UPDATED GEOTECHNICAL INVESTIGATION

26-38 Hounslow Avenue, Toronto, ON

Client

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Project Number

BIGC-GEO-154H

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1 Introduction

B.I.G. Consulting Inc. (BIG) has been retained by Hounslow Holdings Inc. (the "Client") to complete an Updated Geotechnical Investigation for the proposed re-development on the property located at 26-38 Hounslow Avenue in Toronto, Ontario (the "Site"). The Site location plan is shown on Figure 1 in Appendix A.

The original geotechnical investigation was authorized by Adrian Tarapacky on October 30, 2019. The updated geotechnical investigation was authorized by Mr. Billy Caden (on behalf of the Client) on August 2, 2023, and this recent report update was authorized on March 7, 2024.

Based on the architectural plan prepared by Studio JCI, dated March 25, 2024 (Issued for OPA/ZBA Resubmission), it is understanding that the proposed re-development at the Site will consist of a twenty-six (26) Storey residential building with two (2) levels of underground parking structure (P2).

The field work for this investigation was carried out in conjunction with Hydrogeological Investigation (HG). This report addresses the geotechnical aspects of the proposed development only and the reports for the HG will be issued under separate covers.

Two preliminary geotechnical investigations were conducted on the subject property by Shad & Associates Inc. (Shad) in 2016 and BIG in 2019, and a Geotechnical Investigation was conducted by BIG in 2021 for the proposed development of 10-Storey residential building with two (2) levels of underground parking (P2). However, the proposed design was subsequently revised to a higher residential building with two (2) levels of underground parking structures (P2). Based on the revised design, an Updated Geotechnical Investigation was required to support the changed development requirements.

In view of the current site restrictions and limitations with majority of the proposed building footprint being occupied by existing buildings, the purpose of the original geotechnical investigation by BIG was to characterize the subsoils and groundwater conditions at the Site by means of advancing two (2) additional boreholes near the perimeter of site boundary, in-situ as well as laboratory tests of selected soil samples and based on this information collected to prepare an updated geotechnical engineering report pertaining to the design and construction of the proposed re-development.

The recommendations and comments are based on factual information obtained from this investigation and are intended only to use for the design engineers. The number of boreholes, tests data and their interpretation presented in this report may not be sufficient to determine all the factors that may have effects on the design and construction of the proposed re-development. ***Design drawings (such as foundation general arrangement) of the proposed building were not available to BIG at the time of preparation of this report. Therefore, it should be noted that once the project transitions into the design stage, additional investigation and analysis are required (upon demolition of existing buildings) at the proposed building footprint to support the recommendations made in this report, and further recommendations will be made as appropriate.***

This report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. On-going liaison with BIG during the final design and construction phase of the project is recommended to ensure that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed development should be directed to BIG for further elaboration and/or clarification.

The Limitations of this Report are stated in Section 10, which is an integral part of this report. The site investigation and recommendations of this report follow generally accepted Geotechnical Engineering practice in Ontario.

The report contents are governed by the amount of data available, both acquired in this our previous and this investigation and as supplied by others at the time of preparation of this report. The laboratory testing conducted by BIG is in compliance with ASTM, CSA and similar standards, or modifications that have become accepted practice.

2 Site Description

The municipal address of the subject Site is 26 – 38 Hounslow Avenue in Toronto, Ontario. The Site is located north of Hounslow Avenue and east of Beecroft Road as shown on Figures 2A and 2B in Appendix A. The Site is currently occupied by four (4) residential buildings and measures approximately 2,200 m² in size.

3 Geological Settings

For the purpose of regional characterization of the subsoil conditions in the general areas of the Site, select geological publications and maps were reviewed. The findings are summarized for reference in the following paragraphs.

Physiographic mapping for Southwestern Ontario (*Champman, L.J and Putnam, D.F. 2077*; Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release – Data 228) identifies the subject site is located in the Physiographic Region Known as Bevelled Till Plains. The site is within the Pleistocene deposit predominantly silt to silty clay matrix, high in matrix carbonate content and clast poor.

Bedrock geology mapping for Southwestern Ontario (*Ontario Geological Survey. 1:250000 scale, Bedrock Geology of Ontario*. Ontario Geological Survey, Miscellaneous Release Data 126, Revised 2006) indicates the bedrock in the general area consists of Shale, limestone, dolostone, siltstone on Georgian Bay Formation; Blue Mountain Formation; Billings Formation; Collingwood Member, Eastview Member.

4 Previous Investigations

A preliminary geotechnical investigation was conducted by Shad & Associates Inc. (Ref. No. T16650, dated July 25, 2016) targeting for four-storey townhouses with one level of underground parking structure. Three (3) boreholes, BH1 to BH3, were drilled on the front yard driveway of the existing dwellings to the depth of approximately 10.4 m below ground surface (BGS). The subsurface conditions, in general, consisted of ground surface cover (paving stones) overlying fill, which in-turn was underlain by clayey sandy silt till/clayey silt till with occasional sand seams.

Another preliminary geotechnical investigation was conducted on the subject property by BIG in 2019 (Project No.: BIGC-ENV-154E, dated: October 22, 2019) targeting for a mid-rise residential building with two (2) levels of underground parking. This investigation consisted of drilling three (3) boreholes, BH/MW201 to BH/MW203, to the depths varying between 12.8 and 20.4 m BGS. It should be noted that, in this preliminary geotechnical investigation report, in addition to above three boreholes, BIG has used addition seven (7) boreholes BH/MW101 to BH/MW107, that were drilled during the Hydrogeological Investigation (BIG Project No.: BIGC-ENV-154E, November 13, 2019, Updated).

