PRELIMINARY GEOTECHNICAL INVESTIGATION - DRAFT

27 Grosvenor Street and 26 Grenville Street, Toronto, ON

Client

Greenwin Holdings Inc.
19 Lesmill Road
Toronto, Ontario
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Project Number

BIGC-ENV-222A

Prepared By:

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Date Submitted

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Table of Contents

Page

1 Introduction 1
2 Terms of Reference 1
3 Site Description 1
4 Field and Laboratory Work 1
5 Subsurface Conditions 2
5.1 Pavement Structure/Slab-on-grade 2
5.2 Fill 2
5.3 Silty Sand 2
5.4 Sandy Silt/Sand and Silt (Glacial) Till 3
5.5 Groundwater Conditions 3
6 Foundation Recommendations 3
6.1 Foundations - General 4
7 Floor Slabs and Permanent Drainage 5
8 Frost Protection 5
9 Earth Pressures 5
10 Excavations and Groundwater Control 5
11 Shoring Considerations 6
12 Earthquake Considerations 7
13 Underground Services 7
14 General Comments 7

Apppendx A: Borehole Location Plan
Appendix B: Borehole Logs
Appendix C: Grain Size Distribution Curves
Appendix D: Drainage and Backfill Recommendations

1 Introduction

Ms. Patricia Castro of Greenwin Holdings Inc. (the "Client"), has retained B.I.G. Consulting Inc. (BIG) to provide professional consulting services including Geotechnical and Hydrogeological investigations, and Phase One and Two Environmental Site Assessments (ESA) to support the proposed development at a site located at 27 Grosvenor Street and 26 Grenville Street, Toronto, Ontario (hereinafter referred to as the "Site").

The site will be developed to house a purpose-built rental housing mixed use building composed of approximately 700 units with retail at grade and 2 to 4 levels of underground garage. Further detailed investigations and analysis may become necessary if the data obtained in this investigation will require an update once detailed designs are finalized.

The purpose of this investigation was to obtain information on the soil and groundwater conditions by drilling five (5) selected exploratory boreholes and from the findings in these boreholes, to provide an engineering report commensurate with the details of the proposed development available at this time.

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 Description

The site is located between Grosvenor and Grenville Streets and between St. Vincent Lane and St. Luke Lane in Toronto, Ontario and most of the site footprint is occupied by concrete buildings/parking garage and a brick apartment building at the southeast quadrant of the site.

The soil overburden is primarily composed of Lake Iroquois shallow water deposits: sand and silty sand and Older lakes; deeper water deposit; silt, clay Thorncliffe Formation (Preliminary Map P2204, Quaternary Geology, Toronto and Surrounding Area). Bedrock in the area is shale, interbedded siltstone, and minor limestone, (Georgian Bay Formation).

4 Field and Laboratory Work

The field work was carried out between August 15 and 20, 2018 and December 10 and 11, 2018. It consisted of the advancing of five (5) boreholes (BH/MW1 to BH/MW4 and BH5) to a depth ranging from 2.6 to 21.9 m below ground surface (bgs), i.e. Elevation 83.1 to 95.3 m ASL. BH5 contacted refusal at 2.6 m due to possible buried obstruction. The boreholes were advanced using truck mounted hollow stem

continuous flight auger equipment, operating 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) Procedure. 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 and gradation).

Water level observations were made in the boreholes during and on completion of drilling.

The ground surface geodetic elevations at the borehole locations were surveyed by BIG personnel and referenced to City of Toronto Benchmark "Station 12219740769" aka CT769 with a published geodetic elevation of 105.524 m ASL.

5 Subsurface Conditions

The borehole locations are shown on the site plan in Appendix A. Subsurface data for this investigation are presented on the borehole log sheets in Appendix B.

The soil boundaries indicated on the borehole logs 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 encountered at the borehole locations are summarized as follows:

5.1 Pavement Structure/Slab-on-grade

BH/MW3 was drilled from the at-grade pavement. All remaining boreholes were drilled from the existing lowest underground parking garage floor level. BH/MW1 and BH/MW2 contacted a composite pavement structure consisting of 25 and 80 mm of asphaltic concrete overlying 280 and 130 mm of concrete which was in turn underlain by 200 and 280 mm of granular fill at the respective boreholes.

At BH/MW2, BH/MW4 and BH5, drilled from the basement slab-on-grade, 300 to 360 mm of concrete overlying 50 to 130 mm of granular fill was contacted at the surface of the boreholes.

5.2 Fill

Beneath the pavement structure in BH/MW3, a layer of fill was encountered and extended to a depth of 1.7 m below ground surface (bgs). The fill generally consisted of silty sand with brick and slag inclusions below 0.8 m depth.

Standard Penetration Test 'N' values in the fill were in the order of 2 blows/0.3 m indicating it to be very loose. Water content in the fill was in the order of 7 percent.

5.3 Silty Sand

Below the granular fill or fill in BH/MW1, BH/MW2, BH/MW4 and BH5 a deposit of silty sand was contacted and extended to a depth ranging from 2.6 to 4.6 m bgs, and the maximum depth explored in BH5. At BH/MW3, a silty sand deposit intersects the till between 9.1 and 12.2 m depth. Gravel inclusions were present in the deposit and the deposit was brown and became grey with increasing depth.

Standard Penetration Test 'N' value in the silty sand stratum ranged from 54 blows/0.3 m to in excess of 100 blows/0.3 m, indicating it to be in a very dense state. Water content ranged from 4 to 17 percent indication moist to very moist condition.

Typical Grain Size Distribution Curves for the silty sand are provided in Appendix C.

5.4 Sandy Silt/Sand and Silt (Glacial) Till

The predominant subsurface deposit encountered in the investigated depths was sandy silt/sand and silt (glacial) till which encountered to the maximum depth explored in BH/MW1 to BH/MW4, i.e. a depth ranging from 8.2 to 21.9 m bgs. The till was intersected by a silty sand deposit between 9.1 and 12.2 m depth in BH/MW3. Gravel was widely dispersed throughout the deposit, and sand, silt and clay inclusions were prevalent. The deposit was generally moist to wet.

Standard Penetration Test 'N' value in the till ranged from 4 blows/0.3 m to in excess of 100 blows/0.3 m indicating it to be loose to very dense. However, the till was typically very dense. Water content ranged from 9 to 22 percent.

Typical Grain Size Distribution Curves for the till are provided 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 4.11 to 15.53 m below ground surface or at about elevation 89.5 to 93.0 m ASL, on January 11, 2018. 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 house a purpose-built rental housing mixed use building composed of approximately 700 units with retail at grade and 2 to 4 levels of underground garage. Further detailed investigations and analysis may become necessary if the data obtained in this investigation will require an update once detailed designs are finalized. Based on the preliminary design drawings (Drawing Nos.: A-201 to A-205 – Building Sections and A-301 to A-304 – Building Elevations by Sweeny&Co Architects) the following is understood. Parking Level P2 will be at a depth of 7.550 m below ground surface; P3 at a depth of 10.550 m below ground surface and P4 at a depth of 13.550 m below ground surface.

