4 in Soil Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.