BIG performed a Geotechnical Investigation on the subject property dated November 6, 2020, and revised on April 16, 2021 (Project No.: BIGC-ENV-154F) consisting of 1 borehole (BH301) drilled to the depth of about 17.4 m BGS.

The subsurface conditions, in general, consisted of ground surface cover (paving stones and topsoil) overlying fill, which in-turn was underlain by clayey silt till, sandy silt till and sand deposits respectively. To obtain the stabilized groundwater level information, BIG's all ten (10) boreholes were equipped with monitoring wells.

5 Field Investigation Procedures

Prior to initiating the subsurface investigation activities, the borehole locations were marked at the Site by BIG personnel and all applicable public utility services (Gas, Bell, Rogers, Hydro, Network cables, etc.) were cleared with the assistance of Ontario-One-Call. A Private Utility Locator was also retained to locate underground private utility lines adjacent to the borehole locations to ensure that the lines will not be damaged and safety of the worker during the investigation work.

The fieldwork for this investigation was carried out on August 14 and 15, 2023 and consisted of advancing two (2) exploratory boreholes BH401 and BH/MW402 extended to the depths of 25.0 and 24.7 mBGS, respectively. The approximate borehole locations established and drilled at the Site are shown on Figure 2 in Appendix A.

Boreholes were advanced by using truck mounted, power operated hollow stem continuous flight auger, supplied, and operated by a specialist drilling contractor, working under the full-time supervision of an experienced BIG geotechnical personnel. Soil samples of the overburden were generally taken at 0.76 m or 1.5 m intervals while performing the Standard Penetration Test (SPT) in accordance with ASTM D1586. This consisted of freely dropping a 63.5 kg hammer for a vertical distance of 0.76 m to drive a 51 mm outer diameter split-barrel (split-spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the ground by a vertical distance of 0.30 m was recorded as SPT 'N' value of the soil which indicates the consistency of cohesive soils or the relative density/compactness of non-cohesive soils.

The BIG's drilling supervisor examined and logged the overburden soil samples as they were obtained from the boreholes. The recovered samples were sealed in clean, airtight plastic bags and transferred to the BIG's Mississauga laboratory for further examination and laboratory testing.

The ground surface elevations at the borehole locations were surveyed by BIG personnel with reference to the borehole BH/MW106 that was established during the Hydrogeological Investigation at the Site with a Geodetic Elevation of 184.50 mASL.

It should be noted that the ground surface elevations at the borehole locations are approximate and should not be used for design and construction purpose. Contractors performing the work should confirm the elevations prior to construction. The borehole locations plotted on Borehole Location Plan are based on the measurements of the Site features and should be considered to be approximate.

6 Subsurface Conditions

The following summary is to assist the designers of the project with an understanding of the anticipated subsurface conditions across the Site. However, it should be noted that the subsurface soil and groundwater conditions between and beyond the drilled borehole locations may differ from those encountered at the borehole locations, and conditions may become apparent during the construction, which could not be detected or anticipated at the time of the Site investigation. The boundaries between the various strata as shown on the Record of Boreholes are based on the non-continuous sampling and represent an inferred transition between the various strata and their lateral continuation, rather than a precise plane of geological change.

Based on the subsurface conditions encountered at the borehole locations, the soil profile generally consisted of glacial deposits of silty clay till followed by silty sand till to the borehole termination depths, as shown on Figure 3.

A brief description of the subsurface stratigraphy and groundwater conditions encountered at the borehole locations are summarized, in order of depth, in the following sections and more information are provided in the Record of Boreholes presented in the Appendix B.

6.1 Topsoil

Approximately 230 mm thick topsoil was encountered at borehole location. Topsoil, in general, consisted of high contents of organics and rootlets. It should be noted that topsoil thickness may vary significantly due to some on-site activities. Therefore, it is recommended that allowance be made for possible variations when making construction estimates.

6.2 Earth FILL

Below topsoil, earth FILL predominantly containing clayey silt was encountered that extended to the depth of 0.9 mBGS. The fill also consisted of trace, trace gravel, and trace gravel.

The SPT 'N' value recorded was 9 blows per 300 mm of penetration, indicating a stiff consistency. The moisture content measurement of the recovered sample was 9 % by weight, indicating a moist condition.

6.3 Clayey Silt/Silty Clay Till (CL/CL-ML)

Below fill, native glacial clayey silt/silty clay till deposit was encountered that extended to the depth of 16.5 mBGS. Till deposit also contained trace to some sand and trace gravel.

The SPT 'N' values recorded varied significantly between 10 and over blows per 300 mm of penetration, indicating stiff to hard consistencies. The moisture content measurements of the recovered samples varied between 8 and 13 % by weight, indicating a moist condition.

Due to the nature of till formation, cobbles and boulders should be anticipated within the glacial till deposit.

Geotechnical laboratory test consisting of Grain Size Distribution Analysis (Hydrometer) and Atterberg Limit tests were carried out on two (2) selected soil samples from this deposit. The laboratory test results are included on the Record of Boreholes in Appendix B and are included in detail in Appendix C, and also summarized in the tables below:

Particle Size Analysis Test Results:

Borehole No.	Sample No.	Depth (m)	% Gravel	% Sand	% Silt	% Clay
BH401	SS3	9.4	0	29	51	20
BH/MW402	SS4	11.0	1	28	52	19

Atterberg Limit Results:

Borehole No.	Sample No.	Depth (m)	LL%	PL%	PI%
BH401	SS3	9.4	20	12	8
BH/MW402	SS4	11.0	19	13	6

In accordance with the Unified Soil Classification System, the tested soil samples can be described as Clayey Silt/Silty Clay Till, sandy, trace gravel and classified as CL/CL-ML.