The boreholes indicate that within the range of the lowest basement slab-on-grade floor depths/elevations, very dense silty sand and/or sand and silt/sandy silt (glacial) till soils are available to support the proposed building. Therefore, subject to adequate and effective dewatering being in place, where required, i.e. for three to four levels of underground parking, spread footings are feasible on the silty sand, and sand and silt/sandy silt (glacial) till.

The design Ultimate Limit States (ULS) and Serviceability Limit States (SLS) geotechnical resistance values for spread footings will depend on footing size and shape, allowable total and differential settlements and groundwater control conditions. For preliminary design purposes, subject to confirmation during detailed design stages, a geotechnical resistance values of 500 kPa SLS/750 kPa ULS may be adopted. Table 6-1 provides the bearing values and the corresponding founding elevations at the borehole locations.

Table 6-1: Bearing Resistance Values at Borehole Locations

Borehole	Bearing Soil	Bearing Value (kPa)	Approximate Depth (m)	Approximate Elevation (m)
BH/MW1	Silty Sand to Sand and Silt Till	500 SLS/750 ULS	below 0.9*	Below 96.2
BH/MW2	Silty Sand to Sand and Silt Till	500 SLS/750 ULS	below 0.9*	Below 96.2
BH/MW3	Sand and Silt Till to Silty Sand	500 SLS/750 ULS	below 7.6	Below 97.4
BH/MW4	Silty Sand to Sandy and Silt Till	500 SLS/750 ULS	below 0.9*	Below 97.1
**BH/MW5	Silty Sand	500 SLS/750 ULS	below 0.9*	Below 97.0

*Depth is relative to finished floor level at basement slab-on-grade.

**Deeper sampled borehole should be carried out a detail design stage to confirm the adequacy of the subsoils below the borehole refusal depth.

For three to four levels of underground garage, positive dewatering of the site to at least 1.0 m below the lowest foundation elevation will be necessary prior to excavation for the duration of the below grade construction in order to maintain the in-situ integrity of the native soils. If the subsurface is not dewatered prior to excavation, the native soils will become disturbed and bearing resistance values given will not be reliable. Additionally, if adequate dewatering is not in place, there is a potential for basal upheave for footings and slab-on-grade. However, general site dewatering may affect adjacent/adjoining buildings and infrastructure and as such, the dewatering contractor must provide a system/methodology which will minimize soil loss and potential resultant intolerable settlements. BIG should be retained to perform pre-construction surveys and reviews (with photographs, etc.) and arrange for monitoring of adjacent buildings and utilities/infrastructure with instrumentation appropriate for the intended purpose.

6.1 Foundations - General

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 two to four levels of underground garage extending to a depth of 7.55 to 13.55 m± below existing ground surface, conventional slab on grade construction can be supported on the natural undisturbed soils, provided adequate dewatering is in place, where required.

A moisture barrier consisting of at least 200 mm of clear crushed stone should be installed under slabs on grade. A conceptual underfloor drainage is attached (Drawing 1 in Appendix D). It should be noted that upon completion of the detailed design of the below grade structure, the underfloor drainage system design shall be reviewed and finalized.

A perimeter drainage system is required for the shoring wall and a conceptual design is shown on Drawing 2 in Appendix D. Details of the shoring considerations are discussed in Section 11 of this report. Please note that the hydrogeological investigation provides information on the anticipated groundwater discharge volumes.

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, retaining 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 Excavations and Groundwater Control

The fill, silty sand and till can be excavated using heavy hydraulic excavators.

It should be noted that the till is a non-sorted sediment and may contain boulders. Provisions must be made in the excavation contract for the removal of possible boulders.

All temporary excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, any fill or loose to compact native soils material is

classified as Type 3 soil and soils below the groundwater table are classified as Type 4. 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.

Groundwater monitoring indicated that the groundwater was generally present between elevation: 89.5 and 93.0 m ASL. Therefore, positive dewatering should be carried out prior to excavating below this elevation. Dewatering requirements can be minimized by using a suitable shoring method, e.g. caisson wall extending into the lower tills. It should be noted that dewatering volumes exceeding 50,000 L/day will require a Permit to Take Water (PTTW). Detailed discussions on groundwater and construction dewatering, and permit requirements are provided in the Hydrogeological Investigation report.

Dewatering requirements will be governed by the time of year the construction is performed. It is the responsibility of the contractor to propose a suitable dewatering system based on the time of construction and the groundwater levels. The method used should not undermine adjacent structures.

Seasonal variations in the water table should be anticipated, with higher levels occurring during wet weather conditions (spring thaw and late fall) and lower levels occurring during dry weather conditions.

11 Shoring Considerations

Earth retention will be required for the proposed 7.55 to 13.55± m deep excavation. If present, adjacent building structures or sensitive infrastructure will require for consideration to 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.

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 soil parameters that are considered to be applicable for this project are as follows:

- Active earth pressure coefficient
- earth pressure coefficient - K = 0.45 where movements must be minimized
- earth pressure coefficient – K = 0.25 where minor movements can be tolerated
- Approximate unit weight of the soil - a value of 21.0 kN/m^3 may be assumed

The soldier piles should be installed in pre-augered holes taken below the deepest excavation. The holes should be filled with concrete below the excavation level and half bag mix above the base of the excavation. The concrete strength must be specified by the shoring designer. Temporary liners will be required to help prevent the fill or loose sand from caving during the installation period. Positive measures will be required to prevent the loss of soil through the spaces between the lagging boards. This could probably be achieved by placing well graded sand and gravel behind the lagging boards or by installing a geotextile filter cloth.

A soil to concrete bond resistance of 48 kPa can be used in the very dense silty sand and sand and silt/sandy silt till for the design of the soil anchors. This value must be confirmed by load testing. The design capacity of soil anchors depends on the method of installation; hence the contractor must decide on a capacity and confirm its availability. The anchor holes should be adequately cased during the drilling and installation process.

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, where applicable.

12 Earthquake Considerations

The proposed structure must be designed to resist a minimum earthquake force. Based on the characteristics of the subsoils at this site, the subject property would be classified as Site Class C for foundations bearing on the native silty sand and sand and silt/sandy silt till per The Ontario Building Code Act (2012) Section 4.1.8.4.

13 Underground Services

Proposed underground services can be supported on undisturbed native soils, provided adequate dewatering is in place if and where required. All trench excavations must be carried out in accordance with the Occupational Health and Safety Act. If open cut excavations are not carried out, the sides of the excavations should be adequately shored.

Class 'B' type bedding is recommended. The bedding should conform to local municipal standards or consist of a minimum thickness of 150 mm OPSS Granular A material compacted to 98 percent Standard Proctor Maximum Dry Density (SPMDD). The dimensions of the bedding material should conform to the Municipality's current standards. The bedding and granular cover should extend to about 0.3 m above the obvert of the pipe. Since the performance of the pipe depends upon the degree of compaction, the specified compaction both below and adjacent to the pipe must be stringently carried out.

The native materials can be used as backfill provided that free-draining characteristics are not required, and compaction machinery appropriate to the soil type is used. Some moisture conditioning will be required before reuse of the native soils as backfill. Where free-draining characteristics are required, materials conforming to OPSS Granular 'B' is recommended. In confined areas, such as adjacent to manholes and catch-basins, sand backfill should be used. The materials should be placed in shallow lifts not exceeding 200 mm and compacted to 95 percent SPMDD. The compaction in the upper 0.75 m should be increased to 98 percent.

