GEOTECHNICAL INVESTIGATION

Proposed Development
1260 & 1280 Dundas Street West, Oakville, ON

Client
Delmanor Oakville Limited
4800 Dufferin Street
Toronto, ON
M3H 5S9

Project Number
BIGC-ENV-185C

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1 Introduction

Ms. Kara Green of Delmanor Oakville Limited (the "Client"), has retained B.I.G. Consulting Inc. (BIG) to provide geo-environmental services including environmental, hydrogeological, updated slope stability and geotechnical assessments and to support a Pre-Purchase Due Diligence exercise of a site located at 1260 and 1208 Dundas Street West, Oakville, Ontario (hereinafter referred to as the "Site").

The site is presently vacant of any structures and will be developed to include a mid-rise retirement residence(s) with potential of one level of basement.

Substantive details of the proposed development is not available as of this submission. Hence, further detailed investigations and analysis may become necessary once detailed designs are finalized.

BIG previously carried out a slope stability assessment on the 1280 Dundas Street West property. The subsurface findings from that previous slope stability assessment in conjunction with the findings from the current investigation will be used in this report as they relate to the geotechnical considerations for the site.

This report addresses the geotechnical engineering aspects of the proposed project. Reports under separate covers will be provided for the environmental and hydrogeological assessments. The field investigation for the geotechnical assessment was combined with that for the environmental and hydrogeological assessments.

The purpose of this investigation was to obtain information on the soil and groundwater conditions by drilling seven (7) exploratory boreholes and from the findings in these boreholes coupled with relevant subsurface information from the previous slope stability assessment to provide an engineering report commensurate with the details of the proposed development available at the time of preparation of this report.

2 Terms of Reference

This report is provided on the basis of the project scope presented above, and on the assumption that the design will be in accordance with the applicable standards, codes and sound engineering practice. BIG should be contacted for consultation and review, should any changes in the design features relevant to the geotechnical analyses, or any questions arise concerning the geotechnical aspects of the codes and standards. The purpose of this review is to ensure that the recommendations in this report are correctly interpreted and implemented. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations in this report follow generally accepted practice for geotechnical engineering consultants in Ontario. The contents are governed by the amount of data available, both as acquired in this investigation and as supplied by others at the time of preparation of this report. Laboratory testing is in compliance with ASTM, CSA and similar standards or modifications that have become accepted practice.

3 Site and Geology

The site is located south and west of Fourth Line, south of Dundas Street West, and west of Sixteen Mile Creek in Oakville, Ontario. There are two major slopes adjacent to the site, i.e. Sixteen Mile Creek Valley, located to the immediate east and the West Valley, located to the immediate west/southwest of the site.

Land use is generally a mixture of residential/commercial with green space.

The soil overburden is primarily composed of Halton Till, predominantly silt to silty clay matrix, high in matrix carbonate content and clast poor (Map 2556 MNDM; Quaternary Geology of Ontario, Southern Sheet).

4 Field and Laboratory Work

The field work was carried out on November 13 and 18, 2019. It consisted of the advancing of seven (7) boreholes (BH/MW102, BH/MW103, BH104, BH/MW106, BH107, BH108 and BH/MW110) to depths ranging from 2.1 m to 6.7 m below ground surface (bgs). The boreholes were drilled and sampled to the bedrock surface. BH/MW102, BH/MW103 and BH/MW106 had monitoring wells installed for long term groundwater level observations and for environmental and hydrogeological assessment purposes.

The boreholes were advanced using truck mounted hollow stem continuous flight auger equipment under the direction and supervision of BIG field personnel. Samples were retrieved at regular intervals of depth (0.76-1.5 m) with a 50 mm O.D. split-barrel sampler driven in accordance with the Standard Penetration Test (ASTM D1586). The samples were logged in the field and returned to the BIG laboratory for detailed visual examination by the project engineer and for laboratory testing of selected specimens for index properties (water content).

Water level observations were made in the boreholes during and on completion of drilling as well as in the monitoring wells on December 2, 2019.

Borehole logs are provided in Appendix B.

The ground surface geodetic elevations at the borehole locations were surveyed by BIG personnel and referenced to Local Benchmark No. 1 taken from J.D. Barnes Topographic Plan “Reference No.: 17-30-187-00-TOPO” dated January 2nd, 2018. Benchmark description is as follows: “PK NAIL in asphalt sidewalk at Fourth Line Turn Around and Northeast Trail Entrance. A Benchmark Geodetic Elevation of 149.453 m (ASL) was taken from the J.D. Barnes Topographic Plan.

5 Subsurface Conditions

The borehole locations are shown on the site plan in Appendix A. Detailed subsurface conditions are presented on the borehole log sheets in Appendix B. The soil boundaries indicated on the borehole logs and discussed herein are inferred from visual observations, auger resistance and laboratory test data. They should not be regarded as exact planes of geological change.

The subsurface conditions (strata) encountered in this investigation was generally consistent with that from the previous slope stability assessment investigation. The soil conditions encountered at the site are summarized as follows:

5.1 Topsoil

A surficial veneer of topsoil was encountered at all borehole locations. The thickness of the topsoil ranged from 100 mm to 125 mm. Topsoil across the site is expected to be variable and may vary in thickness. Exact topsoil thicknesses, when required are easily determined with a hand shovel.

5.2 Fill

Fill was encountered below the surficial topsoil in BH104 and BH110 and extended to a depth of 1.5 m below ground surface (bgs). The fill generally consisted of silty clay to clayey silt with inclusions of gravel and trace organic staining or some rootlets.

Standard Penetration Test 'N' values in the fill ranged from 7 to 11 blows/0.3 m indicating a firm to stiff consistency. Water contents are in the order of 15 to 30 percent.

5.3 Clayey Silt to Silty Clay (Glacial) Till

Clayey silt to silty clay (glacial) till was encountered below the surficial topsoil or fill in all sampled boreholes. The till extended to a depth ranging from 1.5 to 6.1 m bgs, i.e. the inferred bedrock surface in the boreholes. The till was disturbed in the upper levels, i.e. above 0.6 m depth likely due to site operations and/or water softening. Sand and gravel sized particles, and weathered shale are present throughout the clayey till matrix. A shale-till complex was encountered below a depth of 1.9 to 6.0 m in BH/MW102, BH/MW106, BH/MW107 and BH110. The shale-till complex is the transition zone sometimes present above the shale bedrock and is characterized by a mixture of clayey silt to silty clay till and weathered shale. The deposit is brown to reddish brown in colour and in a moist state.

Standard Penetration Test 'N' values in the clayey silt to silty clay till ranged from 6 blows/0.3 m to 81 blows/0.3 m indicating firm to hard consistency. However, the till was generally very stiff to hard. Water contents were in the order of 11 to 23 percent.

5.4 Shale Bedrock

Shale bedrock was contacted below the till and/or till/shale complex deposit in all boreholes. The bedrock was encountered at a depth of approximately 1.5 to 6.1 m below ground surface.

The shale on the site is of the Queenston Formation of Upper Ordovician Age. It is defined as the rock unit that overlies the bluish grey shales of the Georgian Bay Formation.

The rock can be penetrated by augering for various depths.

