GEOTECHNICAL INVESTIGATION
CULVERT REPLACEMENT
REID SIDEROAD
MILTON, ONTARIO

Submitted to:
TOWN OF MILTON
INFRASTRUCTURE DEPARTMENT
150 Mary Street
Milton, Ontario
L9T 6Z5
Attention: Mr. John Brophy, Director of Infrastructure

Submitted by:
Wood Environment & Infrastructure Solutions
3450 Harvester Road, Suite 100
Burlington, Ontario
Canada L7N 3W5
Tel: (905) 335-2353

May 2019

Project #TPB188147S.2000.1

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1. AUTHORIZATION

Formal authorization to proceed with this investigation was received from the Town of Milton, Infrastructure Department, ("Client") in the form of a purchase order, number C-18-37.

2. INTRODUCTION

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited ("Wood"), was retained by the Client to conduct a geotechnical investigation for the proposed replacement culvert located on Reid Sideroad approximately 400 m west of Stokes Trail in Milton, Ontario. The overall site location is shown on Figure 1 in Appendix A.

2.1. SITE AND PROJECT DESCRIPTION

The existing Reid Sideroad 900 mm diameter culvert consisted of a corrugated steel pipe (CSP) at the up-stream end and a PVC pipe at the down-stream end. The culvert which is situated approximately 3 m below road grade is scheduled for replacement with a larger diameter concrete culvert, the size and invert grades of which were not available at the time of report preparation.

The following report sections provide a summary of the findings of the field investigation, and provide geotechnical engineering recommendations pertaining to subgrade preparation, soil foundation bearing values, excavations during construction, soil reuse and groundwater conditions.

2.2. TERMS OF REFERENCE

The findings of the investigation, together with Wood's comments and recommendations, are presented in this report. The anticipated construction conditions are also discussed but only to the extent that they may influence the design decisions. Any construction methods discussed express Wood's opinions only and are not intended to direct contractors on how to carry out the construction. Contractors should also be aware that the data and the interpretation presented in this report may not be sufficient to assess all the factors that may have an effect on construction.

This report was prepared with the assumption that the design will be in accordance with applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practices.

Further, the recommendations and opinions expressed in this report are only applicable to the proposed project as described above.

An ongoing liaison with Wood must be maintained during both the design and construction phases of the project to ensure that the recommendations in this report have been interpreted and implemented correctly. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of this project, Wood should be contacted immediately.

2.3. GEOLOGICAL SETTING

Map 2509 - Quaternary Geology of the Hamilton Area Southern Ontario published by the Ontario Ministry of Northern Development and Mines, indicates that surficial soils in the project area are likely to consist of sand and gravel associated with kame and esker formations.

Map 2336 - Paleozoic Geology of the Hamilton Area published by the Ontario Division of Mines, indicates the bedrock in the project area consists of blue – grey dolostone of the Amabel Formation.

Map P.495 – Southern Ontario Hamilton Sheet Drift Thickness Series published by the Ontario Department of Mines indicates the dolostone can be expected to be located more than 8 m below grade.

3. FIELD AND LABORATORY INVESTIGATION

The investigation was carried out to obtain information about the soils at this site by means of sampled boreholes and laboratory testing.

3.1. FIELD WORK

A total of two (2) boreholes were drilled on January 4th, 2019. The locations of the sampled boreholes are indicated on the attached Borehole Location Plan (Figure 2).

Drilling operations were performed by Davis Drilling Inc. using a truck mounted drill rig. The rig was outfitted with 150 mm solid stem augers.

Boreholes BH1 and BH2 were drilled on Reid Sideroad, with BH1 in the west bound lane and BH2 in the east bound lane, both to a depth of 8.2 m below existing grade.

All soil samples and auger cuttings were visually examined and classified in the field. Prior to carrying out any fieldwork, the appropriate utility companies were notified to carry out underground service clearances at the borehole locations.

The drilling, sampling and testing operations were conducted under the direction of a qualified Wood geotechnical personnel who logged the various soil strata. All soil samples and auger cuttings were visually examined and classified in the field. Groundwater and drilling conditions as well as any pertinent subsurface observations were also recorded during drilling progression.

Samples were obtained through the overburden soil by driving a split spoon sampling device in accordance with the requirements of the Standard Penetration Test (SPT), ASTM D-1586. The number of blows required to drive the sampler for 0.3 m of penetration was recorded.

Upon completion, Boreholes BH1 and BH2 were backfilled to grade with bentonite in accordance with the requirements of Ontario Regulation 903, as amended.

Groundwater conditions were measured during and upon completion of drilling.

3.2 PHYSICAL LABORATORY WORK

The soil samples were returned to Wood's Burlington laboratory for further visual examination and classification. The following analyses were performed:

- Water content determination on each of the collected soil samples
- Two (2) grain size distribution analysis on representative samples

All soil samples will be stored for three months upon completion of this report. The samples will then be discarded unless Wood is instructed otherwise.

3.3 ENVIRONMENTAL SAMPLE COLLECTION AND ANALYSIS

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

- Conducting the soil sampling activities in accordance with the Ministry of the Environment (MOE) document entitled "Guide for Completing Phase Two Environmental Site Assessments under Ontario Regulation 153/04" dated June 2011, the Ministry of the Environment and Energy (MOEE) document entitled "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario", dated December 1996; and MOE document entitled "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" issued by the Laboratory Services Branch of the MOE and dated March 9, 2004, amended as of July 1, 2011 (Analytical Protocol). It should be noted that the MOE has recently been renamed the Ministry of Environment, Conservation and Parks (MECP);

- Submission of two (2) soil samples (1 from each borehole) for laboratory analysis of metals and inorganics so as to assist in determining appropriate soil disposal options, if required, during construction;

- Submission of one (1) soil sample for Ontario Regulation 347 (O. Reg. 347) as amended by Ontario Regulation 558/00 (O. Reg. 558/00) Toxicity Characteristic Leaching Procedure (TCLP) for volatile organic compounds (VOCs), benzo(a)pyrene (B(a)P) and metals and inorganics to determine landfill acceptability of soil/fill originating from the Site;

- Comparing laboratory analytical results to the soil and groundwater outlined in the MECP "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act," dated April 15, 2011 and O. Reg. 347 (as amended by O. Reg. 558/00) Schedule 4 Leachate Quality Criteria provided in the MECP document entitled "Registration Guidance Manual For Generators of Liquid Industrial and Hazardous Waste," October 2000 (the "Schedule 4 Criteria").

3.3.1. SITE CONDITION STANDARDS

Soil results were compared to the MECP Table 1 SCS for Residential / Parkland / Institutional / Industrial / Commercial / Community Property Use (Table 1 SCS) and Table 3 SCS for Industrial / Commercial / Community Property Use (Table 3 SCS) as presented in "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", dated April 15, 2011. Additionally, one (1) soil sample was compared to Schedule 4 Leachate Quality Criteria of O. Reg. 347 (as amended by O. Reg. 558/00)

3.3.2. SOIL SAMPLING, INSPECTION AND PRESERVATION PROCEDURES

Soil samples were obtained for laboratory analysis and field screening, where applicable, using a drill rig equipped with split spoon sampling capabilities. The drillers cleaned the split spoon by removing loose dirt from the split spoon using a wire brush, washing the split spoon using a brush in a dilute mix of potable water and Alconox soap, rinsing the split spoon with distilled water and rinsing the split spoon with methanol and allowing the split spoon to air dry.

The drillers obtained the split spoon sample by auguring to the specified depth, hammering the spoon about 0.6 m into the soil and removing the spoon. The split spoon sample was inspected for visual and/or olfactory evidence of environmental impacts. Disposable nitrile gloves were used and replaced between the handling of successive samples.

Soil samples deemed to be representative of the Site conditions were collected and placed in laboratory-supplied glass jars equipped with Teflon seals and submitted for metals & inorganics. The samples were selected on the basis of visual/olfactory evidence of impacts, field screening results, or from the vicinity of the apparent water table. All samples were stored in coolers, on ice, immediately after collection and during transport to the laboratory.

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

4. GENERAL SUBSURFACE CONDITIONS

For a description of the soil conditions encountered at each location during this investigation, reference should be made to the Record of Borehole Logs in Appendix A.

Pavement Structure

Approximately 215 mm and 180 mm of asphalt was encountered in Boreholes BH1 and BH2, respectively.

Sand Fill

The asphalt in both boreholes was underlain by a sand fill deposit, which contained trace to some silt and gravel. The sand fill deposit extended to a depth of 2.1 m in Borehole BH1 and 2.2 m in Borehole BH2. The SPT 'N' values ranged from 40 to 74 blows for 0.3 m of penetration within the sand fill which indicated the fill material was in a dense to very dense condition. The natural moisture content of the sand fill deposit ranged from 5% to 12%.

Silty Clay Fill

The sand fill in both boreholes was underlain by a silt clay fill deposit, which contained trace to some sand and gravel. This silty clay fill deposit extended to 3.8 m and 3.7 m below surface grade in Boreholes BH1 and BH2, respectively. The SPT 'N' values ranged from 4 to 12 blows for 0.3 m of penetration which indicated firm to stiff consistencies. The natural moisture content ranged from 11% to 16%.

Peat

The silty clay fill in both boreholes was underlain by a deposit of peat, which extended to 4.1 m and 4.0 m below surface grade in Boreholes BH1 and BH2, respectively. The natural moisture content of the peat was determined to be 128%.

Cobbles and Gravel

The peat in Borehole BH2 was underlain by a deposit of cobbles and gravel which extended to a depth of 4.1 m below existing grade.

Silt and Sand

The peat in Borehole BH1 and the cobbles and gravel in Borehole BH2 were underlain by a silt and sand deposit, which contained some clay, trace gravel and organics. The silt and sand deposit extended to a depth of 5.3 m in Borehole BH1 and 5.2 m in Borehole BH2. The SPT 'N' values of 3 and 5 blows for 0.3 m of penetration within the silt and sand indicated the material was in a loose condition. The natural moisture content of the silt and sand deposit was determined to be 28% and 30%.

The result of one grain size / hydrometer analysis of the selected sample is summarized in the following table. The results are also noted in Figure 3.