14 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.

DRAFT

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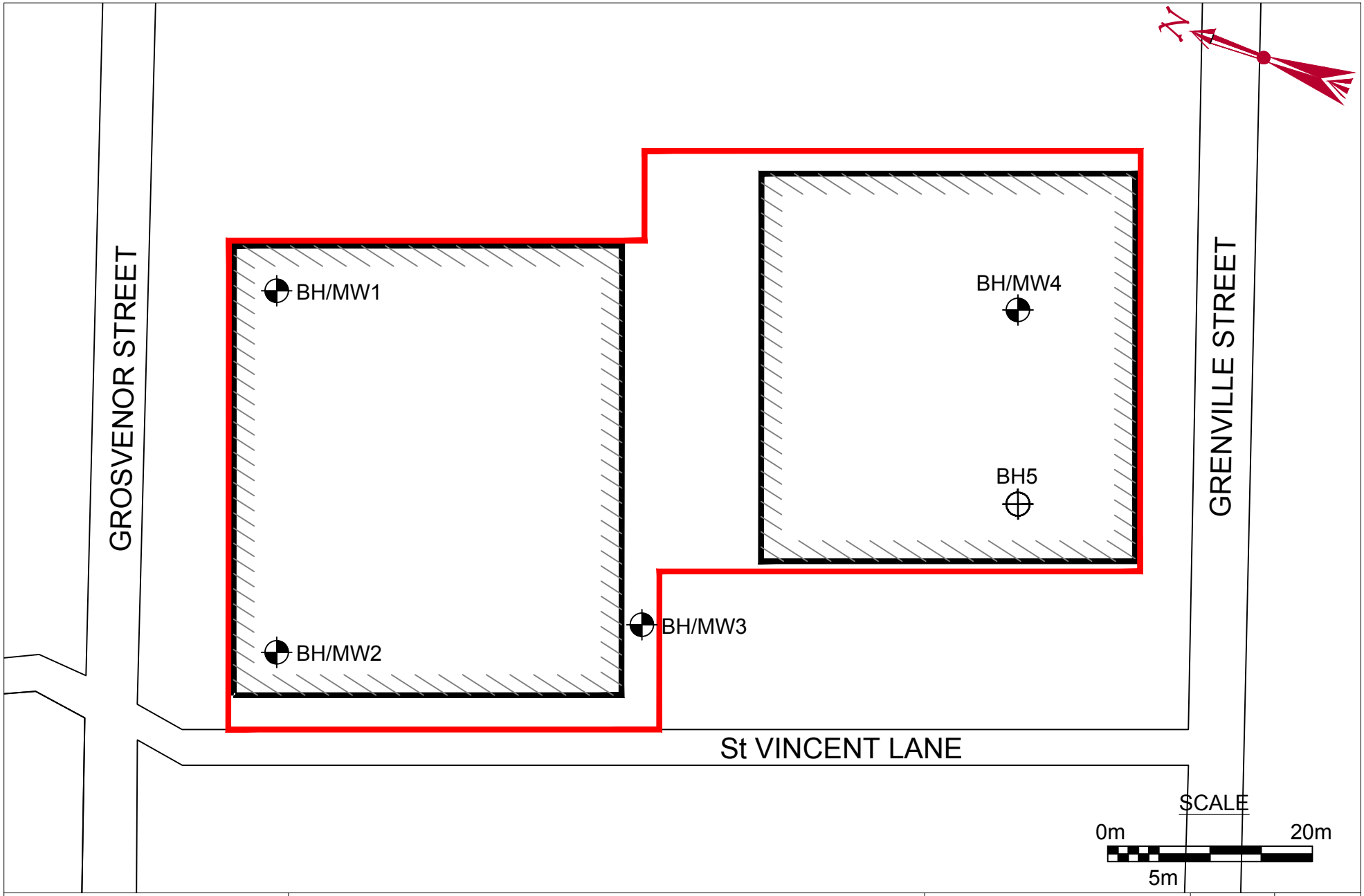
Appendix A – Borehole Location Plan



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LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE BUILDING FOOTPRINT
- APPROXIMATE LOCATION OF BOREHOLE/MONITORING WELL
- APPROXIMATE LOCATION OF BOREHOLE

TITLE AND LOCATION

BOREHOLE/MONITORING WELL LOCATION PLAN
PRELIMINARY HYDROGEOLOGICAL INVESTIGATION
27 GROSVENOR STREET AND 26 GRENVILLE STREET, TORONTO, ONTARIO

PROJECT NO.	DWN.
BIGC-ENV-222A	O.A.
SCALE	CK.
AS NOTED	E.L.
DATE	FIG NO.
JANUARY 2019	6

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		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

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

UNIFIED SOIL CLASSIFICATION

2. Fill: 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. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

4. 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

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RECORD OF BOREHOLE No BH/MW1

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-222A | LOCATION 27 Grosvenor Street, Toronto, ON. | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continous flight hollow stem auger | COMPILED BY D.N.

PROJ. NAME Geotechnical Investigation | DATE 2018.08.15 - 2018.08.15 | CHECKED BY

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
97.10											
0.0	**ASPHALT:** 25 mm		1	SS	0						
90.8	**CONCRETE:** 280 mm										
90.6	**GRANULAR:** 200 mm		2	SS	55						6 72 (22)
	SILTY SAND: trace gravel, brown, moist, very dense		3	SS	100						
			4	SS	100						
	- sand and silt at 3 m		5	SS	100						2 54 (44)
92.5											
4.6	**SAND AND SILT TILL:** trace gravel, grey, wet, very dense		6	SS	100						
			7	SS	100						
			8	SS	100						
88.9											
8.2	**Borehole terminated at 8.2 m**										

Notes:
1. Water at 6.4 m upon completion of drilling
2. Open to 6.7 m upon completion of drilling
3. Water level at 4.31 m (Elev. 92.8 m ASL) on Dec. 13, 2018
4. Water level at 4.41 m (Elev. 92.7 m ASL) on Jan. 11, 2019

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

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RECORD OF BOREHOLE No BH/MW2

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-222A | LOCATION 27 Grosvenor Street, Toronto, ON. | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight hollow stem auger | COMPILED BY D.N.

PROJ. NAME Geotechnical Investigation | DATE 2018.08.16 - 2018.08.16 | CHECKED BY

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
97.12											
0.0	**CONCRETE:** 360 mm		1	SS	0						
0.4	**GRANULAR:** 130 mm										
0.5	**SILTY SAND:** trace gravel, brown, oxidized pockets, moist, dense		2	SS	69						
	- clayey silt pockets, grey, very dense below 1.5 m		3	SS	100						
94.5			4	SS	100						
2.6	**SAND AND SILT TILL:** fine sand pockets, brown-grey, moist, very dense		5	SS	100						
	- grey below 3.1 m		6	SS	100						
	- wet, rocks throughout below 6.1 m		7	SS	100						
			8	SS	100						
87.3			9	SS	100						7
9.8	**Borehole terminated at 9.8 m**										

Notes:
1. Water at 5.2 m upon completion of drilling
2. Open to 6.1 m upon completion of drilling
3. Water level at 3.92 m (Elev. 93.2 m ASL) on Dec. 13, 2018
4. Water level at 4.11 m (Elev. 93.0 m ASL) on Jan. 11, 2019

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

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RECORD OF BOREHOLE No BH/MW3

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-222A | LOCATION 27 Grosvenor Street, Toronto, ON. | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight hollow stem auger | COMPILED BY D.N.