The upper portion of the bedrock is commonly weathered to a depth of 600 to 1000 mm and within this weathered zone hard limestone layers or lenses are common. These hard limestone layers can result in contractual problems for augers, and can provide misleading bedrock elevations. Where the weathering is more extensive a till/shale layer may be found above the bedrock, as was the case on this site. In the sound bedrock, the limestone, sandstone, dolostone inclusions are hard to very hard. Lenses of harder rock can have thicknesses as much as 750 to 900 mm as have been encountered on other site within the Queenston Shale. These lenses can vary significantly in thickness over short distances and should be

anticipated on this site. It is also common to encounter closely spaced groupings of thin strong rock layers, which collectively can be as thick as 1.0 m or more.

Shale Characteristics from Previous Slope stability Investigation

Coring of the bedrock was carried out in the previous slope stability assessment investigation and the core recovery was very good. The rock quality was variable ranging from very poor to poor, i.e. Rock Quality Designation (RQD) of 22 % between 9.1 and 9.6 m depth at BH/MW3 to RQD of 40 % between 7.7 and 8.1 m depth at BH/MW6 to good to excellent quality, i.e. RQD ranging from 84 to 98 % in the lower levels of BH/MW2, BH/MW3 and BH/MW6. The red shale had interbedded grey shale layers, some horizontal fractures along planes, minimal vertical cracking, minimal vertical fractures and some interbedded clayey silt at 9.1 m in BH/MW6.

Detailed description of the bedrock cores and findings from the previous slope stability assessment investigation are shown on the applicable borehole logs in Appendix C.

5.5 Groundwater Conditions

Groundwater levels were monitored in the open boreholes during the course of the fieldwork and after completion.

The groundwater levels in the monitoring wells were noted to be at a depth of 0.2 to 3.9 m below ground surface or at about elevation 147.2 to 150.4 m asl, on December 2, 2019. It should be noted that the elevated groundwater level in BH/MW106 is likely attributable to interference from surface water. The screening intervals and depths for monitoring well installations are shown on the appended borehole log sheets and should be referred to for groundwater data interpretations.

It should be noted that groundwater levels are subject to seasonal fluctuations and changes in the subsurface drainage domains near any site.

6 Foundation Recommendations

It is understood that the site will be developed to include a mid-rise retirement residence(s) with potential for one level of basement.

For a building without basement, conventional spread footings with a geotechnical resistance value of 300 kPa SLS/450 kPa ULS is available on the natural undisturbed clayey silt/silty clay till. Table 6-0 provides the bearing values and the corresponding founding elevations at the borehole locations.

Table 6-0: Bearing Resistance Values for Conventional footings

Borehole	Bearing Soil	Bearing Value (kPa)	Approximate Depth (m)	Approximate Elevation (m)
BH1	Clayey Silt Till	300 SLS/450 ULS	below 2.6	Below 148.2
BH/MW2	Clayey Silt Till	300 SLS/450 ULS	below 1.5	Below 150.3
BH/MW3	Clayey Silt Till	300 SLS/450 ULS	below 1.5	Below 149.6
BH/MW4	Clayey Silt Till	300 SLS/450 ULS	below 1.8	Below 149.5
BH5	Clayey Silt Till	300 SLS/450 ULS	below 1.2	Below 150.0
BH/MW6	Clayey Silt Till	300 SLS/450 ULS	below 1.2	Below 150.1
BH/MW7	Clayey Silt Till	300 SLS/450 ULS	below 1.2	Below 149.7
BH/MW102	Clayey Silt Till/Silty Clay Till	300 SLS/450 ULS	below 1.0	Below 150.1
BH/MW103	Clayey Silt Till/Silty Clay Till	300 SLS/450 ULS	below 1.5	Below 150.1
BH104	Clayey Silt Till/Silty Clay Till	300 SLS/450 ULS	below 1.8	Below 148.8
BH/MW106	Clayey Silt Till/Silty Clay Till	300 SLS/450 ULS	below 1.2	Below 149.4
BH107	Clayey Silt Till/Silty Clay Till	300 SLS/450 ULS	below 1.0	Below 149.8
BH108	Clayey Silt Till/Silty Clay Till	300 SLS/450 ULS	below 1.0	Below 149.8
BH110	Clayey Silt Till/Silty Clay Till	300 SLS/450 ULS	below 1.8	Below 148.1

Based on the findings from the previous slope stability assessment investigation and the current geotechnical investigation, the bedrock surface on the east half of the site (BH1, BH/MW2, BH/MW3, BH/MW4, BH5, BH/MW6, BH/MW7 and BH/MW102) is considerably deeper than that on the west half, i.e. (BH/MW103, BH104, BH/MW106, BH107, BH108 and BH110). On the east half of the site, i.e. the portion of the site closer to Sixteen Mile Creek, the bedrock was encountered at a depth ranging from 5.6

to 7.6 m bgs, i.e. Elevation: 143.5 to 145.2 m asl. At the west half of the site, bedrock was encountered at a depth ranging from 1.5 to 3.0 m bgs, i.e. elevation: 148.5 to 149.3 m asl.

Given that the average ground surface is at about Elev. 151 m, excavation for a 1-level of basement will result in an excavation extending to a depth of about 3 to 4± m, i.e. about Elev. 147 to 148± m. As such, foundations on the west half of the site will be founded on the shale and foundations on the east portion of the site will be supported on the clayey silt to silty clay till overburden soils.

we recommend that additional boreholes extending into the bedrock be carried out to explore the bedrock across the site beyond that explored for this investigation to confirm to quality/consistency of the sound shale bedrock.

For preliminary design purposes, subject to further investigation of the bedrock profile and confirmation during detailed design stages, the following geotechnical resistance values can be used for conventional footings on hard clayey silt /silty clay till or weathered Queenston Shale bedrock at or below Elev: 147 to 148± m.

- Clayey silt/Silty Clay Till: 400 kPa SLS/600 kPa ULS
- Weathered Shale: ULS – 1,500 kPa

Given the findings in the boreholes and depending on the proposed building configuration(s), the building(s) may encounter significant variations in bearing resistances and stiffness between shale and the glacial till. Hence, consideration should be given to the incorporation of movement or settlement joints to allow the supported blocks of structures to settle differently. This method is often a most economical way of handling situations where large differences in bearing resistances and stiffnesses are encountered on site.

Where significant differential settlements are expected, services into the building(s) or its foundations should be constructed to absorb the movements by the use of flexible joints or telescopic connections at ground/foundation interface.

6.1 Foundations - General

Footings founded on glacial till or shale strata and designed for the above applicable bearing resistance values are expected to limit total and differential settlements to within the normally tolerated limits of 25 mm and 19 mm, respectively.

All footings exposed to seasonal freezing conditions must have at least 1.2 metres of soil cover for frost protection.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

It should be noted that the recommended bearing resistances have been calculated by BIG from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is

underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by BIG to validate the information for use during the construction stage**.**

7 Floor Slabs and Permanent Drainage

For basement extending to a depth of 3 to 4 m± below existing ground surface, conventional slab on grade construction can be used on the glacial till or weathered shale bedrock expected at the basement subgrade level.