Table 1: Summary of Grain-Size Distribution

BH ID	Sample	Depth (m)	Particle Size Distribution			
			Gravel	Sand	Silt	Clay
BH1	SS6B & SS7	4.1 to 5.2	6.5%	37.8%	43.6%	12.1%

Sand

The silt and sand deposit in both boreholes was underlain by a sand deposit, which contained some silt and gravel and trace clay. The sand deposit extended to at least the borehole termination depths of 8.2 m below existing grade. The SPT 'N' values within the sand deposit ranged from 7 to 12 blows for 0.3 m of

penetration which indicates the material was in a loose to compact condition. The natural moisture content of the sand deposit ranged from 5% 17%.

The result of one grain size / hydrometer analysis of the selected sample is summarized in the following table. The results are also noted in Figure 4.

Table 2: Summary of Grain-Size Distribution

BH ID	Sample	Depth (m)	Particle Size Distribution			
			Gravel	Sand	Silt	Clay
BH2	SS8	5.3 to 5.9	22.4%	53.3%	20.1%	4.2%

4.1 GROUNDWATER CONDITIONS

Upon completion of the boreholes, the groundwater level was measured to be 4.1 m and 2.8 m below existing grade in Boreholes BH1 and BH2, respectively. Additionally, the borehole cave in depths upon completion were measured to be at 4.6 m and 6.7 m below existing grade in Boreholes BH1 and BH2, respectively.

It should be noted that water levels are subject to seasonal fluctuations and weather conditions. Groundwater levels can be expected to be somewhat higher during the spring months, and in response to major weather events and will likely match the creek water levels.

5. DISCUSSION AND RECOMMENDATIONS

The project will consist of replacing the existing 900 mm diameter culvert located approximately 3 m below the Reid Sideroad surface with a larger diameter concrete culvert.

5.1. CULVERT FOUNDING CONDITIONS

Based on the soil profile observed at the borehole locations and assuming the invert level for the proposed culvert likely match that of the existing culvert, the founding subgrade for the culvert would be within the fill soils which are underlain by the peat deposit. The fill soils and underlying peat are not considered suitable to support the proposed replacement culvert. Unacceptable settlements could occur if the culvert is placed on these soils.

The culvert will have to be founded below the fills and peat into the loose silt and sand / cobbles and gravel present at elevations of 289.6 m and 287.9 m in BH1 and BH 2, respectively, and may be designed to a factored ultimate limit state (ULS) bearing value of 150 kPa, and serviceability limit state (SLS) bearing value of 100 kPa. The total and differential settlements are anticipated to be less than 25 mm and 15 mm respectively.

For subgrade protection, lean concrete mud mat (or approved material) is recommended to be placed on the exposed subgrade.

Should higher bearing values be required, or the recommended founding levels be impractical for the proposed culvert, consideration can be given to full removal of any fill and peat present below the specified founding level and their replacement with either lean mix concrete fill or Engineered Fill. The engineered fill material can consist of suitable on-site materials as discussed in Section 5.5 or approved imported granular. A specification for engineered fill can be found in Appendix B.

The creek will require diversion during construction to ensure work is completed in dry conditions.

For construction of culvert foundations, Ontario Provincial Standard Specification (OPSS) 902 (*Construction Specifications for Excavating and Backfilling - Structures*) should be followed. Backfill, backfill transition and cover for the culvert should conform to Ontario Provincial Standard Drawing (OPSD) 802.031 (*Rigid Pipe Bedding, Backfill and Cover for Type 3 soil – Earth Excavation)*

Granular bedding material should be placed in layers not exceeding 200 mm in thickness and compacted to 100% of the material's Standard Proctor Maximum Dry Density (SPMDD).

5.2. EXCAVATIONS

Conventional heavy equipment should be capable of excavating the asphalt, fills, and peat.

All excavations must comply with the Occupational Health & Safety Act and Regulations for Construction Projects. All excavations deeper than 1.2 m must be sloped as outlined in the Act.

The fill materials are considered to be type 3 soils and the peat is considered to be a type 4 soil. If the soils are saturated at the time of construction, the condition of each soil type should be re-evaluated, and the classification revised if required.

In general, temporary excavation side slopes of 1 horizontal to 1 vertical for the proposed culvert are expected to remain stable through the overburden soils. Some flattening of excavation sides may be required if saturated soils are encountered.

If vertically cut and braced excavations through soils are used to limit disturbance to traffic, the guidelines governing trench side support are outlined in the Act.

A trench liner box is considered suitable for the safety of workers and is an approved construction technique. However, it does not provide a 'tight' soil support system and can result in soil loss from beneath the edges of the pavement along the sides of the trench.

It is recommended that qualified geotechnical personnel be present during excavation to review the conditions of the subgrade material.

5.3. GROUNDWATER DURING CONSTRUCTION

Based on the encountered soil and groundwater levels and the anticipated excavation depth of 4.1 m below the road surface, groundwater flow into the excavation is anticipated to be moderate to heavy. Due to the soils encountered at the anticipated excavation depths, dewatering using sumps would likely result in unstable excavation during construction. As such, specialized dewatering procedures may be required to control groundwater flow and maintain base and side slope stability.

As excavation is anticipated to be below the groundwater level where groundwater flow into the excavation is anticipated to be moderate to heavy, a hydrogeological investigation is recommended to further assess the dewatering requirements, and to obtain the appropriate water taking permitting (EASR / PTTW) and associated discharge permitting (if required).

All surface water should be directed away from any open excavations. A cofferdam and/or diversion of the creek flow will be required for such purpose. During construction, temporary erosion and sediment controls such as sediment trap, interceptor drain, dyke and/or silt fence should be provided and installed to prevent uncontrolled water/sediment flow into the existing water course.

5.4. EROSION CONTROL

Inlet and outlet protection, in accordance with OPSS 511 (*Rip-Rap, Rock Protection and Granular Sheeting*) and OPSD 810.010 (*Rip-Rap Treatment for Sewer and Culvert Outlets*), are recommended to prevent erosion adjacent to the culvert as well as scour that could undermine the culvert foundation. Non-woven geotextile should be placed below the rip-rap, in accordance to OPSS 1860 (*Geotextiles*), to minimize the potential for erosion of fine particles from below the inlet/outlet treatment.

The embankment slope surface should be covered with topsoil and seeded/sodded as soon as possible after completion of construction. Seeding and sodding should comply with OPSS 803 (*Construction Specification for Seed and Cover*) and OPSS 804 (*Construction Specification for Sodding*).

Temporary erosion control measures required for construction should comply with OPSS 805 (*Construction Specification for Temporary Erosion and Sediment Control Measures*).

5.5. RE-USE OF EXCAVATED MATERIAL AS MASS FILL AND BACKFILL

The material excavated from the site is anticipated to consist of asphalt, sand and silty clay fills and peat. The asphalt and peat are not suitable for re-use. The sand and silty clay fills are suitable for re-use provided the soil is clean and can be properly compacted. Generally, heavy compaction equipment must be used in order to break up and thoroughly re-compact clayey soils to prevent post-construction settlement. Poorly compacted backfill will settle and will be reflected in the surface pavement. Also, it is generally difficult to adequately place and compact cohesive soils in small, confined areas such as within narrow trenches.

The soils must also be at a suitable water content for re-compaction. Typically, the optimum moisture content for sandy and clayey soils for re-compaction are 13% and 18%, respectively. The moisture contents recorded for the sand fill ranged from 5% to 12% and from 11% to 22% for the silty clay fill. Therefore, some reconditioning may be required depending on the moisture conditions at the time of construction.

In view of the above, it may be more practical to import a granular fill where fill is needed. Imported Granular 'B' or better can be used as backfill / engineered fill. Granular fills are generally easier to place and compact in confined areas, expediting the compaction process. Any unsuitable soils encountered during the excavation should be removed from the site and disposed of appropriately, depending on the condition of the soil. The degree of compaction required in a filled location will depend on the amount of settlement that is tolerable. All fills below settlement sensitive areas should be placed in maximum 30 mm loose lifts and compacted to a minimum of 100% of Standard Proctor Maximum Dry Density (ASTM D6938).

The pavement structure in the excavated area should be reinstated to match the existing pavement structure on both sides of the culvert, or as per the Town of Milton's specifications.

5.6. ENVIRONMENTAL TESTING RESULTS AND CONSIDERATION

Wood completed an Environmental Soil Quality Testing Program as part of the Geotechnical Investigation. The details of the drilling program, including borehole locations and drilling methodology are presented in the geotechnical investigation sections of this report. Two (2) soil samples were submitted for laboratory analysis of metals and inorganics based on presence of fill material and depth of construction works. One (1) TCLP soil sample was submitted for laboratory analysis of volatile organic compounds (VOCs), benzo(a)pyrene (BaP) and metals and inorganics.

Aside from fill material (i.e., sand / silty clay) in the boreholes, no other evidence (i.e., visual/olfactory) of environmental impacts were observed in any of the soil samples collected from this project area.

All soil sample results were reported below the Table 1 SCS for metals & inorganics with the following exceptions":

- Electrical conductivity (EC) (Table 1 SCS – 0.57 millisiemens per centimeter [mS/cm]) was detected in BH1 at 1.12 mS/cm at a depth between 3.8-4.4 mbgs (sample BH1-SS6) and in □□□ □t 1.19 mS/cm at a depth between 3.1-3.6 mbgs (sample BH2-SS5); and

Sodium Adsorption Ratio (SAR) (Table 1 SCS – 2.4 [unitless]) was detected in BH1 at 4.48 at a depth between 3.8-4.4 mbgs (sample BH1-SS6) and in BH2 at 3.86 at a depth between 3.1-3.6 mbgs (sample BH2-SS5).A representative soil sample was submitted for TCLP analysis of VOCs, benzo(a)pyrene and metals and inorganic parameters. The sample met the applicable Schedule 4 criteria, therefore the soil is considered non-hazardous for disposal purposes (at an MECP approved facility).

The laboratory certificates of analysis are presented in Appendix C.

The laboratory data is considered acceptable to be relied upon based on the reporting limits being met for all samples and tested parameters, no tested parameter being present in a detectable concentration in any laboratory Method Blank and all laboratory surrogates, reference materials and spikes were within acceptable limits.