6.4 Cohesionless Sand/Silty Sand/Silty Sand Till (SM)

Below clayey silt/silty clay till glacial deposit, deposit of sand was encountered that extended to the borehole termination depths of about 17.4 to 25.0 mBGS.

The SPT 'N' value recorded varied between 57 and over 50 blows per 300 mm of penetration, indicating a very dense relative density. The moisture content measurement of the recovered samples varied between 7 and 24% by weight, indicating moist to very moist condition.

Geotechnical laboratory test consisting of three (3) Grain Size Distribution Analysis (Hydrometer) were carried out on a selected soil samples from this deposit. The results are presented on the Borehole Record in Appendix B and the details of laboratory test results are included in Appendix C, and also summarized in the table below:

Particle Size Analysis Test Results:

Borehole No.	Sample No.	Depth (m)	% Gravel	% Sand	% Silt	% Clay
BH401	SS9	18.5	0	67	30	3
BH/MW402	SS6	13.9	1	42	46	11
BH/MW402	SS11	21.7	0	83	14	3

In accordance with the Unified Soil Classification System, these soil samples are described as Silty Sand/ Sandy Silt, trace to some clay, trace gravel, and classified as SM.

6.5 Groundwater Observation

Groundwater observations were not made during and immediately upon completion of drilling as mud rotary drilling method was used.

To obtain the information on stabilized groundwater level, borehole BH/MW402 was equipped with monitoring well, upon completion of drilling. Groundwater observation made in open boreholes during site exploration as well as the groundwater level recorded in the installed monitoring wells (recent and previous) on August 17, 2023, are tabulated below:

Groundwater Observation:

Borehole No.	Ground Elevation (m)	Borehole Depth (mBGS)	MW Depth (mBGS)	Screen Length (m)	Groundwater Observation on August 17, 2023	
					Depth (mBGS)	Elevation (mASL)
BH/MW402	183.30	24.7	21.3	3	20.13	163.17
BH/MW201	183.31	20.42	13.1	3	Dry	-
BH/MW202	183.30	12.80	10.7	3	Dry	-
BH/MW203	183.59	12.80	12.8	3	11.87	171.72
BH/MW101	183.31	6.7	6.1	3	3.53	179.78
BH/MW102	184.60	9.8	9.1	3	4.25	180.35
BH/MW103	183.59	6.7	6.7	3	4.25	179.34
BH/MW104	183.41	8.2	6.7	3	2.61	180.80
BH/MW105	184.34	8.2	7.6	3	N/A	N/A
BH/MW106	184.50	8.2	7.6	3	N/A	N/A
BH/MW107	184.77	8.2	7.6	3	N/A	N/A

mBGS: Meter Below Ground Surface
mASL: Metre Above Sea Level
N/A: Data not available

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

7 Engineering Discussion and Recommendation

It is our understanding that the proposed re-development at the Site will consist of a twenty-six (26) storey residential building with two (2) levels of undergrounding parking structure. ***However, detailed structural/ foundation design drawings (i.e. foundation general arrangement) of the proposed development were not available at the time of preparation of this report. Therefore, it should be noted that once the detailed design drawings become available, additional investigation will likely be required to confirm/update the general recommendations made in this report, and to provide further recommendations, as appropriate.***

Based on the architectural plan prepared by Studio JCI, dated March 25, 2024, it is anticipated that the finished slab-on-grade of 2-levels of underground parking structure will be at an elevation of 175.3 mASL.

The recommendations and comments provided in this report are based on factual information obtained from this investigation and are intended only for use for the design engineers. The number of boreholes, tests data and their interpretation presented in this report may not be sufficient to determine all the factors that may have effects on the design and construction of the proposed development.

The following discussion and recommendations should be revised or supplemented where necessary, when the conditions of the proposed development are different from the noted conditions/assumptions.

7.1 Grading and Site Preparation

Proper grading and site preparation are very important for the success of any planned development. As parts of effective and efficient design and construction of the proposed development, following items highlight the fundamental geotechnical requirements to be considered during grading and site Preparation. Detailed recommendations are provided in the following sections:

a) All ground surface cover (topsoil, pavement structures, etc.) should be stripped and removed from the area of the proposed development.
b) It is our understanding that all existing buildings will be demolished, and the floor slabs, walls, foundations, etc. of the demolished buildings will be sub-excavated and removed completely from the area of the proposed development. Further, any existing infrastructures (e.g., manholes, catch basins, buried structures, etc.) should be sub-excavated and removed from the area of the proposed development, if they are located in the zone of influence of foundations of the proposed development. The zone of influence of the foundation is defined as an area laterally extending 1 m beyond the bottom edge of the foundation with downward slope of 1H:1V. Similarly, any existing underground services, outside of the foundation influence, should be either removed or abandoned by injecting with non-shrinkable grout.
c) Where open excavation is not feasible, a properly designed perimeter shoring system should be installed prior to the mass excavation for the proposed development. For the drilling and installation of shoring system (e.g, caissons, etc.), travel path and working platform areas of the Site for drill rig must be properly prepared, inspected and approved by a geotechnical engineer from BIG prior to starting the installation of shoring system.
d) During the excavation, groundwater should be kept at least 1 m below the base of excavation (i.e., lowest depth of excavation), before the excavation deepens.