For a building where there is no basement, after removal of surficial topsoil, the exposed subgrade should be proof rolled under the guidance of the geotechnical engineer. Any soft spots revealed during proof rolling should be sub-excavated and backfilled with clean inorganic soils placed in 200 mm thick loose lifts and each lift compacted to at least 98 percent Standard Proctor Maximum Dry Density (SPMDD). If required, the site can be raised to final subgrade level in the same manner.

A moisture barrier consisting of at least 200 mm of clear crushed stone should be installed under the floor slabs.

For a structure with a basement, the perimeter drainage system shown on Drawing 1 in Appendix D is recommended for slab on grade construction at the basement level.

A perimeter drainage system for a timber lagging and soldier pile shoring wall is shown on Drawing 2 in Appendix D.

8 Frost Protection

The design frost penetration depth for this site is 1.2 m, or equivalent insulation.

9 Earth Pressures

The lateral earth pressures acting on basement walls, etc. may be calculated from the following expression:

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

where p = lateral earth pressure in kPa acting at depth h

K = earth pressure coefficient, assumed equal to 0.40

γ = unit weight of backfill, a value of 21 kN/ cu.m may be assumed

h = depth to point of interest in metres

q = equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the buildup of any hydrostatic pressure behind the wall and that granular fill is used.

Earth pressures on soil retention structures will depend on soil type, groundwater conditions, conditions of wall restraint, backfill slope geometry, surcharge conditions and similar factors. If required, appropriate further recommendations can be provided once detailed structure design and construction related retention system details become available.

10 Shoring Considerations

Earth retention will likely be required for the proposed 3 to 4± m deep excavation. If and where adjacent sensitive structures/services are present, consideration should be given to an unyielding shoring system, possibly consisting of interlocking caissons (secant wall). The shoring system should be designed in accordance with the guidelines provided in the latest edition of the Canadian Foundation Engineering Manual (CFEM). The upper levels of the secant wall shoring system may require internal bracing with struts. If an easement for tie-back anchors is available from the adjacent building structures, the lower levels of the secant wall shoring system could be restrained by means of tie-back anchors.

A bond resistance of 48 kPa can be used for anchors in the hard 5till in dense till and 600 kPa for the shale.

The shale is encountered at depths of 1.5 to 7.6 m below ground surface and excavation for one level of basement will penetrate the bedrock on the south portion of the site. Rock excavation is typically nominally self-supporting in a vertical face where bedding is horizontal. Rock bolts may be used in a vertical face to provide support to joint surfaces that may not be readily apparent in the open face. The excavation face should be inspected by geotechnical personnel to ensure that loose rock with the potential for spalling and materials which can slide and fall on workers below are removed. This would also be a requirement of the Occupational Health and Safety Act (OHSA).

Along the other sides of the property where non-sensitive structures exist, shoring may be achieved with traditional soldier piles and timber lagging.

For the more conventional shoring systems, the design values for earth pressure calculations can be provided once further details of shoring system configuration, depth, groundwater control and similar facts become available.

Subject to hydrogeological considerations, construction dewatering or long-term underfloor drainage system may adversely impact nearby structures, it would be best to provide a sufficient depth of shoring system cut-off below the excavation level to avoid piping, uplift and basal heave.

11 Excavation and Backfill Considerations

It is anticipated that excavation for the proposed foundations, underground services, etc. will extend through the fill, native clayey silt to silty clay till and into the shale (south portion of the site). The excavation within the overburden may be undertaken with a mechanical shovel. In the shale bedrock, the limestone inclusions are hard to very hard. Lenses of harder rock can have thicknesses as much as 750 to 900 mm as have been encountered on other site within the Queenston Shale. These lenses can vary significantly in thickness over short distances and should be anticipated on this site. It is also common to encounter closely spaced groupings of thin strong rock layers, which collectively can be as thick as 1.0 m or more. As such, the use of pneumatic hammers, hoe rams, etc. should be anticipated for bedrock excavation.

Cobbles and boulders could be encountered in the till as well as obstructions in the fill, and their presence may influence the progress of excavation. Consequently, provision should be made in the contract documents to cover any delays caused by boulder obstruction or obstruction in the fill.

Excavations may be undertaken as "open-cut", provided they comply with the requirements of the current Occupational Health and Safety Act (OHSA). For guidance, the fill is considered a Type 3 soil. The very stiff to hard silty clay till is considered to be Type 2. The weakest material in an excavation site will govern.

The OSHA requires that excavation slopes be cut at predetermined inclinations, based on the soil types. Locally, where loose/soft materials are encountered, or within zones of persistent seepage at depth, it may be necessary to flatten the side slopes further. However, as noted in the previous section of this report, earth retention may be required for an excavation extending to a depth of 3 to 4± m below ground surface.

It is important to note that soils encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in the boreholes advanced at the site. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, we recommend that BIG be contacted immediately to evaluate the conditions encountered.

Backfill used to satisfy underfloor slab requirements, in footings and service trenches, etc., should be compactable fill, i.e. inorganic soil with its moisture content close to its optimum moisture content determined in a Standard Proctor Test. The excavated native soils, which are not mixed with topsoil/organics or other obviously unsuitable materials, may be reused as backfill. Materials found to be wet should be allowed to air dry before reusing.

Any organic, excessively wet, or otherwise deleterious material should not be used for backfilling purposes. Any shortfall of suitable on-site excavated material can be made up with imported granular material such as OPSS Granular 'B' or equivalent. We would recommend that the shale not be used due to the difficulties in adequately pulverizing this material and obtaining adequate moisture contents to facilitate compaction.

In general, the overburden soils are not suitable for use in confined areas. Imported granular material conforming OPSS Granular 'B' Type 1 would be suitable for these purposes as well as in areas where free-draining characteristics are required. Backfill against the foundation walls should also consist of free-draining material such as Granular 'B' Type 1.

Backfill should be placed in lifts not exceeding 200 mm and compacted to the requirements as stated in Section 6 of this report.

Backfill should be placed simultaneously on both sides of the foundation walls. Heavy compactors, which generate large lateral stress, should be kept at a safe distance from walls to avoid structural damage.

All backfill and compaction operations should be monitored by qualified geotechnical personnel to approve material, to evaluate placement operations, and to verify that the specified degree of compaction is being achieved throughout the fill.

12 Earthquake Considerations

Given the competent subsurface conditions, the proposed structure may be designed for Site Class C. Upgrading of the site class can be explored with appropriate additional testing (MASW, VSP, etc.), i.e. shear-wave velocity sounding.

13 General Comments

The contents of this report are based on the limited and preliminary subsurface information obtained in this investigation. BIG should be retained to review final designs and specifications to ensure that the intended geotechnical recommendations have been appropriately adopted. BIG is unable to assume any responsibility if the requested opportunity is not forthcoming.

The comments given in this report are intended for general information on subsurface conditions and for general guidance towards finalization of plans and preliminary designs for the proposed development.

Reliance solely on borehole data involves risks taken entirely by those who do so. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual data, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The information in this report in no way reflects on the environmental aspects of the site.