It should be noted that EC and SAR are commonly associated with road salt used for de-icing activities along roads and highways. Exceedances of SAR and EC will be exempt as per Section 48 (3) of Ontario

Regulation (O. Reg.) 153/04: "If, having regard to any phase one and phase two environmental site assessments for a property, a qualified person determines that an applicable site condition standard is exceeded at the property solely because a substance has been used on a highway for the purpose of keeping the highway safe for traffic under conditions of snow or ice or both, as provided for under section 2 of Regulation 339 of the Revised Regulations of Ontario, 1990 (Classes of Contaminants — Exemptions), the applicable site condition standard is deemed not to be exceeded for the purpose of Part XV.1 of the Act. O. Reg. 153/04, s. 48 (3)". Therefore, soils only with elevated concentrations of EC and SAR within the road allowance appear to originate from de-icing activities that have occurred along the road and therefore are not considered to exceed the SCS under O. Reg. 153/04 (for re-use within the road allowance).

6. CLOSURE

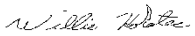
The attached Report Limitations in Appendix D is an integral part of this report and should be reviewed.

We trust that this report is complete within the terms of our reference. However, should questions arise concerning this report, do not hesitate to contact us.

Sincerely,

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

Prepared by:



Willie Kokotec, P. Eng.
Senior Project Engineer

Reviewed by:

Thomas Ring, M.A.Sc., P. Eng.
Senior Geotechnical Engineer

APPENDIX A:
FIGURES AND BOREHOLE LOGS

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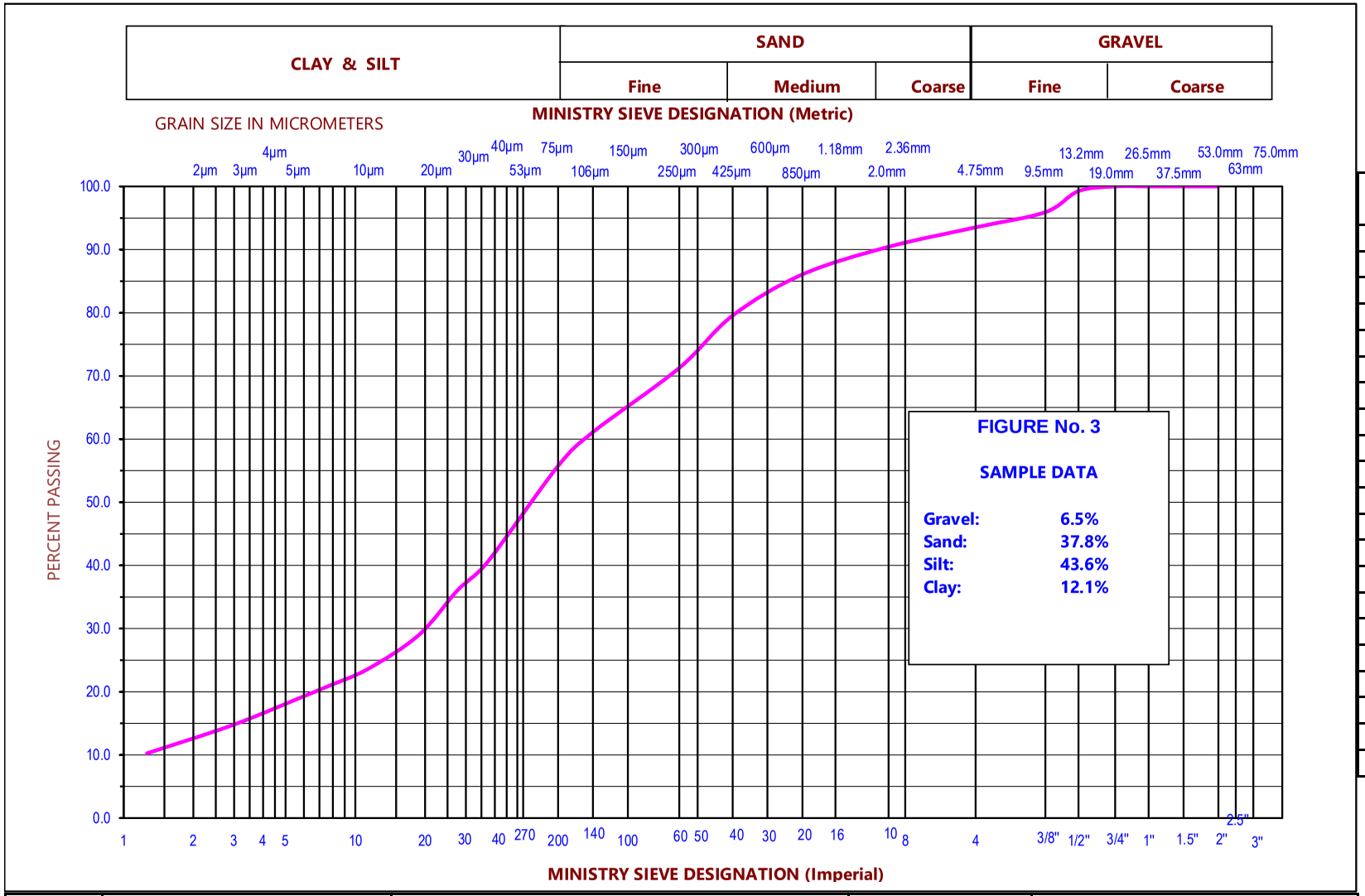
UNIFIED SOIL CLASSIFICATION SYSTEM

Determination of Particle Size Analysis of Soils LS 702 or ASTM D7928

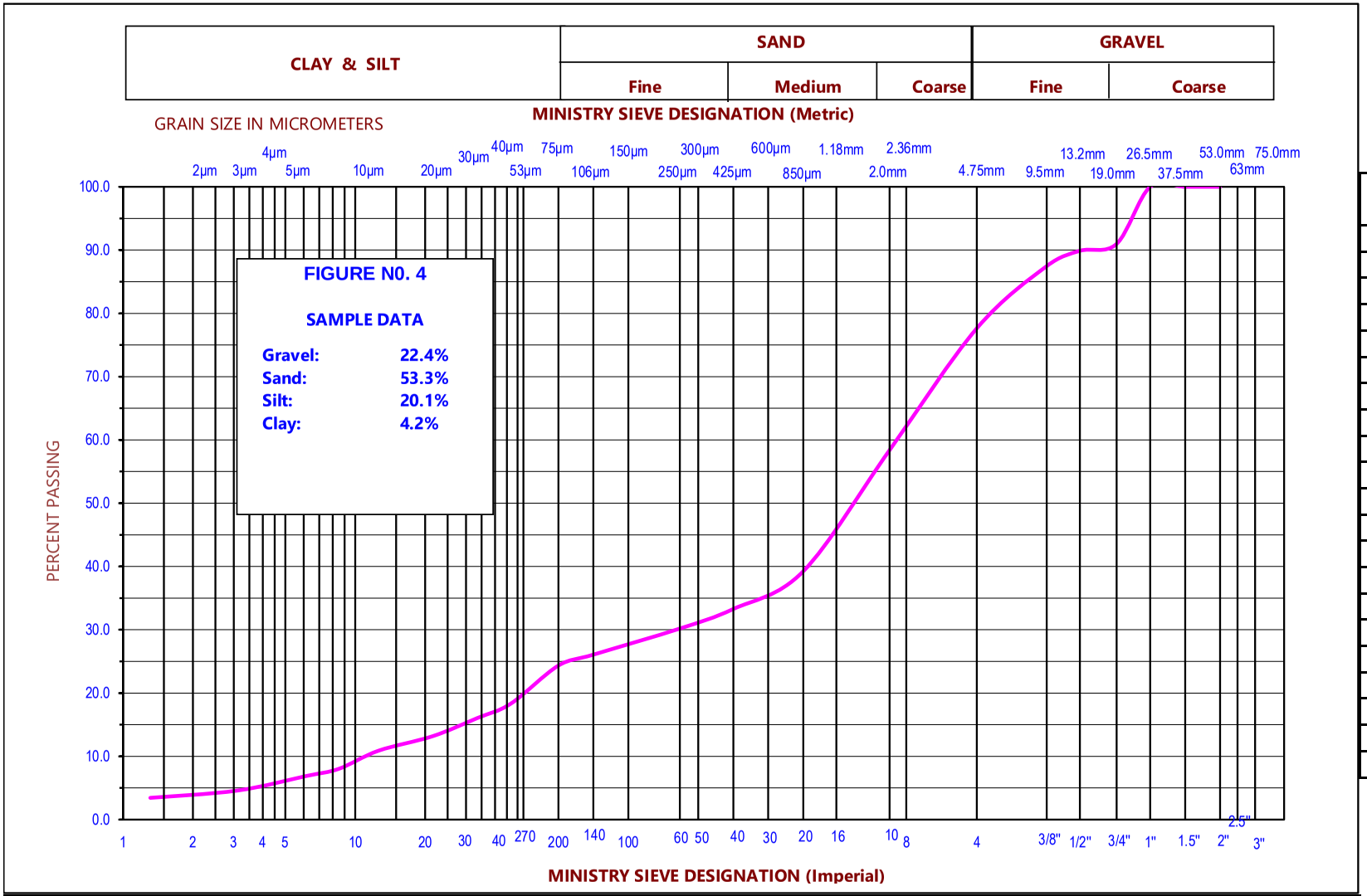


Sieve size (mm)	% Passing
53	100
37.5	100.0
26.5	100.0
19	100.0
13.2	99.3
9.5	95.9
4.75	93.5
2.00	90.4
0.85	86.1
0.425	79.6
0.250	71.3
0.106	61.1
0.075	55.7
0.0373	40.6
0.0277	36.1
0.0188	29.0
0.0114	23.6
0.0077	21.0
0.0059	19.2
0.0030	14.7
0.0013	10.3

Client:	Town of Milton	**GRAIN SIZE DISTRIBUTION**	**Sample No.:**	S013-19
Job No.:	TPB188147S.2000.1	BH1 - SS6B&7	**Tested By:**	KH
Date Received:	3 January 2019	**Silt & Sand, some Clay, trace Gravel**	**Report Date:**	27 January 2019