PROJ. NAME Geotechnical Investigation | DATE 2018.08.20 - 2018.08.20 | CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
105.04				
105.0 / 0.0	**ASPHALT:** 80 mm	1	SS	5
104.8 / 0.2	**CONCRETE:** 130 mm			
104.6 / 0.4	**GRANULAR:** 280 mm	2	SS	2
103.3 / 1.7	**FILL:** silty sand, brown, moist, loose - brick, slag inclusions, very loose at 0.8 m	3	SS	4
	SANDY SILT TILL brown, moist, compact - oxidized fissures at 2.3 m	4	SS	20
	- silt pockets from 3.1 m to 3.4 m - light brown, stiff below 3.1 m	5	SS	10
	- grey silt pockets at 4.6 m - fine grey sand seam, moist to wet at 4.9 m	6	SS	16
98.9 / 6.1	**SAND AND SILT TILL:** fine - medium and coarse sand pockets, grey, moist, dense - very moist at 6.6 m	7	SS	36
	- very dense below 7.6 m	8	SS	100
95.9 / 9.1	**SILTY SAND:** trace gravel, grey, moist to very moist, very dense	9	SS	72
	- very moist at 10.7 m	10	SS	100
92.8 / 12.2	**SANDY SILT TILL:** with silt pockets, grey, moist to very moist, very dense	11	SS	72
	- interbedded sand and silt layers and pockets at 13.7 m	12	SS	85
	- saturated below 15.2 m	13	SS	77
	- dense at 16.9 m	14	SS	43
	- wet at 18.3 m	15	SS	100
	- coarse sand inclusions below 19.8 m	16	SS	86
83.1 / 21.9	- silt interbeds below 21.3 m	17	SS	100
	Borehole terminated at 21.9 m			

Notes:
1. Water at 14.6 m upon completion of drilling
2. Open to 15.2 m upon completion of drilling
3. Water level at 15.41 m (Elev. 89.6 m ASL) on Dec. 13, 2018
4. Water level at 15.53 m (Elev. 89.5 m ASL) on Jan. 11, 2019

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/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

NUMBER	GR	SA	SI	CL
8				7
13				9

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

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

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RECORD OF BOREHOLE No BH/MW4

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-222A | LOCATION 26 Grenville Street, Toronto, ON. | ORIGINATED BY F.C.

DATUM Geodetic | BOREHOLE TYPE Continuous flight hollow stem auger | COMPILED BY D.N.

PROJ. NAME Geotechnical Investigation | DATE 2018.12.10 - 2018.12.10 | 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
97.96											
97.7	**CONCRETE:** 300 mm		1	SS	67				○		
97.6	**GRANULAR:** 50 mm										
0.4	**SILTY SAND:** trace gravel, brown, moist, very dense		2	SS	100				○		2 75 (23)
	- grey at 1.5 m		3	SS	100				○		
	- silt pockets at 2.3 m		4	SS	100				○		
95.0											
3.0	**SAND AND SILT TILL:** grey, moist to very moist, very dense		5	SS	100				○		1 58 (41)
			6	SS	100	▽			○		
			7	SS	100				○		
	- wet below 7.6 m		8	SS	100				○		5 46 (50)
	- some clay, very moist at 9.1 m		9	SS	100				○		
88.2											
9.8	**Borehole terminated at 9.8 m**										

Notes:
1. Water at 5.2 m upon completion of drilling
2. Open to 6.6 m upon completion of drilling
3. Water level at 4.84 m (Elev. 93.1 m ASL) on Dec. 13, 2018
4. Water level at 4.97 m (Elev. 93.0 m ASL) on Jan. 11, 2019

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

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RECORD OF BOREHOLE No BH5

1 OF 1 **METRIC**

PROJ. NO. BIGC-ENV-222A | LOCATION 26 Grenville Street, Toronto, ON. | ORIGINATED BY F.C.

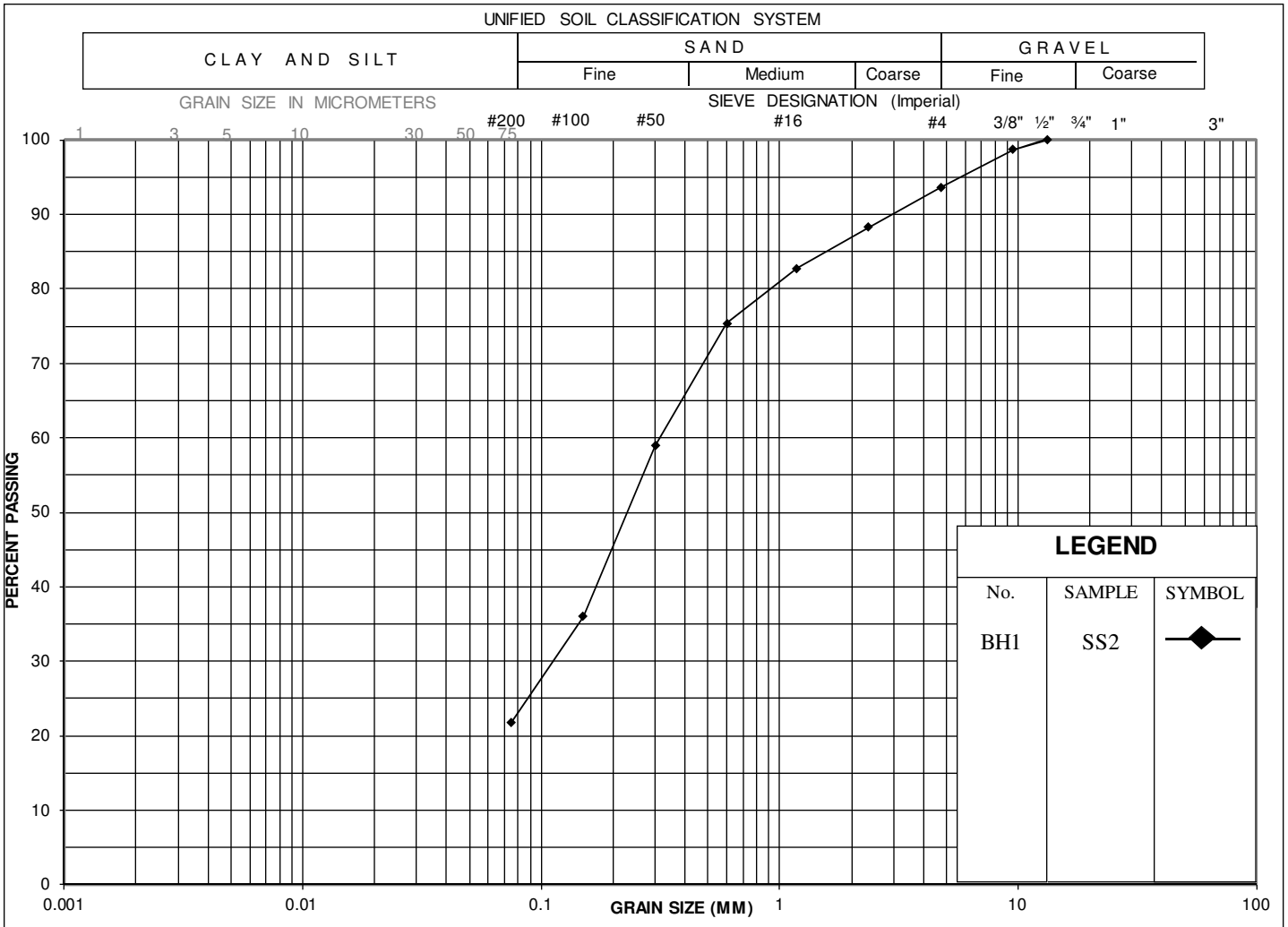
DATUM Geodetic | BOREHOLE TYPE Continuous flight hollow stem auger | COMPILED BY D.N.