This report has been prepared for the account of the Client. The contents of this report reflect our best engineering judgment given the limitations of the site investigation and information on project details. Third party use of this report is at the entire risk of the Third party and BIG shall not held liable for any consequences arising therefrom.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

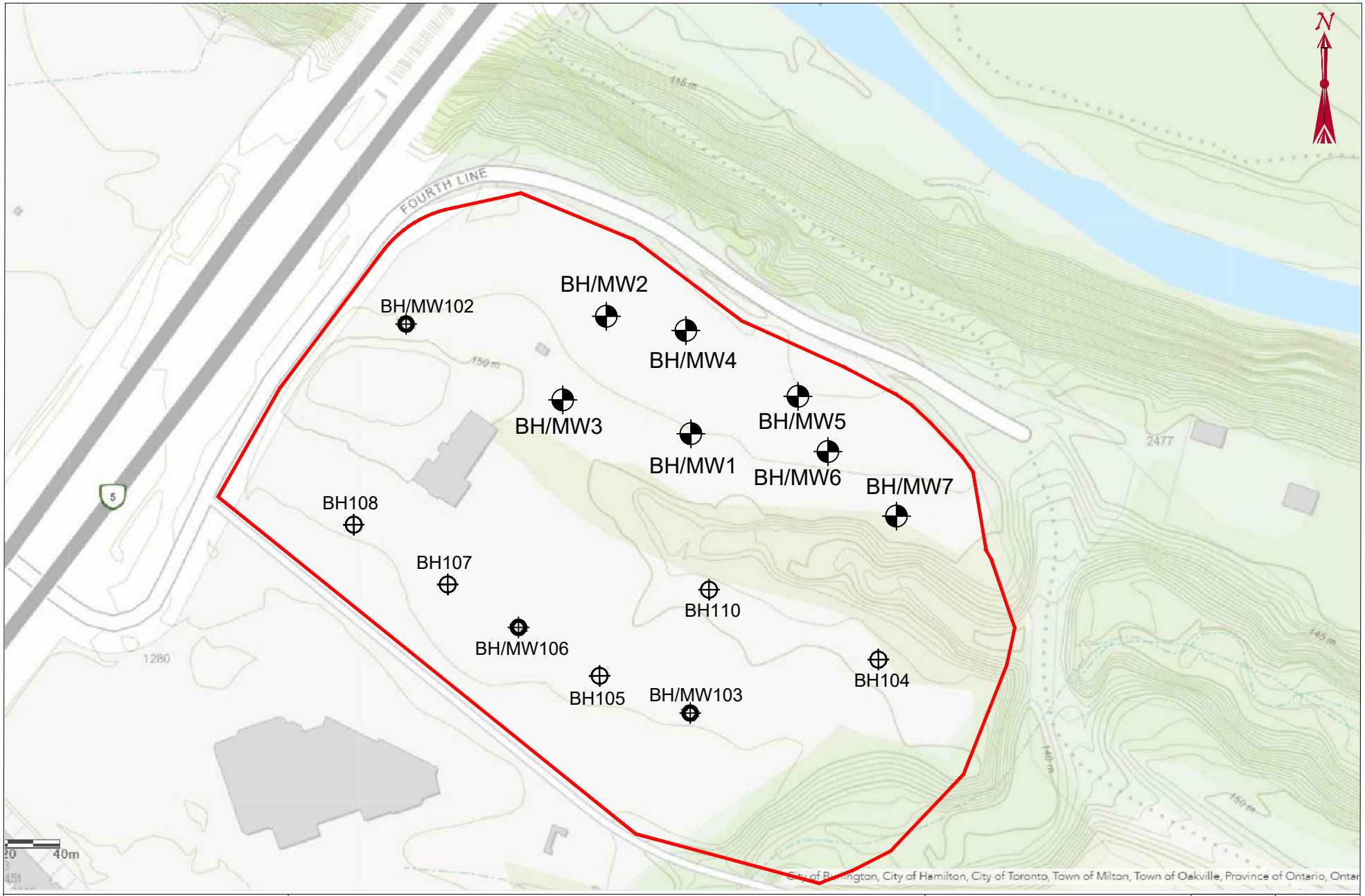
Respectfully submitted,

B.I.G. Consulting Inc.

Osbert (Ozzie) Benjamin, P. Eng.
Manager, Geotechnical Services

Darko Strajin, P.Eng.
Managing Partner

Appendix A – Borehole Location Plan



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LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE BOREHOLE LOCATION (BIG, 2018)
- APPROXIMATE BOREHOLE/MONITORING WELL LOCATION (BIG, 2018)
- APPROXIMATE BOREHOLE LOCATION (BIG, 2019)
- APPROXIMATE BOREHOLE/MONITORING WELL LOCATION (BIG, 2019)
- APPROXIMATE MINI PIEZOMETER LOCATION (BIG, 2019)

SCALE
25m 0m 75m

BASEMAP SOURCED FROM ARCGIS, 2018

TITLE AND LOCATION

BOREHOLE/MONITORING WELL LOCATION PLAN PRELIMINARY GEOTECHNICAL INVESTIGATION

1260 & 1280 DUNDAS STREET WEST, OAKVILLE, ONTARIO

PROJECT NO.	DWN.
BIGC-GEO-185B	S.M.
SCALE	CK.
AS NOTED	O.B.
DATE	FIG NO.
NOVEMBER 2019	1

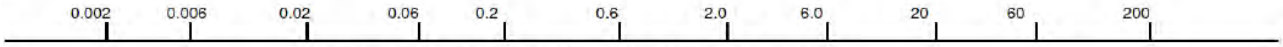
Appendix B - Borehole Logs

Notes On Sample Descriptions Drawing 1A

1. All sample descriptions included in this report follow the Unified Soil Classification System. Laboratory grain size analyses provided by B.I.G. Consulting Inc. also follow the same system. Different classification systems may be used by others; one such system is the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. The following table gives a description of the soil based on particle sizes. With the exception of those samples where grain size analyses have been performed, all samples are classified visually. The accuracy of visual examination is not sufficient to differentiate between this classification system or exact grain size.

Soil Classification		Terminology	Proportion
Clay and Silt	<0.060 mm	“trace” (e.g. Trace sand)	1% to 10%
Sand	0.060 to 2.0 mm	“some” (e.g. Some sand)	10% to 20%
Gravel	2.0 to 75 mm	adjective (e.g. sandy, silty)	20% to 35%
Cobbles	75 to 200 mm	“and” (e.g. and sand)	35% to 50%
Boulders	>200 mm		

The compactness of Cohesionless soils and the consistency of the cohesive soils are defined by the following:

Cohesionless Soil		Cohesive		
Compactness	**Standard Penetration Resistance "N" Blows / 0.3 m**	**Consistency**	**Undrained Shear Strength (kPa)**	**Standard Penetration Resistance "N" Blows / 0.3 m**
Very Loose	0 to 4	Very soft	<12	<2
Loose	4 to 10	Soft	12 to 25	2 to 4
Compact	10 to 30	Firm	25 to 50	4 to 8
Dense	30 to 50	Stiff	50 to 100	8 to 15
Very Dense	Over 50	Very Stiff	100 to 200	15 to 30
		Hard	>200	>30

4. ROCK CORING: Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundless of the rock mass. It is obtained from the rock cores by summing the length of the core covered, counting only those pieces of sound core that are 100 mm or more length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very Poor Quality	<25
Poor Quality	25 to 50
Fair Quality	50 to 75
Good Quality	75 to 90
Excellent Quality	90 to 100

$$\text{Recovery Designation \% Recovery} = \frac{\text{Length of Core Per Run}}{\text{Length of Core Per Run}} \times 100$$

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RECORD OF BOREHOLE No BH/MW102 1 OF 1 METRIC

PROJ. NO. BIGC-ENV-185C | LOCATION 1260 Dundas Street West, Oakville, ON | ORIGINATED BY F.G.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.C.