UNIFIED SOIL CLASSIFICATION SYSTEM

Determination of Particle Size Analysis of Soils LS 702



Sieve size (mm)	% Passing
53	100
37.5	100.0
26.5	100.0
19	91.0
13.2	89.9
9.5	87.5
4.75	77.6
2.00	58.4
0.85	39.2
0.425	33.3
0.250	30.2
0.106	26.1
0.075	24.3
0.0468	18.3
0.0336	16.0
0.0216	13.2
0.0126	10.9
0.0085	8.0
0.0061	6.9
0.0031	4.6
0.0013	3.4

Client:	Town of Milton	**GRAIN SIZE DISTRIBUTION**	**Sample No.:**	S014-19
Job No.:	TPB188147S.2000.1	BH2 - SS8	**Tested By:**	KH
Date Received:	3 January 2019	**Sand, some Silt & Gravel, trace Clay**	**Report Date:**	27 January 2019

EXPLANATION OF BOREHOLE LOG

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GENERAL INFORMATION

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SOIL LITHOLOGY

Elevation and Depth

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Lithology Plot

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Description

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□□□ co□p□ctn□ss condition o□co□□sionl□ss soils □S□□□ □nd t□□ consist□nc□ o□co□□si□□ soils □undr□in□d s□□□r str□n□t□□□r□ d□in□d □s □ollows *(Ref. Canadian Foundation Engineering Manual)*□

Compactness of Cohesionless Soils	SPT N-Value
□□r□ loos□	□ to □
□oos□	□ to □□
□o□p□ct	□□ to □□
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Consistency of Cohesive Soils	Undrained Shear Strength □□□	ps□
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Soil Sampling

S□□ pl□ t□p□s □r□ □□□r□□i□t□d □s □ollows□

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Field and Laboratory Testing

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Instrumentation Installation

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Comments

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3450 Harvester Road, Suite 100
Burlington, Ontario, L7N 3W5
Tel: (905) 335-2353
Fax: (905) 335-1414
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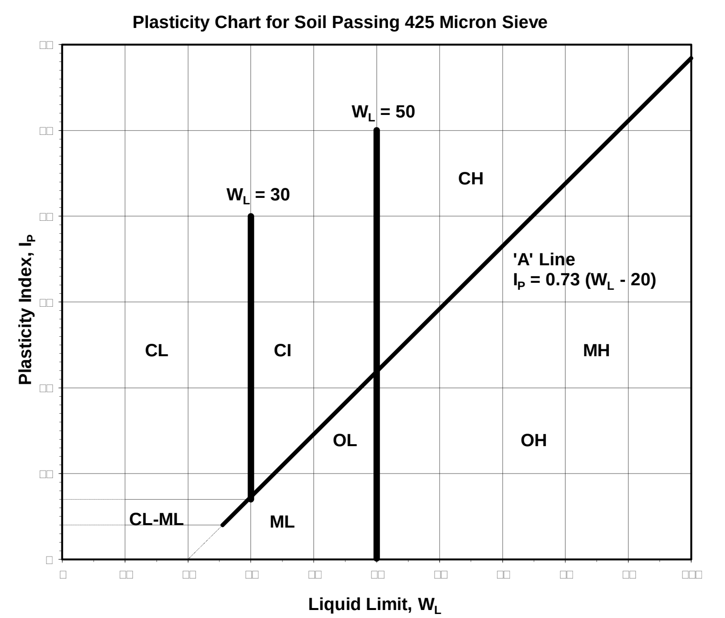

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3450 Harvester Road, Suite 100
Burlington, Ontario, L7N 3W5
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RECORD OF BOREHOLE No. BH1

Project Number: **TPB188147S.2000.1**
Project Client: **Town of Milton**
Project Name: **Reid Sideroad Culvert Replacement Geotechnical Investigation**
Project Location: **Reid Sideroad**
Drilling Location: **BH1**
Drilling Method: **150 mm Solid Stem Augers**
Drilling Machine: **Truck Mounted Drill**
Date Started: **Jan 4, 19** Date Completed: **Jan 4, 19**

Logged by: **TH** Compiled by: **TH** Reviewed by: **WK** Revision No.: **0, 4/24/19**

Local Ground Surface Elevation: 291.7 m

Lithology Plot	DESCRIPTION		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Undrained Shear Strength (kPa) 20 40 60 80	LAB TESTING: Atterberg Limits W_P Plastic – W_L Liquid; Passing 75 um (%); Moisture Content (%) 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS & GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
	Pavement Structure 215 mm **Asphalt**	291.5													
	Brown Sand **FILL** Trace to some silt and gravel Very dense Moist	0.2	SS	1	75	49				5					
			SS	2	79	58	1	291		6					
			SS	3	79	74	2	290		8					
		289.6													
	Brown Silty Clay **FILL** Trace to some sand and gravel Firm to stiff WTPL	2.1	SS	4	17	11		289		13					
			SS	5	13	4	3			11					
		287.9						288							
	Peat	3.8	SS	6	100	5	4				128				
		287.6													
	Brown/Grey **Silt and Sand** Some clay, trace gravel, organics Loose Wet	4.1	SS	7	21	3	5	287		28		6	38	44	12
		286.4													
	Brown/Grey **Sand** Some silt, gravel, trace clay Loose to compact Saturated	5.3	SS	8	58	10		286		12					
			SS	9	25	7	6			5					
			SS	10	8	10	7	285		7					
			SS	11	46	12	8	284		16					
		283.5													
	Borehole Terminated	8.2													

PenetrationTesting: ○ SPT □ PPT ● DCPT
MTO Vane*: △ Intact ▲ Remould
Nilcon Vane*: ◇ Intact ◆ Remould
* Undrained Shear Strength (kPa)
Atterberg Limits: W_P Plastic – W_L Liquid
✳ Passing 75 um (%)
○ Moisture Content (%)

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▽ Groundwater depth during drilling on 1/4/2019 at a depth of: 4.1 m.

◘ Cave in depth after removal of augers: 4.6 m.

RECORD OF BOREHOLE No. BH2

Project Number: **TPB188147S.2000.1** Drilling Location: **BH2**

Project Client: **Town of Milton** Drilling Method: **150 mm Solid Stem Augers**

Project Name: **Reid Sideroad Culvert Replacement Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill**

Project Location: **Reid Sideroad** Date Started: **Jan 4, 19** Date Completed: **Jan 4, 19**

Logged by: **TH** Compiled by: **TH** Reviewed by: **WK** Revision No.: **0, 4/24/19**

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LITHOLOGY PROFILE			SOIL SAMPLING						FIELD TESTING	LAB TESTING		COMMENTS & GRAIN SIZE DISTRIBUTION (%)			
Lithology Plot	DESCRIPTION Local Ground Surface Elevation: 291.9 m		Sample Type	Sample Number	Recovery (%)	SPT 'N' / RQD (%)	DEPTH (m)	ELEVATION (m)	PenetrationTesting: ○ SPT □ PPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	Atterberg Limits W_P Plastic — W_L Liquid; ✳ Passing 75 um (%); ○ Moisture Content (%); 20 40 60 80	INSTRUMENTATION INSTALLATION	GR	SA	SI	CL
	Pavement Structure 180 mm **Asphalt**	291.7													
	Brown Sand **FILL** Trace to some silt and gravel Dense Moist	0.2	SS	1	75	48			○	○ 5					
			SS	2	75	50	1	291	○	○ 12					
			SS	3	75	40	2	290	○	○ 10					
		289.7													
	Brown Silty Clay **FILL** Trace to some sand and gravel Firm to stiff WTPL	2.2	SS	4	63	12			○	○ 13					
			SS	5	50	9	3	289	○	○ 16					
		288.2													
	Peat	3.7													
		287.9													
	Cobbles and Gravel	4.0 287.8	SS	6	92	31	4	288	○	○ 18					
	Brown **Silt and Sand** Some clay, trace gravel, organics Loose Wet	4.1													
			SS	7	63	5	5	287	○	○ 30					
	Brown **Sand** Some silt, gravel, trace clay Loose to compact Saturated	5.2	SS	8	58	8			○	○ 17		23	53	20	4
			SS	9	63	7	6	286	○	○ 13					
							7	285							
			SS	10	63	12	8	284	○	○ 11					
		283.7													
	Borehole Terminated	8.2													

▽ Groundwater depth during drilling on 1/4/2019 at a depth of: 2.7 m.

◆ Cave in depth after removal of augers: 6.7 m.

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Scale: 1 : 47

APPENDIX B
ENGINEERED FILL SPECIFICATIONS

□□□ □n□in□□r□d □ill construction s□ould □□ □onitor□d □nd c□rti□i□d □□ t□□ □□ot□c□nic□l □n□in□□r□ □onstruction s□ould □□ c□rri□d out □ccordin□ to t□□ □ollowin□ proc□dur□□

(i) □□□ □ound□ri□s o□t□□ □r□□ to r□c□i□□ t□□ □□s□ o□t□□ □n□in□□r□d □ill s□ould □□ d□t□r□in□d □nd st□□□d □□ prop□r sur□□□in□ t□c□ni□u□s to □nsur□ t□□t t□□ □n□in□□r□d □ill co□□rs t□□ d□si□n □r□□□

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(iii) □□is sp□ci□ic□tion co□□rs onl□ in□□round □n□in□□r□d □ill □nd not □uildin□ up t□□ □r□d□□ □□r□d□ □uild up on □n□ sid□ o□t□□ □ound□tion produc□s □ slop□ □□□ □□n□□ □nt□□t□□n □ slop□ st□□ilit□ □n□l□sis □nd □ound□tion □ss□ss□nt s□ould □□ c□rri□d out in □ddition to t□□s□ sp□ci□ic□tions□

(iv) □lso□ i□ t□□ □inis□d □r□d□ o□t□□ □r□□ will □□ r□is□d in □□c□ss o□ □□□□ □ t□□n lon□ t□r□ consolid□tion s□ttl□□ □nt □n□l□sis s□ould □□ p□r□or□ □d□