e) Care must be taken during the excavation near the vicinity of the existing structures and any underground utility services located within or adjacent to the excavation. Foundations of heavily loaded settlement sensitive structures and utilities located within the close proximity of the proposed excavation should be accurately located and supported adequately with the suitable temporary or permanent support system where required, prior to excavation, to preserve the integrity of these structures. Similarly, the excavation near the vicinity of any existing structure should be carried out without disturbing and/or undermining their foundations/footings.

f) The exposed subgrade/base of excavation should be compacted consistently with suitable compactors, as deemed necessary by on-site geotechnical engineers. The subgrade should then be inspected and approved by a geotechnical engineer from BIG. During inspection, any spongy, wet and soft/loose spots identified should be sub-excavated and replaced with compacted engineered fill, as directed by the geotechnical engineer.

g) Materials used for engineered fill may consist of imported OPSS Granular B, OPSS Select Sub-grade, or the on-site soils which do not contain any organics and deleterious materials. Some reconditioning (i.e., drying) prior to reuse may be required, if the materials are found to be too wet. However, any imported soils to the Site for Engineered Fill must meet the requirements of O. Reg. 153/04 as determined by BIG.

h) To reduce the post-construction settlements, all new fills should be placed in thin lifts, not exceeding 200 mm thick loose lifts, within ±2 % of its optimum moisture content, and thoroughly compacted with suitable heavy compactors to at least 98% of Standard Proctor Maximum Dry Density (SPMDD), before placing the next lift.

i) The existing on-site soils are susceptible to disturbance when exposed to weather and construction traffic. Water (e.g., surface water runoff) should not be permitted to enter and/or pond within the construction area. This is especially important to the success of the planned construction.

j) Consideration should be given to redirecting the surface water runoff from the neighboring properties, if there would be a down gradient and grade difference between final site grades (permanent and/or temporary) and the existing grades in the neighboring properties.

7.2 Foundation Options and Design Parameters

With reference to the Architectural Drawings dated March 25, 2024, the Finished Floor Elevation (FFE) of the P2 underground parking level is situated at Elev. 175.3 mASL. Hence, it is expected that the foundation of the proposed 26-storey building will be found at approximate elevations of between Elev. 174.0 mASL and 173.0 mASL.

Based on the information obtained from the geotechnical investigations to date, the Site is generally considered suitable for construction of the proposed development from the geotechnical viewpoint, subject to the following considerations. Assuming the foundation elevation at or below ~Elev. 174.0 mASL under P2 level of underground parking structure, the subsoils immediate below the underside of foundations generally consist of stiff to very stiff clayey silt/silty clay glacial till deposit down to about Elev. 173± mASL underlain by more competent dense to very dense silty sand/sandy silt till extending down to at least Elev. 158.3 mASL (termination depths of BH/MW401 and BH/MW402). Therefore, the following foundation options have been recommended.

OPTION-1: Conventional/Extended Spread/Strip Footings or Short Drilled Piers

Based on the available borehole information to date, the proposed building may be supported by conventional spread/strip or extended footings founded on native undisturbed dense to very dense till deposit encountered at or below Elev. 173.0 mASL, provided that the groundwater table in confirmed to

be at least 1 m below the proposed excavation depth (otherwise a tanked raft foundation system may need to be considered, as discussed in section 7.5 below). For preliminary design propose, the following Geotechnical Resistances at Serviceability Limit States (SLS), Factored Geotechnical Resistances at Ultimate Limit State (ULS) are recommended at the specified depths at each borehole location, subject to adequate groundwater control and field evaluation and approval of all footing bases by the Geotechnical Engineer during construction:

Recommended Bearing Values and Anticipated Founding Depth (Spread/Strip Footings or Short Drilled Piers):

Borehole No.	Geotechnical Reaction at SLS (kPa)	Factored ULS Geotechnical Reaction (0.5 x ULS)(kPa)	Highest Possible Founding Depth/ Elevation (mBGS)/ (mASL)
BH/MW201	100 400	150 600	9.0 / 174.3 10.7 / 172.6
BH/MW202	110 500	165 750	9.0 / 174.3 10.7/ 172.6
BH301	500 600	750 900	10.7 / 173.7 12.2/172.2
BH401	200 600	300 900	9.0 / 174.3 10.7 / 172.6
BH/MW402	200 600	300 900	9.0 / 174.3 10.7 / 172.6

It should be noted that above bearing capacities should be further reviewed during detailed design stage, as appropriate.

In general, the minimum footing sizes, footing thickness, excavations, and other footing requirements should be designed in accordance with the latest edition of the Ontario Building Code. However, a minimum width of 600 mm is recommended for the strip footings.

Total and differential settlements of footings founded on Engineered Fill and/or Undisturbed Native Subsoils (as described on each borehole log at or below the proposed founding levels) and designed with the recommended bearing values outlined above should not exceed 25 and 19 mm respectively, provided that the founding subgrade remains undisturbed and is not loosened or softened by construction activities or prolonged exposure to the weather.

During the excavation, groundwater (if any) should be kept at least 1 m below the base of excavation. In no case should the footing be placed on dilated or disturbed subgrade soil. The footing subgrade should be protected, immediately after excavation and inspection, with a 50 mm thick concrete mud-slab, if water seepage is encountered and/ or the excavation is to remain open for more than a day.

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

Prior to the placement of concrete, all footing subgrades must be inspected and approved by a Geotechnical Engineer from BIG to ensure that the founding soils are similar to those identified in boreholes are capable of supporting the design bearing resistance.