PROJ. NAME Geo/HG/PII Investigations | DATE 2019.11.13 - 2019.11.13 | CHECKED BY F.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
151.1											
151.0	**TOPSOIL:** 125 mm										
0.1	**CLAYEY SILT TILL/SILTY CLAY TILL:** disturbed upper 300 mm, rootlets, reddish brown, moist, very stiff to hard (Pocket Penetrometer: > 225 kPa)		1	SS1	9				○		
			2	SS2	32		150		○		
			3	SS3	41		149		○		
			4	SS4	52		148		○		
	- rock fragments below 3.05 m		5	SS5	81	▽	147		○		
	- reddish brown and grey below 4.57 m		6	SS6	36		146		○		
145.0	-shale-till complex below 6.0 m										
6.1	**SHALE:** weathered, red, damp		7	SS7	100		145		○		
144.4											
6.7	**Borehole terminated at 6.7 m**										

Notes:
1. Open to 6.7 m bgs upon completion of drilling.
2. Dry upon completion of drilling.
3. Water level was 4.5 m bgs on November 25, 2019.
4. Water level was 3.9 m bgs on December 2, 2019.

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

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RECORD OF BOREHOLE No BH/MW103

1 OF 1

METRIC

PROJ. NO. BIGC-ENV-185C | LOCATION 1260 Dundas Street West, Oakville, ON | ORIGINATED BY F.G.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.C.

PROJ. NAME Geo/HG/PII Investigations | DATE 2019.11.13 - 2019.11.13 | CHECKED BY F.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
151.6											
151.5 / 0.1	**TOPSOIL:** 125 mm										
	CLAYEY SILT TILL/SILTY CLAY TILL: disturbed upper 300 mm, brown, moist, very stiff to hard		1	SS1	6		151		○		
			2	SS2	19				○		
			3	SS3	36		150		○		
	- reddish brown, shale inclusions below 2.29 m		4	SS4	46		149		○		
148.6											
3.0	**SHALE:** weathered, red, damp		5	SS5	100				○		
148.1											
3.5	**Borehole terminated at 3.5 m**										

Notes:
1. Open to 3.5 m bgs upon completion of drilling.
2. Dry upon completion of drilling.
3. Water level was at 3.32 m bgs November 25, 2019.
4. Water level was as 3.09 m bgs on December 2, 2019.

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

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RECORD OF BOREHOLE No BH104

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-185C | LOCATION 1260 Dundas Street West, Oakville, ON | ORIGINATED BY F.G.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.C.

PROJ. NAME Geo/HG/PII Investigations | DATE 2019.11.13 - 2019.11.13 | CHECKED BY F.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
150.6											
150.5	**TOPSOIL:** 50 mm										
	FILL: clayey silt to silty clay, trace organic staining, brown, moist		1	SS1	7						Metals & Inorganics, Pesticides, Herbicides Analysis PAHs Analysis
			2	SS2	8		150				
149.1											
1.5	**CLAYEY SILT TILL/SILTY CLAY TILL:** reddish brown, moist, stiff to hard (Pocket Penetrometer: > 225 kPa)		3	SS3	26		149				
			4	SS4	59		148				
147.7	-weathered shale inclusion below 2.7 m										
2.9	**SHALE:** highly weathered, red, damp		5	SS5	100		147				
146.9											
3.7	**Borehole terminated at 3.7 m**										

Notes:
1. Open to 3.7 m bgs upon completion of drilling.
2. Dry upon completion of drilling.

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

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RECORD OF BOREHOLE No BH/MW106

1 OF 1

METRIC

PROJ. NO. BIGC-ENV-185C | LOCATION 1260 Dundas Street West, Oakville, ON | ORIGINATED BY F.G.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.C.

PROJ. NAME Geo/HG/PII Investigations | DATE 2019.11.13 - 2019.11.13 | CHECKED BY F.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
150.6											
150.5 / 0.1	**TOPSOIL:** 100 mm										
	CLAYEY SILT TILL/SILTY CLAY TILL: disturbed upper 400 mm, rootlets, cobble, brown, moist, very stiff to hard (Pocket Penetrometer: > 225 kPa)		1	SS1	6		150				
			2	SS2	28						
			3	SS3	100		149				
148.6 / 2.0	-shale-till complex below 1.9 m **SHALE:** weathered, red, damp - limestone layers between 2 m and 3.1 m						148				
147.5 / 3.1	**Borehole terminated at 3.1 m** Notes: 1. Open to 3.1 m bgs upon completion of drilling. 2. Dry upon completion of drilling. 3. Water level at 0.69 m bgs on November 25, 2019. 4. Water level at 0.18 m bgs on December 2, 2019.										

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

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RECORD OF BOREHOLE No BH107

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-185C | LOCATION 1260 Dundas Street West, Oakville, ON | ORIGINATED BY F.G.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.C.

PROJ. NAME Geo/HG/PII Investigations | DATE 2019.11.13 - 2019.11.13 | CHECKED BY F.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
150.8											
150.7 / 0.1	**TOPSOIL:** 125 mm										
	CLAYEY SILT TILL/SILTY CLAY TILL: disturbed upper 400 mm, rootlets, brown, moist, very stiff to hard (Pocket Penetrometer: > 225 kPa)		1	SS1	10		150				Metals & Inorganics, Pesticides, Herbicides Analysis PAHs Analysis
			2	SS2	34						
			3	SS3	32		149				
148.5 / 2.3	-shale-till complex below 2.2 m **SHALE:** weathered, red, damp		4	SS4	100		148				
147.7 / 3.1	**Borehole terminated at 3.1 m** Notes: 1. Open to 3.1 m bgs upon completion of drilling. 2. Dry upon completion of drilling.										

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

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RECORD OF BOREHOLE No BH108

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-185C | LOCATION 1260 Dundas Street West, Oakville, ON | ORIGINATED BY F.G.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.C.

PROJ. NAME Geo/HG/PII Investigations | DATE 2019.11.18 - 2019.11.18 | CHECKED BY F.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
150.8											
150.7 / 0.1	**TOPSOIL:** 125 mm										
	CLAYEY SILT TILL/SILTY CLAY TILL: disturbed above 0.6 m, rootlets, reddish brown, moist, very stiff to hard		1	SS1	6						
			2	SS2	28		150				
149.3											
1.5	**SHALE:** weathered, red, damp		3	SS3	100		149				
148.7											
2.1	**Borehole terminated at 2.1 m**										

Notes:
1. Open to 2.1 m bgs upon completion of drilling.
2. Dry upon completion of drilling.

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

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RECORD OF BOREHOLE No BH110

1 OF 1

METRIC

PROJ. NO. BIGC-ENV-185C | LOCATION 1260 Dundas Street West, Oakville, ON | ORIGINATED BY F.G.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.C.