(v) □□□ □r□□ to r□c□i□□ t□□ □n□in□□r□d □ill s□ould □□ stripp□d o□□ll so□t□n□d cl□□s□□□□□t□tion co□□r□ ro□□n □ □t□ri□ls□w□□□ □nd d□l□t□rious □ □t□ri□ls□ □□t□r strippin□□t□□ □ntir□ □r□□ s□ould □□ insp□ct□d □nd □ppro□□d □□t□□ □□ot□c□nic□l □n□in□□r□ Spon□□□w□t or so□tlloos□ spots s□ould □□ su□□□□c□□□t□d□ to □□pos□ st□□l□ su□□r□d□□ □nd r□pl□c□d wit□ co□p□ct□□l□ □ppro□□d soil□ co□p□ti□l□ wit□ su□□r□d□ conditions□□s dir□ct□d □□t□□ □□ot□c□nic□l □n□in□□r□

(vi) □□r□nul□r □ □t□ri□l is us□d □s □n□in□□r□d □ill o□□r cl□□□□ su□□r□d□□t□□n t□□ su□□r□d□ s□ould □□ □r□d□d □nd slop□d to discour□□□ pond□d w□t□r□ Su□dr□ins □ □□ □□ □lso r□□uir□d d□p□ndin□ on t□□ t□c□n□ss o□t□□ □ill □nd its propos□d us□□

(vii) □□□ □ □t□ri□l us□d □or t□□ □n□in□□r□d □ill □ust □□ uni□or□ □ □o□o□□n□ous□ t□s□ould □□ pl□c□d in t□in li□ts not □□c□□din□ □ppro□i□□t□l□ □□□□ □ □ w□□n loos□□ □□□□ □ □ li□ts s□ould □□ us□d in con□in□d □r□□s w□□r□ □□□□□□ co□p□ctin□ □□uip□□nt c□n not □□ us□d□ □ □□rsi□□ p□rticl□s □co□□l□s □nd □ould□rs□l□r□r t□□n □□l□t□□ li□t t□c□n□ss s□ould □□ disc□rd□d□ □□c□□□t□d n□ti□□ soils r□□ o□si□ni□ic□nt □□ount o□or□□nics or d□l□t□rious □ □t□ri□ls □ □□ □□ suit□□l□ □s □n□in□□r□d □ill □ □t□ri□ls pro□id□d t□□t t□□ir w□t□r cont□nts □r□ □cc□pt□□l□ □nd t□□ soils □r□ not □ro□□n □lt□rn□ti□□l□□□ □SS □r□nul□rs □ □nd □□□ □SS S□l□ct Su□□□r□d□□or □ppro□□d □□ui□□l□nt □ □□ □□ us□d□

(viii) □t □ □□ □□ possi□l□ to us□ in□ □r□in□d co□□si□□ soils □l□□□wit□ □oistur□ cont□nts t□□t □r□ clos□ to opti□u□ □s □n□in□□r□d □ill in □ss □ill pl□c□□ □nt su□□□ct to so□□ r□strictions in t□□ t□c□n□ss □nd ti□ □ o□construction□ t is □□n□r□ll□ □□r□ di□□icult □□nd in so□□ circu□st□nc□s i□ possi□l□ to co□p□ct cl□□□□ soil in w□t or cold w□□t□□r □sp□ci□ll□ to □ d□nsit□ t□□t is □□o□□ □□□□ o□its St□nd□rd □roctor M□□i□u□ □r□ □□nsit□ □S□M□□□□ □lso□ □□□□□□ s□□□ps□oot non□i□r□tor□ □□uip□□nt □ust □□ us□d in ord□r to □r□□□□up □nd t□orou□□l□ r□□□ould□co□p□ct cl□□ soils to □c□i□□□ □d□□u□t□ co□p□ction□ □lso□it is □□n□r□ll□ di□□icult to □d□□u□t□l□ pl□c□ □nd co□p□ct co□□si□□ soils in con□in□d □r□□s suc□ □s tr□nc□□s or □ound□tion □□c□□□tions□ □nd□r suc□ conditions□i□ port□d □r□nul□r □ □t□ri□ls □ □□ □□t□□ onl□ option□

(ix) □□c□li□t s□ould □□ uni□or□l□ co□p□ct□d wit□ □□□□□□ co□p□ctors□suit□□l□ □or t□□ t□p□ o□□ill us□d to □t l□□st □□□□ o□its S□M□□ □or □n□in□□r□d □ill t□□t will support □ound□tions□ □n □ddition□i□cl□□ is us□d □□n□t□ □ □ootin□□it is r□co□□□nd□d t□□t t□□r□ □□ □ wit o□□t l□□st t□r□□ □ont□ □□tw□□n pl□c□□ □nt o□t□□ □ill □nd pourin□ t□□ □ootin□s□ □□□□ w□it is □□s□d on □n □n□in□□r□d □ill up to □□□ □ in t□c□n□ss□□or □ t□c□□r □ill supportin□ s□ttl□□ □nt s□nsiti□□ structur□□t□□ w□it c□n □□ lon□□r □nd s□ould □□ □ss□ss□d on □sit□ □□sit□ □□sis□

(x) □□□ d□□r□□ o□co□p□ction r□□uir□d in □ ill□d loc□tion will d□p□nd on t□□ □□ount o□s□ttl□□ □nt t□□t is tol□r□bl□□ □ll □ills □□low p□□□□ □nt□cur□ □ □utt□r □nd sid□w□l□sl□□ r□□s s□ould □□ pl□c□d in □ □□i□u□ □□□□ □□ loos□ li□ts □nd co□p□ct□d to □□□ o□t□□ S□M□□□ □or t□□ upp□r □□□ □ □□low t□□ su□□r□d□□t□□ d□□r□□ o□co□p□ction s□ould □□ incr□□s□d to □□□ □ □or concr□t□ sl□□□ on□r□d□□□ll suit□□l□ ill s□ould □□ pl□c□d in □ □□i□u□ □□□□ □□ loos□ li□ts □nd co□p□ct□d to □□ □ o□t□□ S□M□□□ □□□ s□ttl□□ □nt o□□□ o□t□□ ill t□c□n□ss □□co□□s □ conc□rn □or □ sp□ci□ic sl□□□ on□r□d□ □ppli□□t□□n t□□ co□p□ction s□ould □□ incr□□s□d to □□□□ o□S□M□□□ □n □ddition□ i□cl□□ is us□d□□n □ppropri□t□ wit ti□ □s□ould □□ □ccount□d □or to □ini□i□□ □n□□d□□rs□ □□□ct o□ post construction s□ttl□□ □nt o□cl□□□□ soils□

(xi) □ull□ti□ □ □□ot□c□nic□l insp□ction □nd □u□lit□ control □□□ □ □□ns o□ r□□u□nt i□ld d□nsit□ □nd l□□or□tor□ t□stin□□ □r□ n□c□ss□r□ □or t□□ construction o□ □ c□rti□i□□l□ □n□in□□r□d □ill□ □□□ co□p□ction proc□dur□ □nd t□st r□□u□nc□s□ould □□ controll□d □□t□□ □□ot□c□nic□l □n□in□□r□

(xii) The engineered fill should not be frozen and should be placed at water contents within 2% of the optimum value for compaction. The engineered fill should not be placed during winter months when freezing ambient temperatures occur persistently or intermittently.

(xiii) Footings and foundation walls constructed partially or entirely on engineered fill will require reinforcing steel. As a minimum, two 15M bars should be placed in the footings and two 15M steel bars at the top of the foundation wall.

(xiv) Spread and/or strip footings founded on engineered fill may be designed using 150 kPa for factored ULS and 100 kPa for SLS bearing values if clayey soil is used to build the fill. If OPSS Granular A is used, then 300 kPa for factored ULS and 200 kPa for SLS bearing values can be used. Bearing values for other materials must be provided by the geotechnical engineer.

HT/PM M P/PB

APPENDIX C
ANALYTICAL LAB RESULTS

AGAT Laboratories

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

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
3450 HARVESTER ROAD, SUITE 100
BURLINGTON, ON L7N 3W5
(905) 335-2353

ATTENTION TO: Willie Kokotec

PROJECT: TPB1881457.2000.1

AGAT WORK ORDER: 19T428150

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Supervisor

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

DATE REPORTED: Jan 21, 2019

PAGES (INCLUDING COVER): 9

VERSION*: 1

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

*NOTES

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

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

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

DATE RECEIVED: 2019-01-15

DATE REPORTED: 2019-01-21

		SAMPLE DESCRIPTION:		BH1-SS6	BH2-SS5
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2019-01-04	2019-01-04
Parameter	Unit	G / S	RDL	9836867	9836868
Antimony	µg/g	1.3	0.8	<0.8	<0.8
Arsenic	µg/g	18	1	5	7
Barium	µg/g	220	2	62	53
Beryllium	µg/g	2.5	0.5	<0.5	<0.5
Boron	µg/g	36	5	<5	7
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.16	0.38
Cadmium	µg/g	1.2	0.5	<0.5	<0.5
Chromium	µg/g	70	2	14	10
Cobalt	µg/g	21	0.5	6.0	5.7
Copper	µg/g	92	1	34	28
Lead	µg/g	120	1	17	23
Molybdenum	µg/g	2	0.5	0.6	0.9
Nickel	µg/g	82	1	13	10
Selenium	µg/g	1.5	0.4	<0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	0.7	1.1
Vanadium	µg/g	86	1	20	18
Zinc	µg/g	290	5	81	77
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	**1.12**	**1.19**
Sodium Adsorption Ratio	NA	2.4	NA	**4.48**	**3.86**
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.36	7.38

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9836867-9836868 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

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

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ATTENTION TO: Willie Kokotec

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
9836867	BH1-SS6	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	mS/cm	0.57	1.12
9836867	BH1-SS6	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	4.48
9836868	BH2-SS5	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity	mS/cm	0.57	1.19
9836868	BH2-SS5	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio	NA	2.4	3.86