PROJ. NAME Geotechnical Investigation | DATE 2018.12.11 - 2018.12.11 | 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 (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	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
97.93											
97.8	**CONCRETE:** 300 mm		1	SS	54				○		
97.6	**GRANULAR:** 50 mm										
0.4	**SILTY SAND:** brown, moist, very dense		2	SS	100				○		
	- grey, moistbelow 1.5 m		3	SS	100				○		
95.3			4	SS	100				○		
2.6	**Borehole terminated at 2.6 m** Notes 1. Open and dry upon completion of drilling 2. Refusal at 2.6 m										

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

Appendix C – Grain Size Distribution Curves



B.I.G. CONSULTING INC.

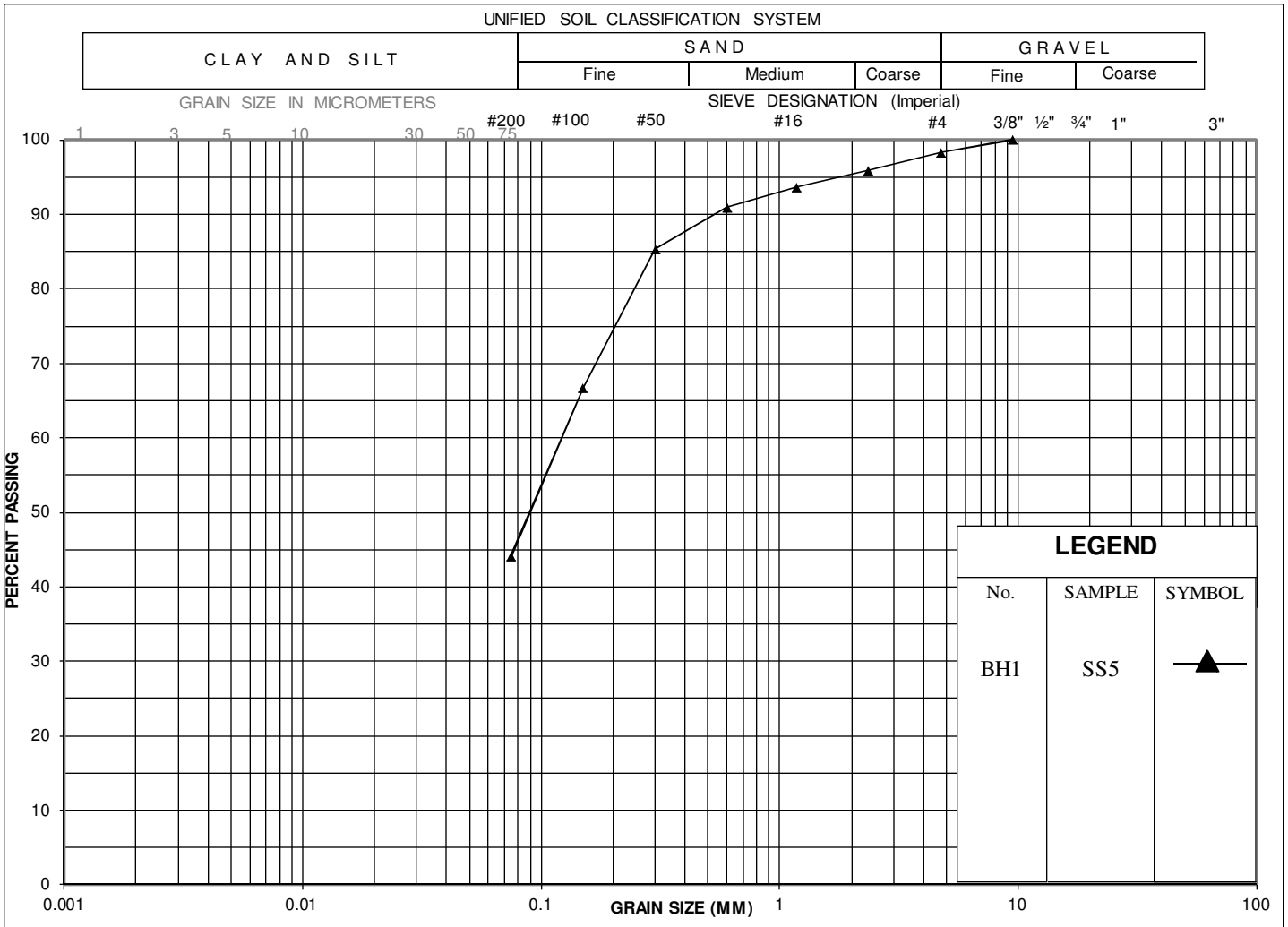
GRAIN SIZE DISTRIBUTION

Silty Sand trace gravel

FIGURE No. 1

Project No.: BIGC-ENV-222A

DATE : 10/09/2018



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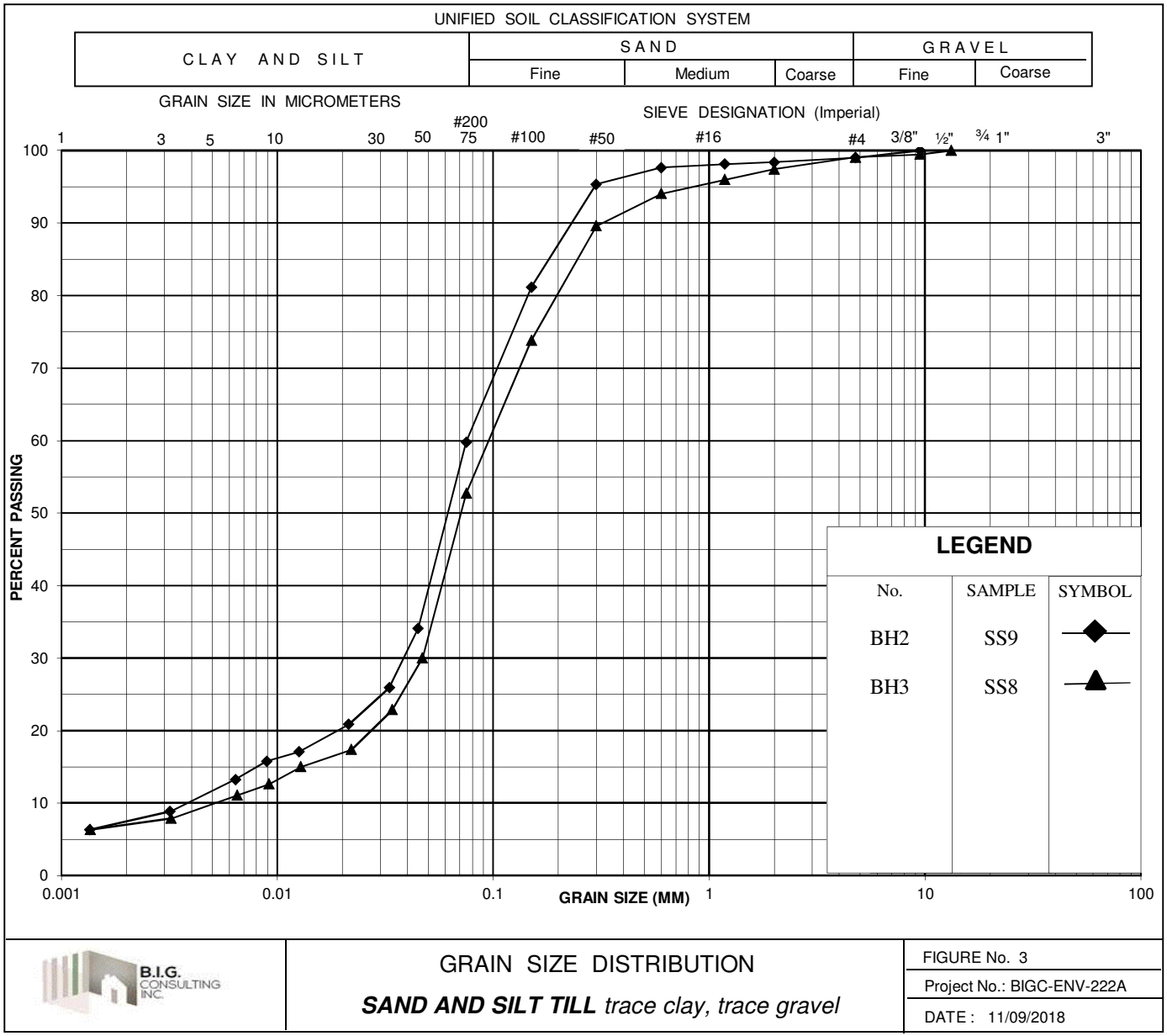
GRAIN SIZE DISTRIBUTION

Sand and Silt Till trace gravel

FIGURE No. 2

Project No.: BIGC-ENV-222A

DATE : 10/09/2018



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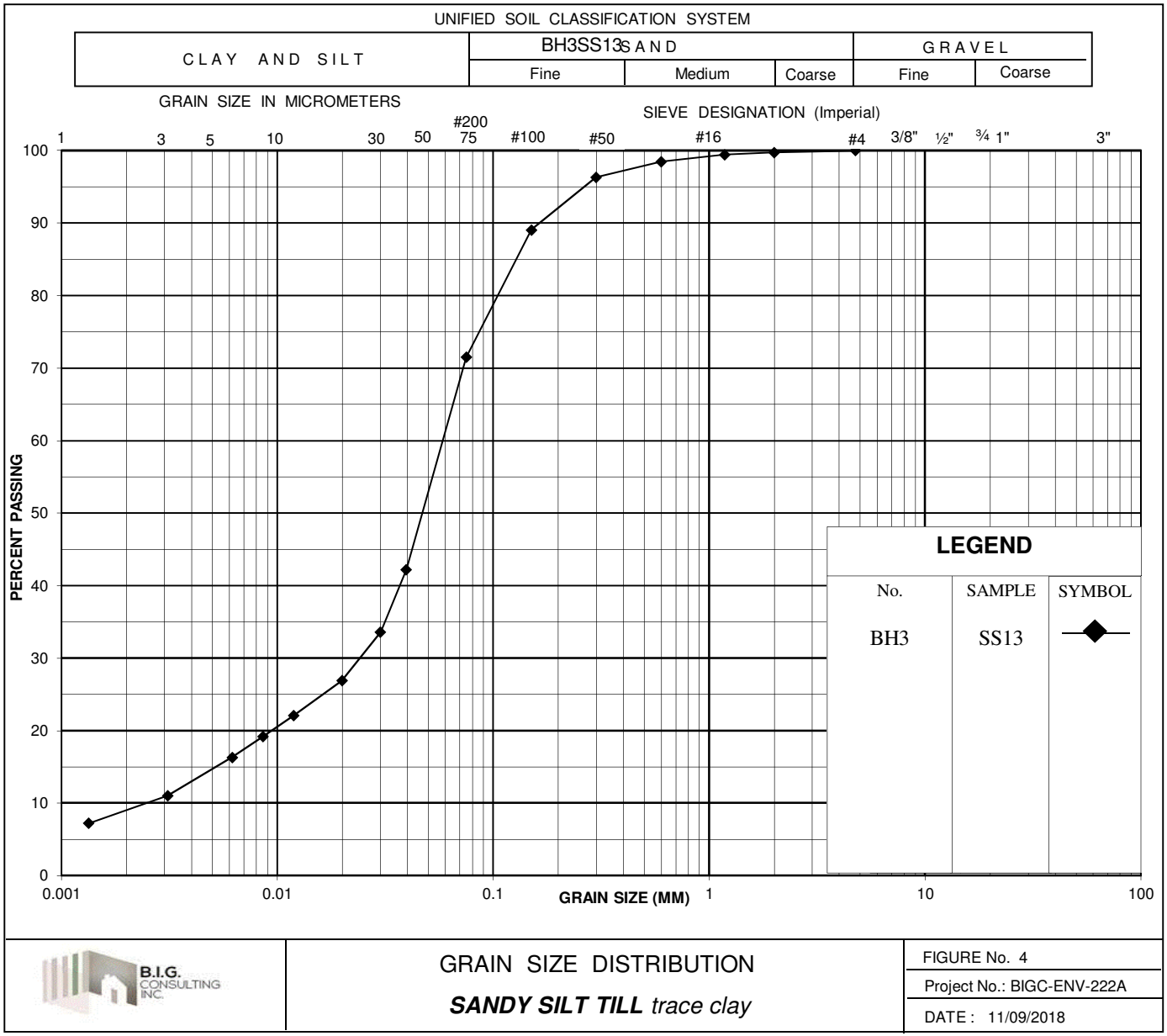
GRAIN SIZE DISTRIBUTION