OPTION-2: Conventional Cast-in-Place Concrete Caisson

Based on the available borehole data, some localized very stiff silty clay till deposits should be anticipated around the proposed founding depth in the vicinity of boreholes BH/MW201, BH/MW202, BH 301, BH401,

BH/MW402, as shown in the borehole logs in Appendix B. To provide adequate support for the proposed building, considerations could be given to conventional cast-in-place concrete caissons which can be drilled through the weaker native deposits and embedded at least 3 times caisson diameter into the underlying deeper more competent hard silty clay/ clayey silt till or silty sand till deposits.

The conventional caisson can be designed and constructed using the geotechnical bearing resistance factors of 0.4 with corresponding minimum founding depths provided in the table below.

Recommended Bearing Values and Anticipated Founding Depths:

Borehole No.	Geotechnical Reaction at SLS (kPa)	Factored ULS Geotechnical Reaction (0.4 x ULS) (kPa)	Highest Possible Founding Depth/ Elevation (m BGS)/ (mASL)
BH301	900	1080	14.2 / 170.3
BH401			13.0 / 170.3
BH/MW402			13.0 / 170.3

Total and differential settlements of footings founded on Undisturbed Native Subsoils (as described on each borehole log at or below the proposed founding levels) and designed with the recommended bearing values outlined above should not exceed 25 and 19 mm respectively, provided that the founding subgrade remains undisturbed and is not loosened or softened by construction activities or prolonged exposure to the weather.

A temporary steel liner is generally expected to be required to prevent sloughing of the soil and groundwater seepage into the caisson shaft and allow caisson base inspection (if no groundwater is encountered). Construction of the caissons should be inspected by geotechnical engineer. The minimum caisson diameter should be 760 mm (30 inches) to allow inspection of the caisson bases, if the caisson holes are dry, prior to pouring the concrete. The recommended minimum spacing of caissons, centre to centre, is two times the diameter. If caisson is installed in a group, the group effect should be considered in account.

For caissons designed to resist tensile loads, the entire length of the caisson should be reinforced and connected monolithically to the main structure.

Depending on the diameter and depth, high (minimum 150 mm) slump concrete may be required for the caissons and the liner should be withdrawn at a slow rate to prevent “necking” (intrusion of the soil from the sides of the caisson hole into the shaft of the caisson).

For caissons designed and constructed in accordance with the above criteria and good construction practice, the total settlement should be less than 25 mm.

It should be noted that cobbles and boulders are normally encountered within the glacial till deposits and fill materials, and therefore allowance should be made in the contract for the possibility of these materials.

The caisson installation should be carried out under full time inspection by BIG from the ground surface, to check that a competent bearing surface has been established at each caisson unit. The bearing surface of each caisson should be evaluated by visual examination of the auger cuttings during drilling, particularly at the caisson base, observation of the progress of drilling operations and comparison of the observations and depth/elevation of each caisson with the information presented on the borehole logs.

OPTION-3: Raft Foundation

Alternatively, the proposed building may also be designed and supported by “tanked” water-proofed continuous raft foundation system at or below Elev.172.5±m avoiding permanent dewatering (i.e., avoiding permanent perimeter and under-floor drainage system) using an estimated SLS geotechnical bearing resistance of 500 kPa.

Higher founding elevation may be available subject to the necessary confirmation by additional borings, in-situ Pressuremeter Testing (PMT) under the entire footprint of the proposed 26-storey building and associated settlement analysis during the design stage. BIG should be provided with the opportunity for geotechnical consultation with the structural designer.

The total and differential settlements of a raft foundation founded on Hard Clayey Silt Glacial Till/Very Dense Silty Sand Till and designed as outlined above is not expected to exceed 50 mm and 20 mm respectively, provided that the founding subgrade is free of any weak zones and is not loosed or softened by construction activities or prolonged exposed to weather.

The advantage of raft foundation is that the wall and column loads are distributed over the entire area of the raft slab, thereby greatly reducing bearing pressures and the differential settlements. The thickness and reinforcement of the raft foundation should be designed by a structural engineer to account for differential settlements.

Positive dewatering of the Site, reducing the water table to at least 1.0 m below the foundation level will be necessary prior to the excavation, for the duration of below grade construction works, in order to preserve the structural integrity of the founding soils.

The footing subgrade should be protected immediately after excavation and inspection, with a minimum of 50 mm thick concrete mud-slab, if water seepage is encountered and/ or the excavation is to remain open for more than a day.

A gap of approximately 600 mm service space should be kept between the top of raft and the basement/ parking level floor slab to allow for the installation and maintenance of drainpipes, sewers and any other underground services. The service space may be filled with clear stone after laying the underfloor service pipes and utilities.

Prior to the placement of concrete, foundation subgrade must be inspected and approved by a Geotechnical Engineer from BIG to ensure that the founding soils are similar to those identified in the boreholes and are capable of supporting the design bearing resistances.

7.3 Floor Slab Construction

It is anticipated that the subsoil immediately under the underground parking level will consist of stiff clayey silt/silty clay till deposits. The floor slab on these materials can be designed and constructed as a conventional slab-on-grade method provided that the proper dewatering measures are in place. The subgrade for the floor slab construction should be adequately prepared, as recommended by a geotechnical engineer, to receive the granular bedding as noted in Section 7.1.

Floor bedding consisting of at least 200 mm of Granular A (OPSS 1010) or its approved equivalent, is recommended as a moisture barrier under the floor slab. A polyethylene vapor barrier or equivalent may be placed at the surface of the stone bedding if a moisture sensitive finish is to be placed on the floor. The bedding should be compacted to at least 98% of SPMDD. A modulus of subgrade reaction of 15,000 kN/m^3 may be used for the design of the slab, provided that the construction is in accordance with the recommendations provided herein.