PROJ. NAME Geo/HG/PII Investigations | DATE 2019.11.18 - 2019.11.18 | CHECKED BY F.C.

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
149.9											
149.8	**TOPSOIL:** 150 mm										
149.7 / 0.2	**FILL:** silty clay to clayey silt silt, some rootlets, reddish brown, very moist to moist		1	SS1	7						PAHs, Pesticides, Herbicides Analysis; Metals & Inorganics Analysis
			2	SS2	11		149				
148.4 / 1.5	**CLAYEY SILT TILL/SILTY CLAY TILL:** silt pockets, reddish brown, moist, very stiff to hard (Pocket Penetrometer: > 225 kPa)		3	SS3	29		148				
147.6 / 2.3	**SHALE-TILL COMPLEX:** red, damp, hard		4	SS4	100						
147.0 / 2.9	-weathered shale at 2.9 m **Borehole terminated at 2.9 m**										

Notes:
1. Open to 2.9 m bgs upon completion of drilling.
2. Dry upon completion of drilling.

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

Appendix C – Borehole Logs from Slope Stability Assessment

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RECORD OF BOREHOLE No BH1

1 OF 1

METRIC

PROJ. NO. BIGC-GEO-185C | LOCATION 1280 Dundas Street West, Oakville, ON | ORIGINATED BY A.B.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.D.

PROJ. NAME Geo/HG/PII Investigations | DATE 2018.05.22 - 2018.05.22 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
150.8											
150.9 / 0.1	**TOPSOIL:** 100 mm										
	FILL: clayey silt, trace gravel and organics, mottled reddish brown, moist		1	SS1	10				○		
	- trace rootlets at 0.8 m		2	SS2	4		150		○		
			3	SS3	8		149		○		
148.5 / 2.3	- 75 mm black organic layer at 2.0 m **CLAYEY SILT TILL:** trace gravel, reddish brown, moist, hard, (Pocket Penetrometer: > 225 kPa)		4	SS4	37				○		
147.8 / 3.1	**CLAYEY SILT TILL:** trace gravel, red shale inclusion, reddish brown, moist, hard, (Pocket Penetrometer: > 225 kPa)		5	SS5	57		148		○		
			6	SS6	55		147		○		
	- grey and very stiff below 4.6 m (Pocket Penetrometer: 200 kPa)		7	SS7	23		146		○		
145.2 / 5.6	Till/Shale Complex below 5.5 m **SHALE:** weathered, red, damp		8	SS8	100		145		○		
144.7 / 6.1	**Borehole terminated at 6.2 m** Notes: 1. Open to 6.2 m bgs upon completion of drilling 2. Water at 4.1 m bgs upon completion of drilling		9	SS9	100						

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

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RECORD OF BOREHOLE No BH/MW2

1 OF 1

METRIC

PROJ. NO. BIGC-GEO-185C | LOCATION 1280 Dundas Street West, Oakville, ON | ORIGINATED BY A.B./F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.D.

PROJ. NAME Geo/HG/PII Investigations | DATE 2018.05.22 - 2018.05.23 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
151.8											
151.7 / 0.1	**TOPSOIL:** 100 mm										
	FILL: clayey silt, trace gravel, some rootlets, topsoil inclusions above 0.3 m, reddish brown, moist		1	SS1	6				○		
151.0 / 0.8	- 150 mm topsoil inclusion at 0.15m						151				
	CLAYEY SILT TILL: trace gravel, mottled, reddish brown, moist, very stiff, (Pocket Penetrometer: > 225 kPa)		2	SS2	18				○		
	- red shale inclusions and hard below 1.5 m		3	SS3	33		150		○		
			4	SS4	41		149		○		
			5	SS5	43	▽	148		○		
147.2 / 4.6	**CLAYEY SILT TILL:** trace gravel, red shale inclusion, grey, moist, hard, (Pocket Penetrometer: > 225 kPa)		6	SS6	31		147		○		
			7	SS7	29		146		○		
144.4 / 7.4	**SHALE:** weathered, red, damp		8	SS8	36		145		○		
			9	SS9	100		144		○		
			10	SS10	100		143		○		
141.1 / 10.7	——Run #1: 10.7 to 11.2 m RQD=81% Recovery=84%		1	CORE			142				
140.6 / 11.2	- red shale, interbedded grey shale - fractive along horizontal plane - minimal vertical cracking						141		○		
	——Run #2: 11.2 to 12.6 m RQD=92% Recovery=100%		2	CORE			140				
139.1 / 12.6	- red shale, interbedded grey shale - minimal vertical fractures										
	Borehole terminated at 12.6 m										

Notes:
1. Open to 12.6 m upon completion of drilling
2. Water at 3.2 m upon completion of drilling
3. Water level at 3.0 m on June 13, 2018

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

$\circ^{3\%}$ STRAIN AT FAILURE

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RECORD OF BOREHOLE No BH/MW3

1 OF 1 **METRIC**

PROJ. NO. BIGC-GEO-185C | LOCATION 1280 Dundas Street West, Oakville, ON | ORIGINATED BY A.B.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.D.

PROJ. NAME Geo/HG/PII Investigations | DATE 2018.05.22 - 2018.05.22 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
151.1							151				
150.9 / 0.2	**TOPSOIL:** 150 mm										
	FILL: clayey silt, trace gravel, rootlets, asphalt fragments, brown, moist		1	SS1	11				○		
149.9			2	SS2	7		150		○		
1.2	**CLAYEY SILT TILL:** trace gravel, mottled, brown, moist, firm to very stiff, (Pocket Penetrometer: 225 kPa) - mottled, red shale inclusions and very stiff to hard below 1.5 m		3	SS3	27				○		
148.1			4	SS4	33		149		○		
3.1	**CLAYEY SILT TILL:** trace gravel, mottled, red shale inclusion, orange-brown, moist, hard, (Pocket Penetrometer: > 225 kPa)		5	SS5	65	▽	148		○		
	- oxidized red and grey at 4.6		6	SS6	60		147		○		
144.8	- Till/Shale Complex below 6.1 m		7	SS7	100		146		○		
6.3	**SHALE:** weathered, red, damp		8	SS8	100		145		○		
142.0							144		○		
9.1 / 141.5	----Run #1: 9.1 to 9.6 m RQD=22% Recovery=77% - weathered red shale - some mottling - vertical and horizontal fractures		1	CORE			143				
9.6	----Run #2: 11.2 to 12.6 m RQD=92% Recovery=100% - red shale, interbedded grey shale - minimal vertical fractures		2	CORE			142				
140.0							141				
11.2	**Borehole terminated at 11.2 m** Notes: 1. Open to 11.2 m bgs upon completion of drilling 2. Water at 2.5 m bgs upon completion of drilling 3. Water level at 2.7 m bgs on June 13, 2018						140				

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

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RECORD OF BOREHOLE No BH/MW4

1 OF 1

METRIC

PROJ. NO. BIGC-GEO-185C | LOCATION 1280 Dundas Street West, Oakville, ON | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.D.