SAND AND SILT TILL *trace clay, trace gravel*

FIGURE No. 3

Project No.: BIGC-ENV-222A

DATE : 11/09/2018



BH3SS13

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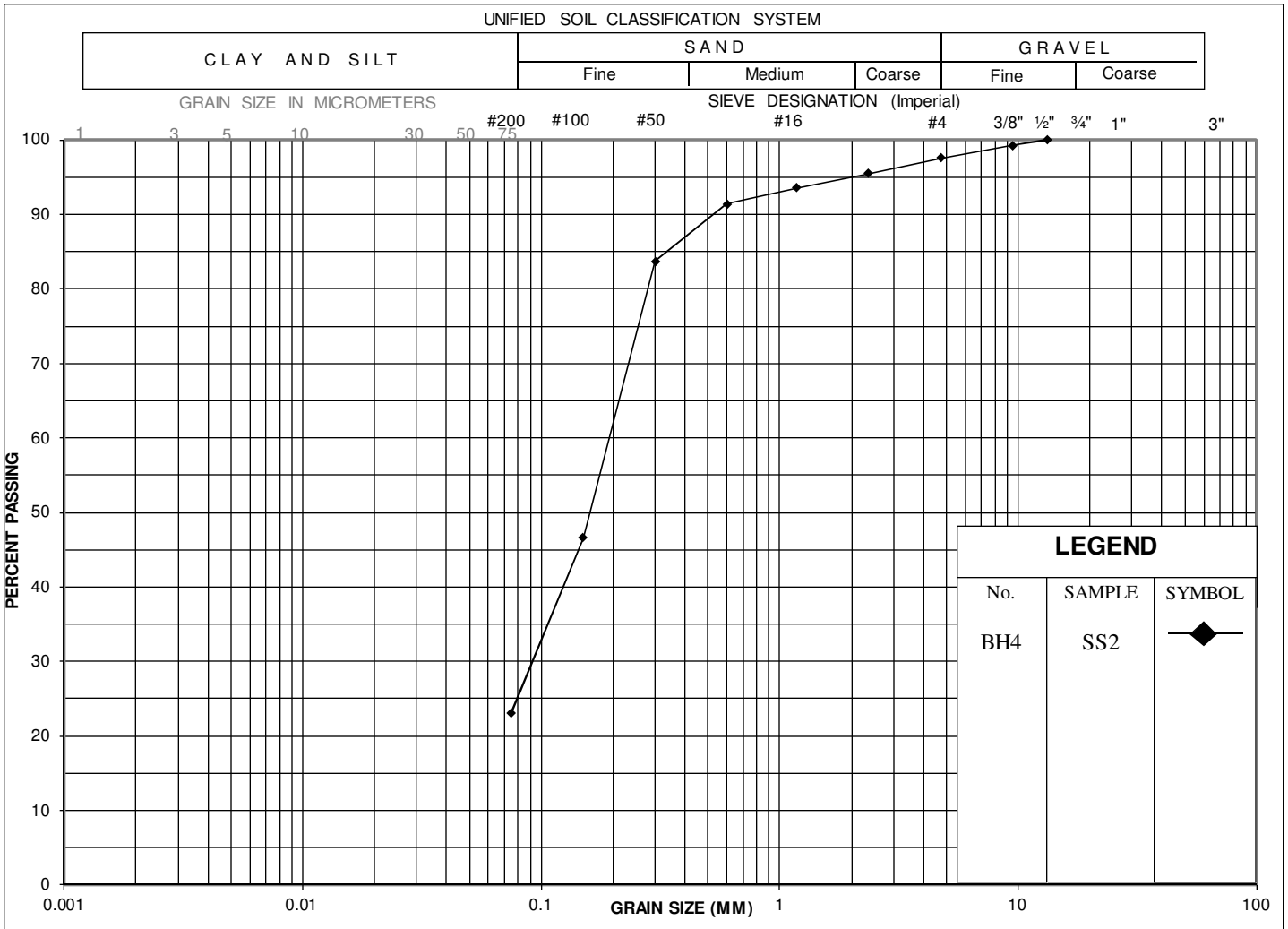
GRAIN SIZE DISTRIBUTION