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Quality Assurance

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Jan 21, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	9836894		<0.8	<0.8	NA	< 0.8	97%	70%	130%	82%	80%	120%	93%	70%	130%
Arsenic	9836894		3	3	NA	< 1	114%	70%	130%	94%	80%	120%	98%	70%	130%
Barium	9836894		59	62	5.0%	< 2	105%	70%	130%	100%	80%	120%	103%	70%	130%
Beryllium	9836894		<0.5	<0.5	NA	< 0.5	99%	70%	130%	98%	80%	120%	86%	70%	130%
Boron	9836894		<5	5	NA	< 5	70%	70%	130%	101%	80%	120%	86%	70%	130%
Boron (Hot Water Soluble)	9836894		<0.10	<0.10	NA	< 0.10	94%	60%	140%	98%	70%	130%	99%	60%	140%
Cadmium	9836894		<0.5	<0.5	NA	< 0.5	107%	70%	130%	97%	80%	120%	100%	70%	130%
Chromium	9836894		11	11	0.0%	< 2	93%	70%	130%	95%	80%	120%	106%	70%	130%
Cobalt	9836894		4.9	5.0	2.0%	< 0.5	96%	70%	130%	98%	80%	120%	100%	70%	130%
Copper	9836894		10	10	0.0%	< 1	100%	70%	130%	103%	80%	120%	99%	70%	130%
Lead	9836894		5	5	0.0%	< 1	110%	70%	130%	105%	80%	120%	101%	70%	130%
Molybdenum	9836894		<0.5	<0.5	NA	< 0.5	102%	70%	130%	102%	80%	120%	109%	70%	130%
Nickel	9836894		10	10	0.0%	< 1	99%	70%	130%	98%	80%	120%	101%	70%	130%
Selenium	9836894		<0.4	<0.4	NA	< 0.4	101%	70%	130%	102%	80%	120%	103%	70%	130%
Silver	9836894		<0.2	<0.2	NA	< 0.2	101%	70%	130%	92%	80%	120%	94%	70%	130%
Thallium	9836894		<0.4	<0.4	NA	< 0.4	95%	70%	130%	99%	80%	120%	96%	70%	130%
Uranium	9836894		<0.5	<0.5	NA	< 0.5	108%	70%	130%	100%	80%	120%	102%	70%	130%
Vanadium	9836894		18	19	5.4%	< 1	98%	70%	130%	97%	80%	120%	101%	70%	130%
Zinc	9836894		26	27	3.8%	< 5	103%	70%	130%	101%	80%	120%	106%	70%	130%
Chromium VI	9836864		<0.2	<0.2	NA	< 0.2	110%	70%	130%	100%	80%	120%	103%	70%	130%
Cyanide	9838618		<0.040	<0.040	NA	< 0.040	92%	70%	130%	103%	80%	120%	91%	70%	130%
Mercury	9836894		<0.10	<0.10	NA	< 0.10	105%	70%	130%	103%	80%	120%	96%	70%	130%
Electrical Conductivity	9836354		0.541	0.549	1.5%	< 0.005	97%	90%	110%	NA			NA		
Sodium Adsorption Ratio	9832792		0.561	0.575	2.5%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	9836864		7.46	7.49	0.4%	NA	101%	80%	120%	NA			NA		
O. Reg. 558 Metals and Inorganics															
Arsenic Leachate	9836897		<0.010	<0.010	NA	< 0.010	103%	90%	110%	95%	80%	120%	98%	70%	130%
Barium Leachate	9836897		0.253	0.256	NA	< 0.100	103%	90%	110%	98%	80%	120%	103%	70%	130%
Boron Leachate	9836897		0.054	0.059	NA	< 0.050	99%	90%	110%	92%	80%	120%	89%	70%	130%
Cadmium Leachate	9836897		<0.010	<0.010	NA	< 0.010	105%	90%	110%	102%	80%	120%	105%	70%	130%
Chromium Leachate	9836897		<0.010	<0.010	NA	< 0.010	105%	90%	110%	99%	80%	120%	107%	70%	130%
Lead Leachate	9836897		1.09	1.11	1.8%	< 0.010	108%	90%	110%	93%	80%	120%	115%	70%	130%
Mercury Leachate	9836897		<0.01	<0.01	NA	< 0.01	103%	90%	110%	99%	80%	120%	99%	70%	130%
Selenium Leachate	9836897		<0.010	<0.010	NA	< 0.010	102%	90%	110%	96%	80%	120%	99%	70%	130%
Silver Leachate	9836897		<0.010	<0.010	NA	< 0.010	108%	90%	110%	95%	80%	120%	102%	70%	130%
Uranium Leachate	9836897		<0.050	<0.050	NA	< 0.050	107%	90%	110%	96%	80%	120%	103%	70%	130%
Fluoride Leachate	9836897		0.32	0.33	3.1%	< 0.05	100%	90%	110%	101%	90%	110%	102%	70%	130%
Cyanide Leachate	9836897		<0.05	<0.05	NA	< 0.05	92%	90%	110%	103%	90%	110%	116%	70%	130%
(Nitrate + Nitrite) as N Leachate	9836897		<0.70	<0.70	NA	< 0.70	99%	80%	120%	100%	80%	120%	105%	70%	130%

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AGAT WORK ORDER: 19T428150

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SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Jan 21, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL

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

Quality Assurance

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Jan 21, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 558 - VOCs															
Vinyl Chloride	9836869	9836869	< 0.030	< 0.030	NA	< 0.030	100%	60%	140%	116%	60%	140%	NA	60%	140%
1,1 Dichloroethene	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	77%	70%	130%	101%	70%	130%	NA	60%	140%
Dichloromethane	9836869	9836869	< 0.030	< 0.030	NA	< 0.030	84%	70%	130%	98%	70%	130%	NA	60%	140%
Methyl Ethyl Ketone	9836869	9836869	< 0.090	< 0.090	NA	< 0.090	106%	70%	130%	83%	70%	130%	NA	60%	140%
Chloroform	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	87%	70%	130%	79%	70%	130%	NA	60%	140%
1,2-Dichloroethane	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	89%	70%	130%	85%	70%	130%	NA	60%	140%
Carbon Tetrachloride	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	85%	70%	130%	101%	70%	130%	NA	60%	140%
Benzene	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	80%	70%	130%	85%	70%	130%	NA	60%	140%
Trichloroethene	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	87%	70%	130%	89%	70%	130%	NA	60%	140%
Tetrachloroethene	9836869	9836869	< 0.050	< 0.050	NA	< 0.050	75%	70%	130%	116%	70%	130%	NA	60%	140%
Chlorobenzene	9836869	9836869	< 0.010	< 0.010	NA	< 0.010	80%	70%	130%	108%	70%	130%	NA	60%	140%
1,2-Dichlorobenzene	9836869	9836869	< 0.010	< 0.010	NA	< 0.010	83%	70%	130%	101%	70%	130%	NA	60%	140%
1,4-Dichlorobenzene	9836869	9836869	< 0.010	< 0.010	NA	< 0.010	83%	70%	130%	107%	70%	130%	NA	60%	140%
O. Reg. 558 - Benzo(a) pyrene															
Benzo(a)pyrene	9836869	9836869	< 0.001	< 0.001	NA	< 0.001	93%	70%	130%	103%	70%	130%	NA	70%	130%

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

Certified By:

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Method Summary

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET -93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Fluoride Leachate	INOR-93-6018	EPA SW-846-1311 & SM4500-F- C	ION SELECTIVE ELECTRODE
Cyanide Leachate	INOR-93-6052	EPA SW-846-1311 & MOE 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & SM 4500 - NO3- I	LACHAT FIA

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Method Summary

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzo(a)pyrene	ORG-91-5105	EPA SW846 3540 & 8270	GC/MS
Vinyl Chloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,1 Dichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Dichloromethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Trichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS

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5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
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webearth.agatlabs.com

Chain of Custody Record

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

Laboratory Use Only

Work Order #: 19T428150

Cooler Quantity: Labeled

Arrival Temperatures: 17.4 | 14.7 | 12.6 / 10.1 | 6.5 | 5.8

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: Wood
Contact: Willie Kokotec
Address: 3450 Harvester Rd, Suite 100
Burlington, ON L7N 3W5
Phone: 416-570-4410 Fax:
Reports to be sent to:
1. Email: Willie.Kokotec@woodplc.com
2. Email: Thomas.Horvat@woodplc.com

Regulatory Requirements:

☒ No Regulatory Requirement

(Please check all applicable boxes)

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

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

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

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

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

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

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

OR Date Required (Rush Surcharges May Apply):

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

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

Project Information:

Project: TPB1881475.2000.1
Site Location: Reid Sideroad, Milton, ON
Sampled By: Thomas Horvat
AGAT Quote #: Standard 2018 PSA PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company: Wood
Contact: Willie Kokotec
Address: 3450 Harvester Rd, Suite 100, Burlington ON
Email: Willie.Kokotec@woodplc.com

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics	All Metals ☐ / Hydride Metals ☐	153 Metals (excl. Hydrides) ☐ / 153 Metals (Incl. Hydrides) ☐	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☒ M&I ☒ VOCs ☐ ABNs ☒ B(a)P ☐ PCBs	Sewer Use
BH1-556	Jan 4	9:00	1	S			X														
BH2-555	"	10:30	1	S			X														
TCLP	"	12:00	1	S															X		
TCLP	"	12:00	1	S															X		
TCLP	"	12:00	1	S															X		

Governed by T&C of MSA MIS-016

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Thomas Horvat	Jan 15 2019	11:20			
				Jan 15/19	12:10
	Date	Time		Date	Time
	Jan 15/19	3:05			

Page 1 of 1

No: T 081672

Document ID: DIV-78-1511_015

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

Date Issued: March 16, 2018

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
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CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
3450 HARVESTER ROAD, SUITE 100
BURLINGTON, ON L7N 3W5
(905) 335-2353

ATTENTION TO: Willie Kokotec

PROJECT: TPB1881457.2000.1

AGAT WORK ORDER: 19T428150

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Supervisor

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

DATE REPORTED: Jan 21, 2019

PAGES (INCLUDING COVER): 10

VERSION*: 1

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

*NOTES

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

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Certificate of Analysis

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 Metals and Inorganics

DATE RECEIVED: 2019-01-15

DATE REPORTED: 2019-01-21

		SAMPLE DESCRIPTION:		TCLP
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2019-01-04
Parameter	Unit	G / S	RDL	9836869
Arsenic Leachate	mg/L	2.5	0.010	<0.010
Barium Leachate	mg/L	100	0.100	0.239
Boron Leachate	mg/L	500	0.050	<0.050
Cadmium Leachate	mg/L	0.5	0.010	<0.010
Chromium Leachate	mg/L	5	0.010	<0.010
Lead Leachate	mg/L	5	0.010	<0.010
Mercury Leachate	mg/L	0.1	0.01	<0.01
Selenium Leachate	mg/L	1	0.010	<0.010
Silver Leachate	mg/L	5	0.010	<0.010
Uranium Leachate	mg/L	10	0.050	<0.050
Fluoride Leachate	mg/L	150	0.05	0.23
Cyanide Leachate	mg/L	20	0.05	<0.05
(Nitrate + Nitrite) as N Leachate	mg/L	1000	0.70	<0.70