The floor slab should not be tied to any load-bearing walls or columns unless they have been designed accordingly. Contraction and expansion joints should be provided for the slabs as required by the structural engineer.

Waterproofing of the perimeter basement walls is recommended. The walls may be dampproofed above the perimeter footings levels to at least 0.6 m below the proposed ground surface level. The manufacturer of the selected product should be consulted for application details for damp proofing.

7.4 Lateral Pressure

The lateral earth and hydrostatic pressures acting on basement walls may be calculated from the following expression:

$$P = K[\gamma(H-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

Where,	P = Lateral earth pressure at depth H (m)	kPa
	K = Lateral earth pressure coefficient	0.4
	γ = Bulk unit weight of the soil	21.0 kN/m^3
	γ' = Submerged unit weight of soil	11.2 kN/m^3
	γ_w = Unit weight of water	9.8 kN/m^3
	H = Depth of the wall below the outer finish grade	m
	h_w = Depth of the wall below the groundwater level	m
	q = Equivalent value of all surcharge loads on the ground surface	kPa

When the development of hydrostatic pressure is eliminated, the above expression can be simplified as follows:

$$P = K (\gamma H + q)$$

Surcharge and point loads at the ground surface (e.g. from the heavy construction equipment, etc.) should also be considered in the structural design.

7.5 Permanent Perimeter and Under-floor Drainage

If the basement is designed as a “drained” structure, permanent perimeter drainage system should be provided around the perimeter walls of the underground parking structure.

For an open-cut excavation, perforated pipes, leading to a frost-free sump, can be used for the permanent perimeter drainage system. The walls of the basement should be waterproofed suitably and wrapped with a continuous drainage blanket connecting to the permanent perimeter drainage system.

Where adequate space is not available for an open cut excavation, a vertical shoring system is used to support the sides of the excavation, and a permanent perimeter drainage system consisting of the prefabricated continuous vertical blanket of Miradrain 6000 or its equivalent should be installed at the shoring location of the perimeter walls. The installation and connections of perimeter drainage system should be carried out as per the manufacturer’s specifications. The collection pipes installed through the perimeter walls to the prefabricated perimeter drainage system should be connected to a solid collector pipe leading to a frost-free sump.

Considering the subsoil and moisture content measurements, underfloor drainage system may be required. However, the need for vertical and underfloor drainage systems and the anticipated volumes of water to be pumped during and post construction should be based on the findings of the hydrogeological investigation report. It should be noted that the need of underfloor drainage system should be reviewed by BIG, once the detailed design of the below grade structure is finalized. The underfloor drainage system, if needed, should be kept separate from the perimeter drainage system.

A provision of additional groundwater control measures, consisting of underfloor sump pumps connected to an emergency power grid, should be installed below the basement floor level for the consequence arising from a failure of the regular system.

A conceptual design of Permanent Perimeter & Under-floor Drainage Systems for Open-cut Excavation and Shoring are shown in Appendix D.

7.6 Frost Protection

The design frost penetration depth for the general Site area is 1.2 m. Therefore, any structural foundation (perimeter and other footings) and buried underground utilities exposed to seasonal freezing conditions should be provided with frost protection comprising at least 1.2 m of earth cover or its equivalent thermal insulation. As a general guidance, 25 mm of insulation provides the same thermal equivalency as 600 mm of soil cover.

7.7 Earthquake Consideration

In conformance to the criteria in Table 4.1.8.4.A, Part 4, Division B of the Ontario Building Code (OBC), the project Site may be classified as Site Class "D-Stiff Soil", if the proposed new foundations are founded on the upper stiff to very Silty Clay Till at an approximate depth elevation of 174.0 mASL.

However, if deeper foundation is considered on more competent strata of hard glacial till at or below 173.3 mASL, then there may be potential improvement on the Seismic Site Classification up to "C-Very Dense Soil", subject to confirmation during detailed design. Further consultation and additional investigations are expected to be required to confirm the Site Class in subsequent phase of the project as soon as the preliminary foundation general arrangements are defined.

The four values of the Spectral response acceleration Sa (T) for different periods and the Peak Ground Acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B of the OBC 2012. The design values of Fa and Fv for the project site should be calculated in accordance with Table 4.1.8.4 B and C.

7.8 Excavation and Temporary Groundwater Control

It is expected that the excavation through the existing fills and glacial till deposits, for two levels of underground parking structure, can be handled by conventional mechanical excavation equipment. Allowance should be made for cobbles and boulders in the earth fills and till deposits, and remnants of demolished buildings during excavation.

All excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulation 213/1991 for Construction Projects to ensure the protection of workers from on-Site contaminants of concerned impacted soil and groundwater. Under the Act, the soils to be excavated can be classified as follows:

Fill soils	Type 3;	When submerged/saturated	Type 4
Clayey Silt Till (firm to stiff)	Type 3;	When submerged/saturated	Type 4
Clayey Silt Till (very stiff)	Type 2;	when saturated and/or fissured	Type 3
Clayey Silt Till (hard)	Type 1;	when saturated and/or fissured	Type 2

For Type 3 soils, a bank slope of 1H:1V is required. For Type 2 soils, a 1.2 m high vertical cut at the bottom of excavation may generally be used. Near the ground surface, occasional 3H:1V slopes may be required due to disturbed surficial soils. In general, above the water table, side slopes of trenches deeper than 1.2 m should be cut to a gradient no steeper than 1V:1H upon the inspection of a qualified geotechnical engineer.