SANDY SILT TILL *trace clay*

FIGURE No. 4

Project No.: BIGC-ENV-222A

DATE : 11/09/2018



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GRAIN SIZE DISTRIBUTION

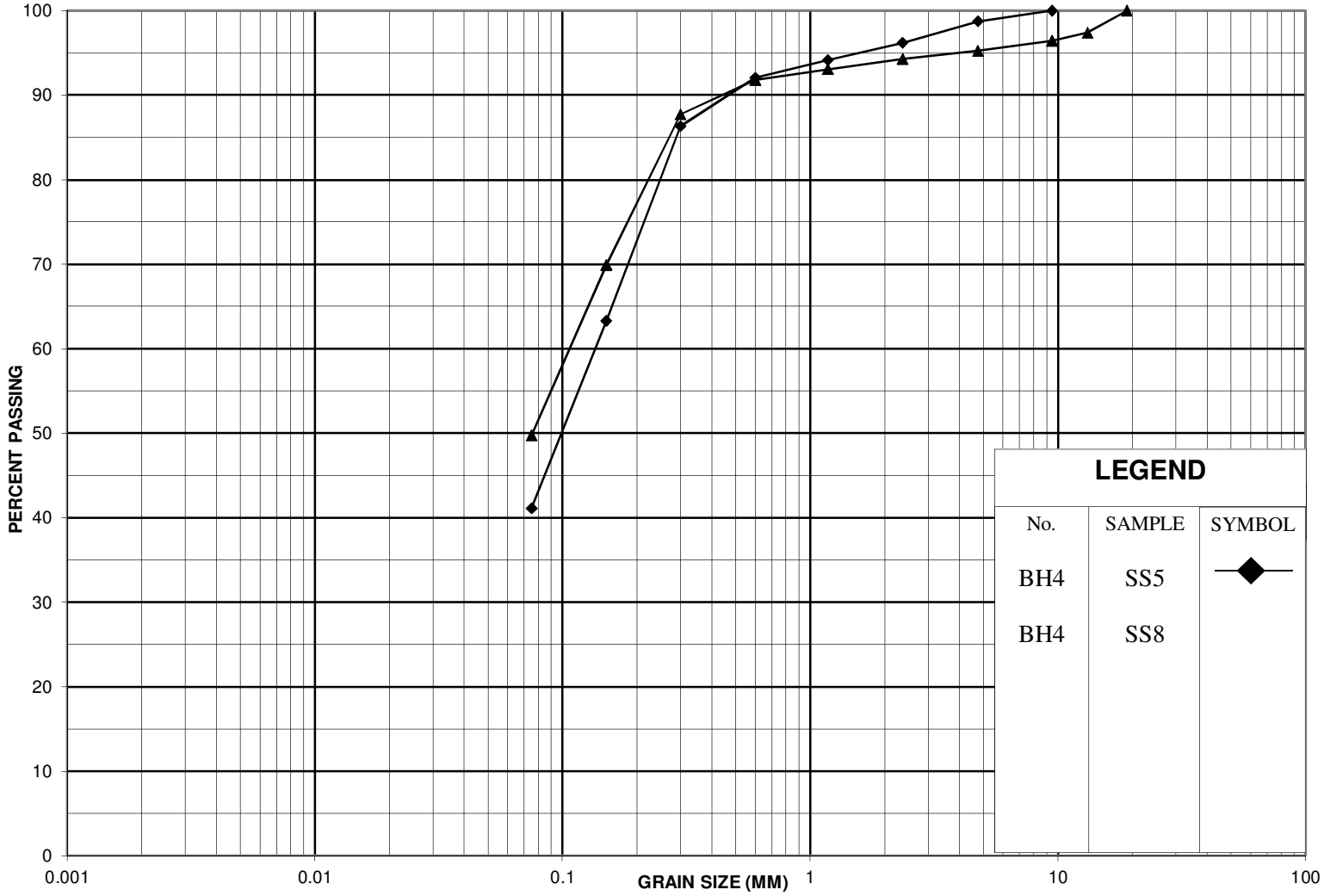
SILTY SAND trace gravel

FIGURE No. 5

Project No.: BIGC-ENV-222A

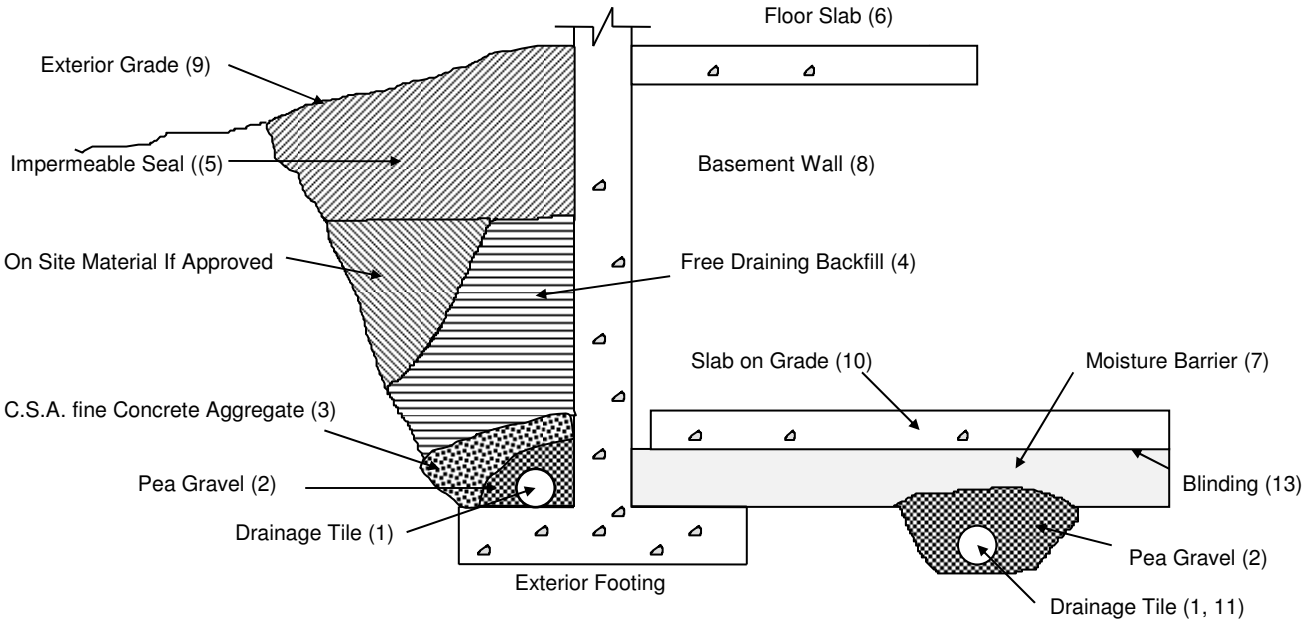
DATE : 21/12/2018

GRAIN SIZE DISTRIBUTION



Appendix D: Drainage and Backfill Recommendations

Project: BIGC-ENV-222A **Drawing No. 1**



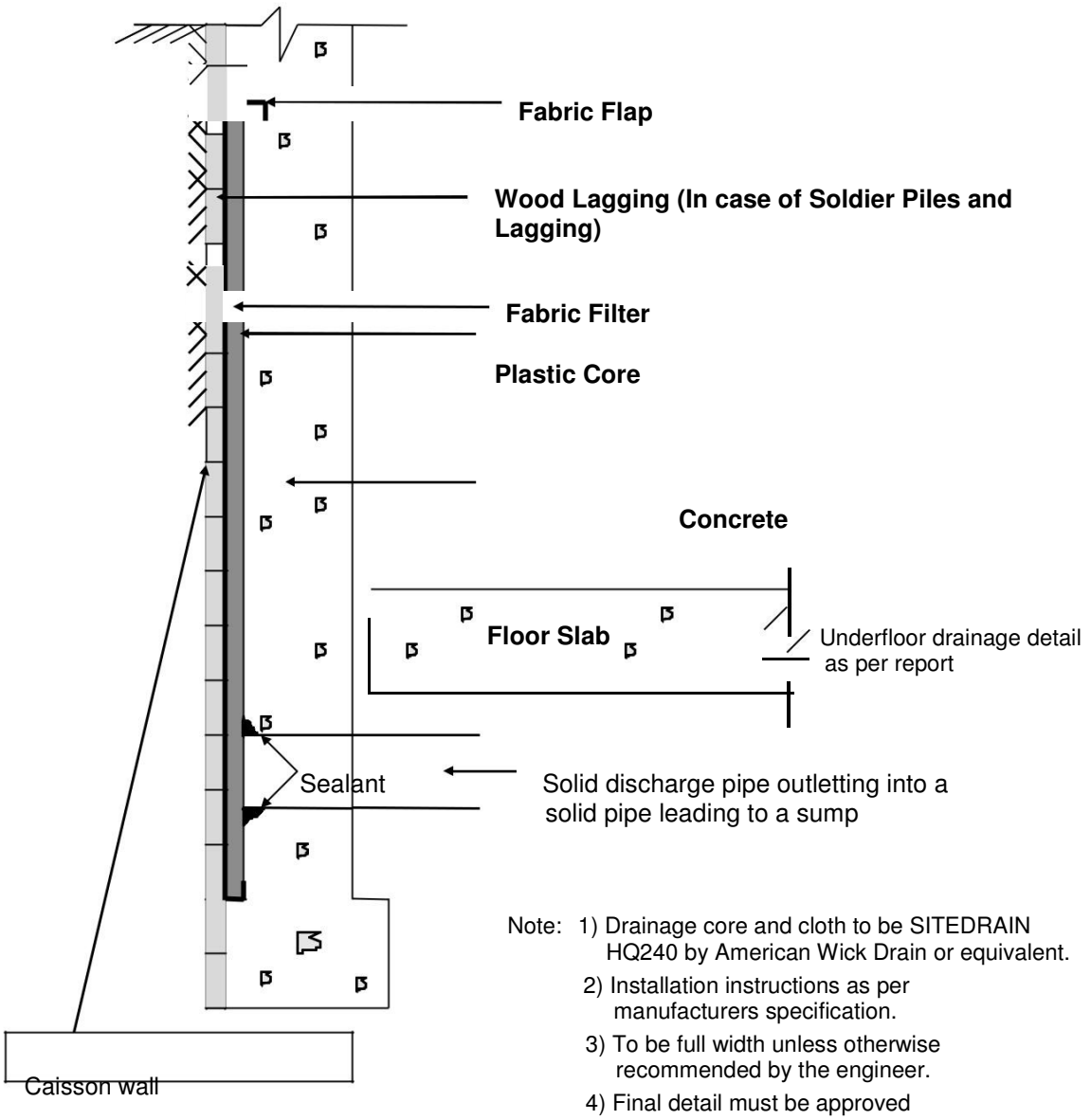
Notes

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-222A **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