PROJ. NAME Geo/HG/PII Investigations | DATE 2018.05.23 - 2018.05.23 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
151.3											
151.2 / 0.1	**TOPSOIL:** 125 mm										
	FILL: clayey silt, trace gravel, brown, moist		1	SS1	10		151		○		
	- mottled, inclusions of black organics, orange-brown at 0.8 m		2	SS2	6				○		
149.8							150				
1.5	**CLAYEY SILT TILL:** trace gravel, mottled, reddish brown, moist, very stiff to hard, (Pocket Penetrometer: > 225 kPa)		3	SS3	24				○		
			4	SS4	43		149		○		
	CLAYEY SILT TILL: trace gravel, red shale inclusion, oxidized fissures, brown/reddish brown, moist, hard, (Pocket Penetrometer: > 225 kPa)		5	SS5	51	▽	148		○		
146.8							147				
4.6			6	SS6	49				○		
	- grey and very stiff to hard at 6.1 m. (Pocket Penetrometer: > 225 kPa)		7	SS7	25		146		○		
143.7							145				
143.6 / 7.6	**SHALE:** weathered, red, damp		8	SS8	100		144		○		
	Borehole terminated at 7.6 m										
	Notes: 1. Water at 3.0 m bgs upon completion of drilling 2. Open to 7.6 m bgs upon completion of drilling 3. Water level at 2.6 m bgs on June 13, 2018										

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

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RECORD OF BOREHOLE No BH5

1 OF 1 **METRIC**

PROJ. NO. BIGC-GEO-185C | LOCATION 1280 Dundas Street West, Oakville, ON | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.D.

PROJ. NAME Geo/HG/PII Investigations | DATE 2018.05.23 - 2018.05.23 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
151.2							151				
~~150.9~~ 0.1	**TOPSOIL:** 125 mm										
	FILL: clayey silt, trace gravel, top soil inclusion, brown, moist		1	SS1	3				○		
150.2	- 125 mm granular fill at 0.8 m										
0.9	**CLAYEY SILT TILL:** trace gravel, reddish brown, moist, very stiff to hard, (Pocket Penetrometer: > 225 kPa)		2	SS2	26		150		○		
			3	SS3	44				○		
148.9							149				
2.3	**CLAYEY SILT TILL:** trace gravel, red shale inclusion, reddish brown, moist, hard, (Pocket Penetrometer: > 225 kPa)		4	SS4	54				○		
			5	SS5	54		148		○		
			6	SS6	42		147		○		
							146				
	- grey and very stiff below 6.1 m (Pocket Penetrometer 175 kPa)		7	SS7	18		145		○		
143.5							144				
7.6 ~~143.3~~	**SHALE:** weathered, red, damp		8	SS8	100				○		
7.9	**Borehole terminated at 7.9 m** Notes: 1. Open to 7.9 m bgs upon completion of drilling 2. Water not measured upon completion of drilling										

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

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RECORD OF BOREHOLE No BH/MW6

1 OF 1

METRIC

PROJ. NO. BIGC-GEO-185C | LOCATION 1280 Dundas Street West, Oakville, ON | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.D.

PROJ. NAME Geo/HG/PII Investigations | DATE 2018.05.24 - 2018.05.24 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
151.3											
151.2 / 0.1	**TOPSOIL:** 125 mm										
	POSSIBLE FILL: clayey silt, trace gravel, rootlets, organic stains, reddish brown, moist		1	SS1	6		151				
150.6 / 0.8	**CLAYEY SILT TILL:** trace gravel, shale inclusion, reddish brown, moist, very stiff to hard (Pocket Penetrometer: > 225 kPa)		2	SS2	28		150				
			3	SS3	26						
	- hard below 2.3 m		4	SS4	31		149				
			5	SS5	43	▽	148				
146.7 / 4.6	**CLAYEY SILT TILL:** trace gravel, red shale inclusions, brown, moist, very stiff to hard, (Pocket Penetrometer: > 225 kPa) - grey below 5.0 m		6	SS6	29		147				
			7	SS7	15		146				
143.7							145				
143.6 / 7.7	**SHALE:** weathered, red, damp		8	SS8	100		144				
143.2	——Run #1: 7.7 to 8.1 m RQD=40% Recovery=78% - weathered red shale, interbedded grey shale - one vertical fracture		1	CORE			143				
8.1	——Run #2: 8.1 to 9.6 m RQD=94% Recovery=98% - red shale, interbedded grey shale - minimal vertical fractures - some horizontal fractures along planes - some interbedded clayey silt at 9.1 m		2	CORE			142				
141.7 / 9.6	**Borehole terminated at 9.6 m**										

Notes:
1. Open to 9.6 m bgs upon completion of drilling
2. Water at 1.09 m bgs upon completion of drilling
3. Water level at 2.8 m bgs on June 13, 2018

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

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RECORD OF BOREHOLE No BH/MW7

1 OF 1

METRIC

PROJ. NO. BIGC-GEO-185C | LOCATION 1280 Dundas Street West, Oakville, ON | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight solid stem auger, split spoon samples and augered core samples | COMPILED BY F.D.

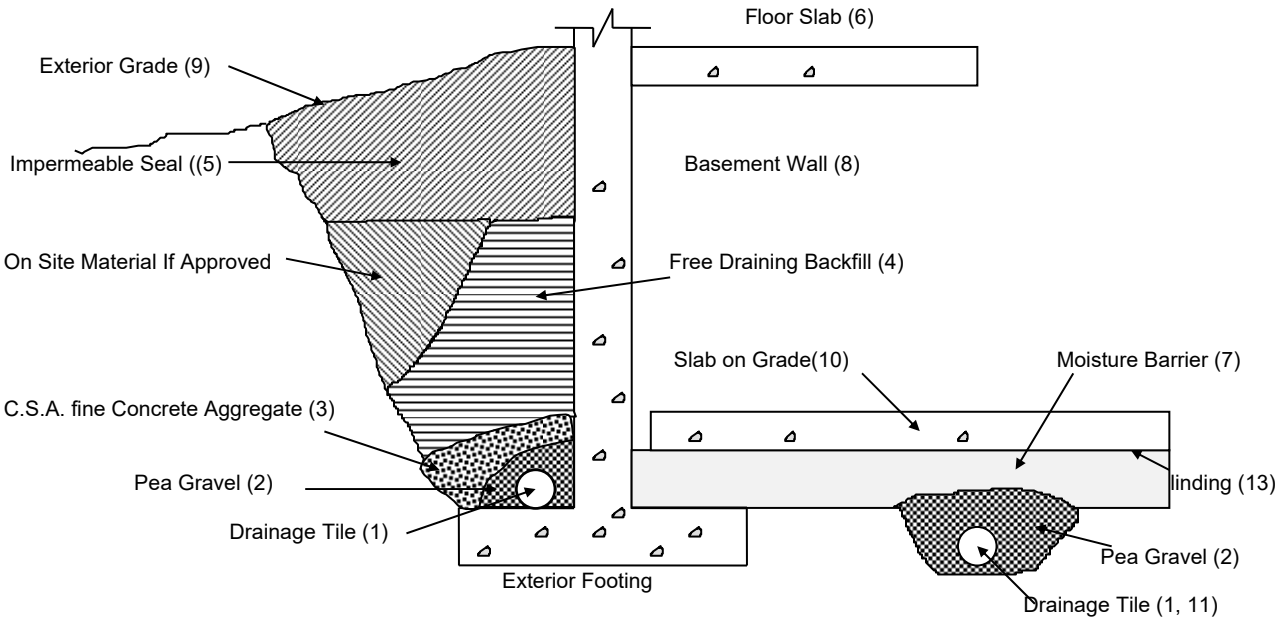
PROJ. NAME Geo/HG/PII Investigations | DATE 2018.05.24 - 2018.05.24 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
150.9											
~~150.8~~ 0.1	**TOPSOIL:** 100 mm										
	POSSIBLE FILL: clayey silt, reworked and distributed, trace rootlets and organic staining, brown, moist		1	SS1	3				○		
150.1 0.8	**CLAYEY SILT TILL:** trace gravel, shale inclusions, reddish brown, moist, stiff to very stiff, (Pocket Penetrometer: > 225 kPa) - very stiff below 1.5 m		2	SS2	26		150		○		
			3	SS3	44		149		○		
	- hard below 2.3 m		4	SS4	54	▽	148		○		
			5	SS5	54		147		○		
146.3 4.6	**CLAYEY SILT TILL:** red shale inclusions, reddish brown, moist, hard, (Pocket Penetrometer: > 225 kPa)		6	SS6	42		146		○		
144.8							145				
~~146.7~~ 6.2	**SHALE:** weathered, red, damp		7	SS7	18				○		
	Borehole terminated at 6.2 m Notes: 1. Open to 6.2 m bgs upon completion of drilling 2. Water not measured completion of drilling 3. Water level at 2.0 m bgs on June 13, 2018										