In areas where an open excavation slope cannot be maintained due to the close proximity of the existing structures on the adjacent properties (e.g., buildings, roads, etc.), the excavation within the overburden should be supported by using a shoring system (e.g., tight wooden bracing, sheet pile, trench box, strutted

soldier pile & lagging wall etc.), designed by a shoring consultant. Further, the depths of shoring walls should be extended sufficiently below the base of the excavation to ensure that toe resistance is maintained when the soil is excavated.

Perched water may be encountered in the earth fills above the groundwater level. The amount of free water from these sources is anticipated to be minor and the water accumulated in the excavation can readily be handled by using temporary filtered sump and pump.

However, based on the installed monitoring wells, the stabilized groundwater level measurements were recorded at elevations between 163.17 m and 180.80 mASL. The excavations of the proposed building are anticipated to extend the elevation of 174±1.0 mASL. In this case, a positive (pro-active) groundwater control should be implemented, and the groundwater should be kept at least 1 m below the base of excavation (i.e., lowest depth of excavation), before the excavation deepens and the base of excavation should be kept dry all the time. Detailed discussions on groundwater and construction dewatering including permit requirements are provided in the Updated Hydrogeological Investigation Report.

Dewatering requirements will be governed by the time of the 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 should not undermine the adjacent structures.

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

Consideration should be given to carrying out the construction during the drier seasons of the year to reduce the need for dewatering and disturbances to the founding soils caused by the excavation below prevailing groundwater table. It should also be noted that the cohesionless soils are very easy to be disturbed, especially under the prevailing groundwater conditions.

7.9 Reuse of On-Site Soils

Based on the conditions encountered in the boreholes, in general, the excavated soils which do not contain excessive organic and deleterious materials can be reused as Engineered Fill. However, depending on the weather condition, the excavated soil may require some reconditioning (e.g., drying) prior to reuse. Unsuitable material such as organic rich pockets, cobbles, boulders, frozen soils, etc., should be wasted. Ideally, dissimilar materials should be stockpiled separately during excavation.

For reuse as an engineered fill for foundation support, uniform material must be used. Significant variations in fill type will require thinner lifts, more compaction effort and more field and laboratory testing. As well, significantly more time will be required during excavation to selectively sort through the fill to ensure a uniform product. Less stringent requirements may be considered for fill quality and placement below slab-on-grade, above footing levels, and pavement areas.

Portions of the existing soils are considered as frost susceptible and should not be reused where a volume change in the presence of freezing conditions would have an adverse effect on the serviceability of the proposed infrastructure.

7.10 Underground Services

It is considered that the sewer depths will not exceed 4.0 m below grades. Trench excavation should be carried out in accordance with the most recent version of the Ontario Occupational Health and Safety Act & Regulations for Construction Projects. The boreholes show that the trenches, generally, will be dug through existing fill materials and native till deposit. Normal conventional excavation equipment will be suitable for excavating trenches in the fill and native soil deposits.

Within these soils, above the groundwater table, the side-slopes of excavations are expected to be temporarily stable at 1V:1H. Flatter slopes will be required for the soils located below groundwater table, if encountered as noted on Section 6.8.

In areas where an open excavation slope cannot be maintained, the excavation within the overburden should be supported using a temporary shoring system (e.g., tight wooden bracing, etc.), designed by a shoring consultant. Excavations can also be carried out at steeper side slopes by using trench box, designed in accordance with the Safety Regulations, for the protection of the workers.

Groundwater seepage into the excavations may occur from perched groundwater or surface water flow. Dewatering should be achievable by properly filtered sumps and pumps.

The groundwater level in the trench should be kept below the bottom of the excavation by dewatering. Ideally, to prevent disturbance of the soil at the bedding level, the groundwater table must be lowered to at least 0.6 m below the base of the trench. In no case should the pipes be placed on disturbed subsoil.

The boreholes show, the anticipated subgrade in their undisturbed state, will generally comprise of stiff to very stiff glacial clayey silt till deposit, which may provide adequate support for the pipes, provided the exposed subgrade at the base of the trenches is further assessed and approved by qualified geotechnical personnel from BIG during construction.

Pipe bedding should be in accordance with the pipe manufacture recommendations, appropriate local municipality requirements and standards (e.g., OPS). However, as a guideline, normal Class 'B' Type bedding (OPSD-802) may be considered. The thickness of the bedding material, however, may have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered. Subject to assessment by the geotechnical engineer on Site, the bedding used to support the pipes in week soils (if any) may need to be wrapped by a geotextile (e.g., Terrafix 270R or equivalent). In general, a minimum of 150 mm thick of OPSS Granular A bedding is recommended for pipes 450 mm diameter or less; for large diameter pipes, the thickness of the bedding should be increased to 200 mm.

Based on visual and tactile examination of the soil samples, the on-site excavated soils can generally be re-used to backfill the service trenches subject to the conditions noted in Sections 6.1 and 6.9.

The trench backfills should be placed in thin lifts not exceeding 200 mm thick loose lifts, within ±2 % of its optimum moisture content, and thoroughly compacted with suitable heavy rollers to at least 95% of SPMDD of the fill material, before placing the next lift. This value should be increased to at least 98 % within the upper 0.6 m of trench backfills for the construction of road pavement.

7.11 Shoring Considerations

In areas where an open excavation slope cannot be maintained, the excavation within the overburden should be supported by using a shoring system. Where settlement sensitive structures are located at the close proximity of the proposed excavation, shoring system consisting of a series of caisson walls embedded sufficiently below the bottom of the excavation, will have to be used to prevent any movement in the adjacent properties. A shoring system consisting of soldier piles and timber laggings can be used, on the other sides, where slight movement in the ground surface can be tolerated, i.e., where non-sensitive structures exist.