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Amanjot Bhela

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
AMANJOT BHELA
CHEMIST

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 - Benzo(a) pyrene

DATE RECEIVED: 2019-01-15

DATE REPORTED: 2019-01-21

				SAMPLE DESCRIPTION:	TCLP
				SAMPLE TYPE:	Soil
				DATE SAMPLED:	2019-01-04
Parameter	Unit	G / S	RDL	9836869	
Benzo(a)pyrene	mg/L	0.001	0.001	<0.001	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9836869 The sample was leached according to Regulation 558 protocol. Analysis was performed on the leachate.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

O. Reg. 558 - VOCs

DATE RECEIVED: 2019-01-15

DATE REPORTED: 2019-01-21

		SAMPLE DESCRIPTION:		TCLP
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2019-01-04
Parameter	Unit	G / S	RDL	9836869
Vinyl Chloride	mg/L	0.2	0.030	<0.030
1,1 Dichloroethene	mg/L	1.4	0.020	<0.020
Dichloromethane	mg/L	5.0	0.030	<0.030
Methyl Ethyl Ketone	mg/L	200	0.090	<0.090
Chloroform	mg/L	10.0	0.020	<0.020
1,2-Dichloroethane	mg/L	0.5	0.020	<0.020
Carbon Tetrachloride	mg/L	0.5	0.020	<0.020
Benzene	mg/L	0.5	0.020	<0.020
Trichloroethene	mg/L	5.0	0.020	<0.020
Tetrachloroethene	mg/L	3.0	0.050	<0.050
Chlorobenzene	mg/L	8.0	0.010	<0.010
1,2-Dichlorobenzene	mg/L	20.0	0.010	<0.010
1,4-Dichlorobenzene	mg/L	0.5	0.010	<0.010
Surrogate	Unit	Acceptable Limits		
Toluene-d8	% Recovery	60-130		76

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg. 558 - Schedule IV Leachate Quality Criteria
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9836869 Sample was prepared using Regulation 558 protocol and a zero headspace extractor.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Jan 21, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	9836894		<0.8	<0.8	NA	< 0.8	97%	70%	130%	82%	80%	120%	93%	70%	130%
Arsenic	9836894		3	3	NA	< 1	114%	70%	130%	94%	80%	120%	98%	70%	130%
Barium	9836894		59	62	5.0%	< 2	105%	70%	130%	100%	80%	120%	103%	70%	130%
Beryllium	9836894		<0.5	<0.5	NA	< 0.5	99%	70%	130%	98%	80%	120%	86%	70%	130%
Boron	9836894		<5	5	NA	< 5	70%	70%	130%	101%	80%	120%	86%	70%	130%
Boron (Hot Water Soluble)	9836894		<0.10	<0.10	NA	< 0.10	94%	60%	140%	98%	70%	130%	99%	60%	140%
Cadmium	9836894		<0.5	<0.5	NA	< 0.5	107%	70%	130%	97%	80%	120%	100%	70%	130%
Chromium	9836894		11	11	0.0%	< 2	93%	70%	130%	95%	80%	120%	106%	70%	130%
Cobalt	9836894		4.9	5.0	2.0%	< 0.5	96%	70%	130%	98%	80%	120%	100%	70%	130%
Copper	9836894		10	10	0.0%	< 1	100%	70%	130%	103%	80%	120%	99%	70%	130%
Lead	9836894		5	5	0.0%	< 1	110%	70%	130%	105%	80%	120%	101%	70%	130%
Molybdenum	9836894		<0.5	<0.5	NA	< 0.5	102%	70%	130%	102%	80%	120%	109%	70%	130%
Nickel	9836894		10	10	0.0%	< 1	99%	70%	130%	98%	80%	120%	101%	70%	130%
Selenium	9836894		<0.4	<0.4	NA	< 0.4	101%	70%	130%	102%	80%	120%	103%	70%	130%
Silver	9836894		<0.2	<0.2	NA	< 0.2	101%	70%	130%	92%	80%	120%	94%	70%	130%
Thallium	9836894		<0.4	<0.4	NA	< 0.4	95%	70%	130%	99%	80%	120%	96%	70%	130%
Uranium	9836894		<0.5	<0.5	NA	< 0.5	108%	70%	130%	100%	80%	120%	102%	70%	130%
Vanadium	9836894		18	19	5.4%	< 1	98%	70%	130%	97%	80%	120%	101%	70%	130%
Zinc	9836894		26	27	3.8%	< 5	103%	70%	130%	101%	80%	120%	106%	70%	130%
Chromium VI	9836864		<0.2	<0.2	NA	< 0.2	110%	70%	130%	100%	80%	120%	103%	70%	130%
Cyanide	9838618		<0.040	<0.040	NA	< 0.040	92%	70%	130%	103%	80%	120%	91%	70%	130%
Mercury	9836894		<0.10	<0.10	NA	< 0.10	105%	70%	130%	103%	80%	120%	96%	70%	130%
Electrical Conductivity	9836354		0.541	0.549	1.5%	< 0.005	97%	90%	110%	NA			NA		
Sodium Adsorption Ratio	9832792		0.561	0.575	2.5%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	9836864		7.46	7.49	0.4%	NA	101%	80%	120%	NA			NA		
O. Reg. 558 Metals and Inorganics															
Arsenic Leachate	9836897		<0.010	<0.010	NA	< 0.010	103%	90%	110%	95%	80%	120%	98%	70%	130%
Barium Leachate	9836897		0.253	0.256	NA	< 0.100	103%	90%	110%	98%	80%	120%	103%	70%	130%
Boron Leachate	9836897		0.054	0.059	NA	< 0.050	99%	90%	110%	92%	80%	120%	89%	70%	130%
Cadmium Leachate	9836897		<0.010	<0.010	NA	< 0.010	105%	90%	110%	102%	80%	120%	105%	70%	130%
Chromium Leachate	9836897		<0.010	<0.010	NA	< 0.010	105%	90%	110%	99%	80%	120%	107%	70%	130%
Lead Leachate	9836897		1.09	1.11	1.8%	< 0.010	108%	90%	110%	93%	80%	120%	115%	70%	130%
Mercury Leachate	9836897		<0.01	<0.01	NA	< 0.01	103%	90%	110%	99%	80%	120%	99%	70%	130%
Selenium Leachate	9836897		<0.010	<0.010	NA	< 0.010	102%	90%	110%	96%	80%	120%	99%	70%	130%
Silver Leachate	9836897		<0.010	<0.010	NA	< 0.010	108%	90%	110%	95%	80%	120%	102%	70%	130%
Uranium Leachate	9836897		<0.050	<0.050	NA	< 0.050	107%	90%	110%	96%	80%	120%	103%	70%	130%
Fluoride Leachate	9836897		0.32	0.33	3.1%	< 0.05	100%	90%	110%	101%	90%	110%	102%	70%	130%
Cyanide Leachate	9836897		<0.05	<0.05	NA	< 0.05	92%	90%	110%	103%	90%	110%	116%	70%	130%
(Nitrate + Nitrite) as N Leachate	9836897		<0.70	<0.70	NA	< 0.70	99%	80%	120%	100%	80%	120%	105%	70%	130%

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

Quality Assurance

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Jan 21, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL

Certified By:

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5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
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Quality Assurance

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
AGAT WORK ORDER: 19T428150
PROJECT: TPB1881457.2000.1
ATTENTION TO: Willie Kokotec
SAMPLING SITE:
SAMPLED BY:

Trace Organics Analysis

RPT Date: Jan 21, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 558 - VOCs															
Vinyl Chloride	9836869	9836869	< 0.030	< 0.030	NA	< 0.030	100%	60%	140%	116%	60%	140%	NA	60%	140%
1,1 Dichloroethene	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	77%	70%	130%	101%	70%	130%	NA	60%	140%
Dichloromethane	9836869	9836869	< 0.030	< 0.030	NA	< 0.030	84%	70%	130%	98%	70%	130%	NA	60%	140%
Methyl Ethyl Ketone	9836869	9836869	< 0.090	< 0.090	NA	< 0.090	106%	70%	130%	83%	70%	130%	NA	60%	140%
Chloroform	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	87%	70%	130%	79%	70%	130%	NA	60%	140%
1,2-Dichloroethane	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	89%	70%	130%	85%	70%	130%	NA	60%	140%
Carbon Tetrachloride	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	85%	70%	130%	101%	70%	130%	NA	60%	140%
Benzene	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	80%	70%	130%	85%	70%	130%	NA	60%	140%
Trichloroethene	9836869	9836869	< 0.020	< 0.020	NA	< 0.020	87%	70%	130%	89%	70%	130%	NA	60%	140%
Tetrachloroethene	9836869	9836869	< 0.050	< 0.050	NA	< 0.050	75%	70%	130%	116%	70%	130%	NA	60%	140%
Chlorobenzene	9836869	9836869	< 0.010	< 0.010	NA	< 0.010	80%	70%	130%	108%	70%	130%	NA	60%	140%
1,2-Dichlorobenzene	9836869	9836869	< 0.010	< 0.010	NA	< 0.010	83%	70%	130%	101%	70%	130%	NA	60%	140%
1,4-Dichlorobenzene	9836869	9836869	< 0.010	< 0.010	NA	< 0.010	83%	70%	130%	107%	70%	130%	NA	60%	140%
O. Reg. 558 - Benzo(a) pyrene															
Benzo(a)pyrene	9836869	9836869	< 0.001	< 0.001	NA	< 0.001	93%	70%	130%	103%	70%	130%	NA	70%	130%

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

Certified By:

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5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
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Method Summary

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET -93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Fluoride Leachate	INOR-93-6018	EPA SW-846-1311 & SM4500-F- C	ION SELECTIVE ELECTRODE
Cyanide Leachate	INOR-93-6052	EPA SW-846-1311 & MOE 3015 & SM 4500 CN- I	TECHNICON AUTO ANALYZER
(Nitrate + Nitrite) as N Leachate	INOR-93-6053	EPA SW 846-1311 & SM 4500 - NO3- I	LACHAT FIA