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

Appendix D: Drainage and Backfill Recommendations

Project: BIGC-ENV-185C **Drawing No. 1**



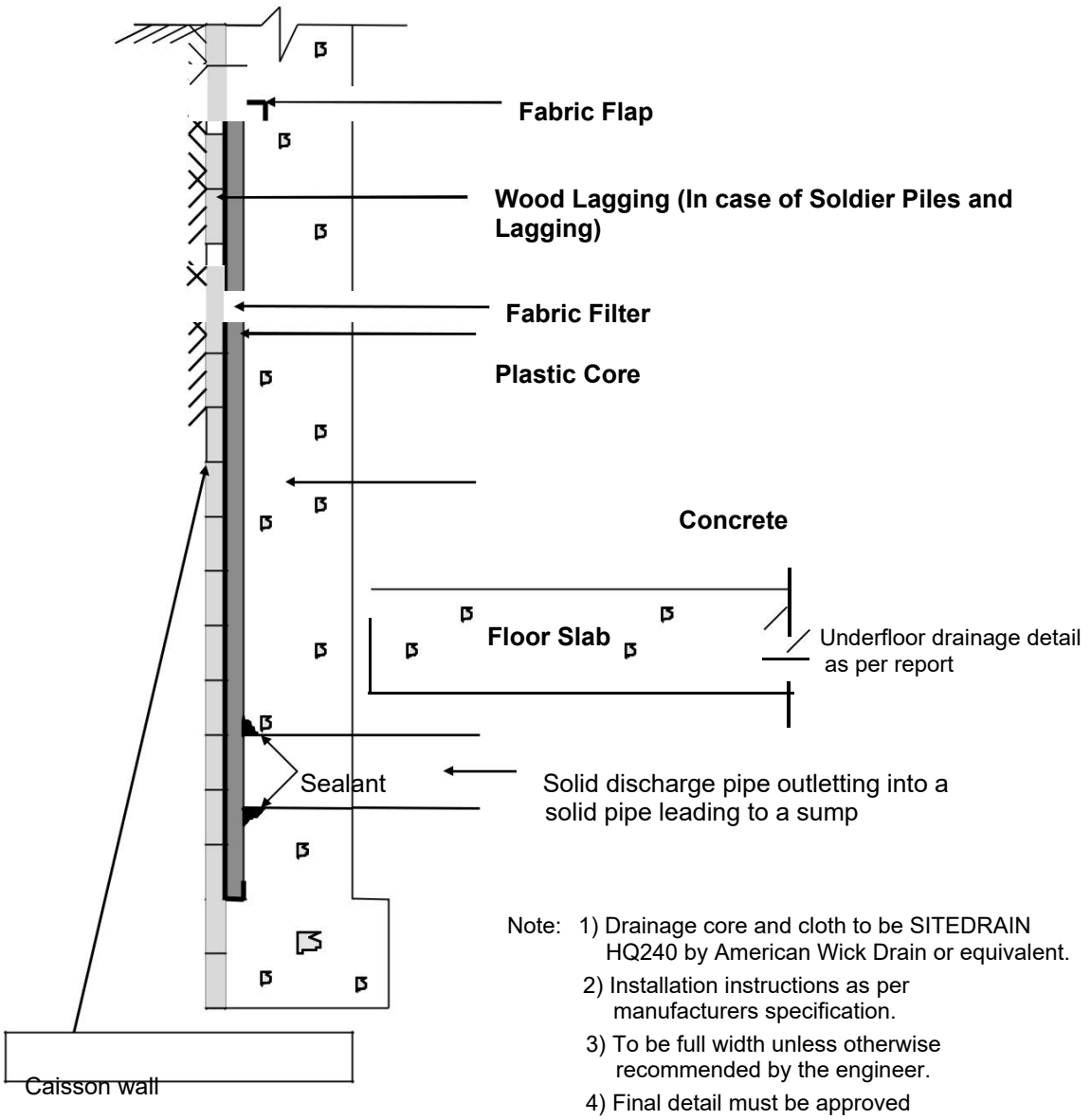
Notes

1. Drainage tile to consist of 100 mm (4”) diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be a minimum of 150 mm (6”) below underside of floor slab.
2. Pea gravel - 150 mm (6”) top and side of drain. If drain is not on footing, place 100 mm (4 inches) of pea gravel below drain. 20 mm (3/4”) clear stone is an alternative provided it is surrounded by an approved porous plastic membrane (Terrafix 270R or equivalent).
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 300 mm (12”) top and side of tile drain. This may be replaced by an approved porous plastic membrane as indicated in (2).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18”) of the wall. Use hand controlled light compaction equipment within 1.8 m (6’) of wall.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8”) of compacted clear 20 mm (3/4”) stone or equivalent free draining material.
8. Basement wall to be water-proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12”) below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25’) centres one way or a minimum of one row per column bay. Place drain on 100 m (4”) pea gravel with 150 mm (6”) of pea gravel on top and sides. Provide filter material as noted in (3) if moisture barrier is not clear crushed stone.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20 mm (3/4”) stone requires surface blinding, use 6 mm (1/4”) clear stone chips.

DRAINAGE AND BACKFILL RECOMMENDATIONS

(not to scale)

Project: BIGC-ENV-185C **Drawing No. 2**



Note: 1) Drainage core and cloth to be SITEDRAIN HQ240 by American Wick Drain or equivalent.

2) Installation instructions as per manufacturers specification.

3) To be full width unless otherwise recommended by the engineer.

4) Final detail must be approved before system is considered acceptable.

5) SITEDRAIN HQ240 should be kept a minimum of 1.2 m below exterior finished grade.

SUGGESTED EXTERIOR DRAINAGE AGAINST SHORING SYSTEM