AGAT Laboratories
5835 COOPERS AVENUE
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Method Summary

CLIENT NAME: WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS

AGAT WORK ORDER: 19T428150

PROJECT: TPB1881457.2000.1

ATTENTION TO: Willie Kokotec

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzo(a)pyrene	ORG-91-5105	EPA SW846 3540 & 8270	GC/MS
Vinyl Chloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,1 Dichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Dichloromethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Methyl Ethyl Ketone	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chloroform	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichloroethane	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Carbon Tetrachloride	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Benzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Trichloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Chlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5001	EPA SW-846 5230B & 8260	(P&T)GC/MS

AGAT Laboratories

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

Chain of Custody Record

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

Laboratory Use Only

Work Order #: 19T428150

Cooler Quantity: Labeled

Arrival Temperatures: 17.4 | 14.7 | 12.6
10.1 | 6.5 | 5.8

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: Wood
Contact: Willie Kokotec
Address: 3450 Harvester Rd, Suite 100
Burlington, ON L7N 3W5
Phone: 416-570-4410 Fax:

Reports to be sent to:
1. Email: Willie.Kokotec@woodplc.com
2. Email: Thomas.Horvat@woodplc.com

Regulatory Requirements:

☒ No Regulatory Requirement

(Please check all applicable boxes)

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

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

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

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

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

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

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

OR Date Required (Rush Surcharges May Apply):

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

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

Project Information:

Project: TPB1881475.2000.1
Site Location: Reid Sideroad, Milton, ON
Sampled By: Thomas Horvat
AGAT Quote #: Standard 2018 PSA PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company: Wood
Contact: Willie Kokotec
Address: 3450 Harvester Rd, Suite 100, Burlington ON
Email: Willie.Kokotec@woodplc.com

Sample Matrix Legend

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

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Y/N)	O. Reg 153: Metals and Inorganics	All Metals ☐ 153 Metals (excl. Hydrides)	Hydride Metals ☐ 153 Metals (Incl. Hydrides)	ORPs: ☐ B-HWS ☐ Cl ☐ CN ☐ C_{av} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☒ M&I ☒ VOCs ☐ ABNs ☒ B(a)P ☐ PCBs	Sewer Use
BH1-556	Jan 4	9:00	1	S			X														
BH2-555	"	10:30	1	S			X														
TCLP	"	12:00	1	S															X		
TCLP	"	12:00	1	S															X		
TCLP	"	12:00	1	S															X		

Governed by T&C of MOU-A MIS-016

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Thomas Horvat	Jan 15 2019	11:20			
				Jan 15/19	12:10
	Date	Time		Date	Time
	Jan 15/19	3:05			

Page 1 of 1

No: T 081672

Document ID: DIV-78.1511.015

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

Date Issued: March 16, 2018

APPENDIX D
REPORT LIMITATIONS

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Limitations to Geotechnical Reports

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□□ **No legal representations:** Wood □ □□□s no r□pr□s□nt□tions w□□tso□□□r conc□rnin□t□□ l□□□l si□ni□ic□nc□ o□its □indin□s□or □s to ot□□r l□□□l □ □tt□rs touc□□d on in t□is r□port□includin□ □ut not li□it□d to□own□rs□ip o□□n□ prop□rt□□or t□□ □pplic□tion o□□n□ l□w to t□□ □□cts s□t □ort□ □□r□in□Wit□ r□sp□ct to r□□ul□tor□ co□pli□nc□ issu□s r□□ul□tor□st□tut□s □r□ su□□□ct to int□rpr□t□tion □nd c□□n□□□Suc□ int□rpr□t□tions □nd r□□ul□tor□c□□n□□s s□ould □□ r□□i□w□d wit□ l□□□l couns□l□

□□ **Decrease in property value:** Wood s□□ll not □□ r□sponsi□l□ □or □n□d□cr□□s□□r□□l or p□rc□i□□d□o□t□□ prop□rt□or sit□'s □□lu□or □ilur□to co□pl□t□ □tr□ns□ction□□s □cons□□u□nc□o□t□□in□or□ □tion cont□in□d in t□is r□port□

□□ **No third party reliance:** □□is r□port is □or t□□ sol□ us□ o□t□□ p□rt□ to w□o□ it is □ddr□ss□d unl□ss □□pr□ssl□st□t□d ot□□rwis□in t□□ r□port or □ontr□ct□□n□us□or r□production w□ic□ □n□t□ird p□rt□□ □□□s o□t□□ r□port□in w□ol□ or in p□rt□or □n□r□li□nc□ t□□r□on or d□cisions □ □d□ □□s□d on □n□in□or□ □tion or conclusions in t□□ r□port is t□□ sol□r□sponsi□ilit□o□suc□t□ird p□rt□□Wood do□s not r□pr□s□nt or w□rr□nt t□□ □ccur□c□□co□pl□t□n□ss□□ □rc□□nt□□ilit□□itn□ss □or purpos□ or us□□uln□ss o□t□is docu□ □nt□or □n□ in□or□ □tion cont□in□d in t□is docu□ □nt□□or us□ or consid□r□tion □□ □n□t□ird p□rt□□Wood □cc□pts no r□sponsi□ilit□w□□tso□□□r □or d□□ □□□s or loss o□□n□n□tur□ or □ind su□□r□d □□ □n□suc□t□ird p□rt□□s □ r□sult o□□ctions t□□□n or not t□□□n or d□cisions □ □d□ in r□li□nc□on t□is r□port or □n□t□in□s□t out t□□r□in□ includin□ wit□out li□it□tion□□n□ indir□ct□sp□ci□l□incid□nt□l□puniti□□ or cons□□u□nti□l loss□li□□ilit□ or d□□ □□□□o□□n□□ind□

[illegible] **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.

[illegible] **Time dependence:** If the project contemplated by the Client is not undertaken within a period of [illegible] 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.

[illegible] **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.

[illegible] **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 subsurface/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.

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□□□ **Factors that may affect construction methods, costs and scheduling**□□□□ p□r□or□ □nc□ o□roc□ □nd soil □ □t□ri□ls durin□ construction is □r□□tl□in□u□nc□d □□t□□ □ □□ns □nd □ □t□ods o□construction□W□□r□ co□ □ □nts □r□ □ □d□ r□l□tin□ to possi□l□ □ □t□ods o□ construction□ construction costs□ construction t□c□ni□u□s□s□□u□ncin□□□□uip□ □nt or sc□□dulin□□t□□□ □r□ int□nd□d onl□ □or t□□ □uid□nc□ o□t□□ pro□□ct d□si□n pro□□ssion□ls□□nd t□os□ r□sponsi□l□ □or construction □onitorin□□□□□nu□ □□r o□t□st □ol□s □ □□not □□ su□ici□nt to d□t□r□in□ t□□ loc□l und□r□round conditions □□tw□□n t□st loc□tions t□□t □ □□ □□□□ct construction costs□construction t□c□ni□u□s□s□□u□ncin□□□□uip□ □nt□sc□□dulin□□op□r□tion□l pl□nnin□□□tc□

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□□□ **Groundwater and Dewatering**□Wood will □cc□pt no r□sponsi□ilit□ □or t□□ □□□□cts o□dr□in□□□ □nd□or d□w□t□rin□ □ □□sur□s i□Wood □□s not □□□n sp□ci□ic□ll□ consult□d □nd in□ol□□d in t□□ d□si□n □nd □onitorin□ o□t□□ dr□in□□□ □nd□or d□w□t□rin□ s□st□□ □

□□□ **Environmental and Hazardous Materials Aspects**□□nl□ss ot□□rwis□ st□t□d□t□□ in□or□ □tion cont□in□d in t□is r□port in no w□□ r□l□□cts on t□□ □n□iron□ □nt□l □sp□cts o□t□is pro□□ct□sinc□ t□is □sp□ct is □□□ond t□□ Scop□ o□Wor□ □nd t□□ □ontr□ct□□nl□ss □□pr□ssl□includ□d in t□□ Scop□ o□Wor□□t□is r□port sp□ci□ic□ll□ □□clud□s t□□ id□nti□ic□tion or int□rpr□t□tion o□ □n□iron□ □nt□l conditions suc□ □s cont□□in□tion□ □□□□rdous □ □t□ri□ls□wild li□□ conditions□r□r□ pl□nts or □rc□□olo□□ conditions t□□t □ □□ □□□□ct us□ or d□si□n □t t□□ sit□□ □□is r□port sp□ci□ic□ll□ □□clud□s t□□ in□□sti□□tion□ d□t□ction□ pr□□□ntion or □ss□ss□ □nt o□conditions t□□t c□n contri□ut□ to □oistur□□□ ould or ot□□r □icro□i□l cont□□in□nt □rowt□ □nd□or ot□□r □oistur□ r□l□t□d d□t□rior□tion□ suc□ □s corrosion□ d□c□□□ rot in □uildin□s or t□□ir surroundin□s□□n□st□t□□ □nts in t□is r□port or on t□□ □orin□lo□s r□□□rdin□odours□colours□□nd unusu□l or suspicious it□□ s or conditions □r□ strictl□ □or in□or□ □tion□l purpos□s

□□□ **Sample Disposal**□Wood will dispos□ o□ □ll uncont□□in□t□d soil □nd roc□ s□□ pl□s □t□r □□ d□□s □ollowin□ t□□ r□l□□s□ o□t□□ □in□l □□ot□c□nic□l r□port□ S□ould t□□ □li□nt r□□u□st t□□t t□□ s□□ pl□s □□ r□t□in□d □or □ lon□□r ti□ □□ t□□ □li□nt will □□ □ill□d □or suc□ stor□□□ □t □n □□r□□d upon r□t□□ □ont□□ in□t□d s□□ pl□s o□soil□roc□ or □roundw□t□r □r□ t□□ prop□rt□ o□t□□ □li□nt□□nd t□□ □li□nt will □□ r□sponsi□l□ □or t□□ prop□r dispos□l o□t□□s□ s□□ pl□s□unl□ss pr□□iousl□ □rr□n□□d □or wit□ Wood or □t□ird p□rt□□

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a Division of Wood Canada Limited