The shoring system should be designed by an experienced shoring consultant in accordance with the guidelines provided in the latest edition of the Canadian Foundation Engineering Manual (Manual). Similarly, the construction of the shoring system should also be carried out by a Contractor, experienced in this type of construction.

The soldier piles should be installed in pre-augured holes which should be filled up to excavation level with 20 MPa (3000 psi) concrete and above that with 1-1/2 bag mix.

The following thicknesses of lagging boards have been recommended in the Manual:

Thickness of lagging	Maximum Spacing of Soldier Piles
50 mm (2 in)	1.5 m (5.0 ft)
75 mm (3 in)	2.5 m (8.0 ft)
100 mm (4 in)	3.0 m (10 ft)

Local experience has indicated that the lagging thickness of 75 mm has been adequate for soldier pile spacing of 3 m for soil conditions similar to those encountered at the subject site. However, it is important to consider all local conditions, such as the duration of excavation, the weather likely to be encountered, seasonal variations in the ground water and ice lensing causing frost heave in determining the lagging thickness.

All spaces behind the lagging must be filled with free draining granular fill. If wet conditions are encountered the space between boards should be packed with geotextile filter fabric or straw to prevent loss of ground.

The shoring system should be designed for a factor of safety of F = 2. The overall factor of safety of the anchored block of soil must be considered. The minimum spacing and the depths of the soil anchors should be as recommended in the Manual.

7.12 Pavement Construction

Pavement design and pavement thicknesses are highly dependent on the subgrade conditions. The pavement subgrade should, therefore, be adequately prepared to receive the granular bases for the pavement construction noted in Section 6.1.

Following the Site grading and prior to the placement of granular bases, the exposed subgrade should be proof-rolled and inspected by the qualified geotechnical personnel from BIG. Any wet/soft areas of subgrade, revealed by this process, should be sub-excavated and replaced with an approved on-site or imported fill compatible to the existing subgrade soils.

All new fills should be placed in a maximum of 200 mm loose lifts, within ±2 % of its optimum moisture content of SPMDD test, and each lift should be compacted by a suitable heavy equipment to minimum 95% of SPMDD before placing the next lift. The uppermost 600 mm of the pavement subgrade should be compacted to a minimum 98% of SPMDD.

Considering the proposed pavement usage, frost susceptibility and assuming adequate drainage, the following minimum pavement structure thicknesses are recommended for the required long-term performance of the pavement:

Recommended Minimum Pavement Structure Thicknesses:

Particulars	Heavy Duty Roadway (mm)	Standard Duty Driveway (mm)
Asphaltic Concrete: OPSS HL3	40	50
Asphaltic Concrete: OPSS HL8	70	50
Base Course - OPSS Granular A or equivalent	150	150
Sub-base Course - OPSS Granular B or equivalent	350	250

The pavement structure within the City's Right-Of-Way (ROW) should also conform to the local regulations and standards inclusive of the City of Toronto design and maintenance requirements.

The granular base and subbase materials should conform to the OPSS 1010 and should be compacted to 100% of the ASTM D698 SPMDD within ±2% of the optimum moisture content.

Hot mix asphalt concrete should conform to OPSS 1150 and OPSS 310 and be placed and compacted to at least 92 to 96.5 % of the Marshall Maximum Relative Density (MMRD). It is recommended that the asphalt mix design be reviewed by BIG prior to the start of the paving.

The pavement thickness considers that construction will be carried out during the drier time of the year and that the subgrade is competent. If the subgrade becomes excessively wet or rutted during construction activities, additional sub-base material may be required. The need for additional subbase material is best determined during construction.

8 Construction Monitoring

Qualified Geotechnical personnel should monitor the foundation excavation, subgrade inspection, in-situ density tests and material testing services in all stages of the proposed development, to ensure that the materials and conditions comply with this geotechnical report and project requirements. Should the condition that encountered vary from those described in this report, our office should be informed immediately so that the proper measures are undertaken. The on-Site review of the condition of the foundation soil is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code.

All backfilling should be supervised to ensure that proper materials are used, and that adequate compaction is achieved. Strict quality control guidelines should be followed during the placement of fill materials.

9 Closure

The subsoil information and recommendations contained in this report have been prepared solely for the purpose to use at the specific project as described in this report and should not be used to any other project or site location. The information contained in this report is for the sole benefit of the Client and his/her Design Consultants. *Reference must be made to the whole of the report in order to properly interpret its contents. BIG cannot be held responsible for the use of portions of the report without reference to the entire report.*

We recommend that BIG be retained to review the recommendations for this specific applicability, once the details of the proposed development are finalized and prior to the final design stage of the project.

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

Yours truly,

B.I.G. Consulting Inc.

Andy Chen, M.Eng., P.Eng.
Senior Geotechnical Engineer

Oswin Li, P.Eng.
Senior Project Manager /
Geotechnical Engineer

10 Report Limitations

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

The design recommendations and opinions given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. Construction methods discussed, however, express BIG's opinion only and are not intended to direct the contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all the factors that may have an effect upon the construction. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably at the site. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The report is prepared based on the condition that the design will be carried out in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice.

The benchmark and elevations mentioned in this report were obtained strictly for use by this office in the geotechnical design of the project. They should not be used by any other party for any other purpose.

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

Appendix A – Figures

KEY PLAN
N.T.S

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Mississauga, ON L4W 2Z4
Canada

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LEGEND
SITE BOUNDARY

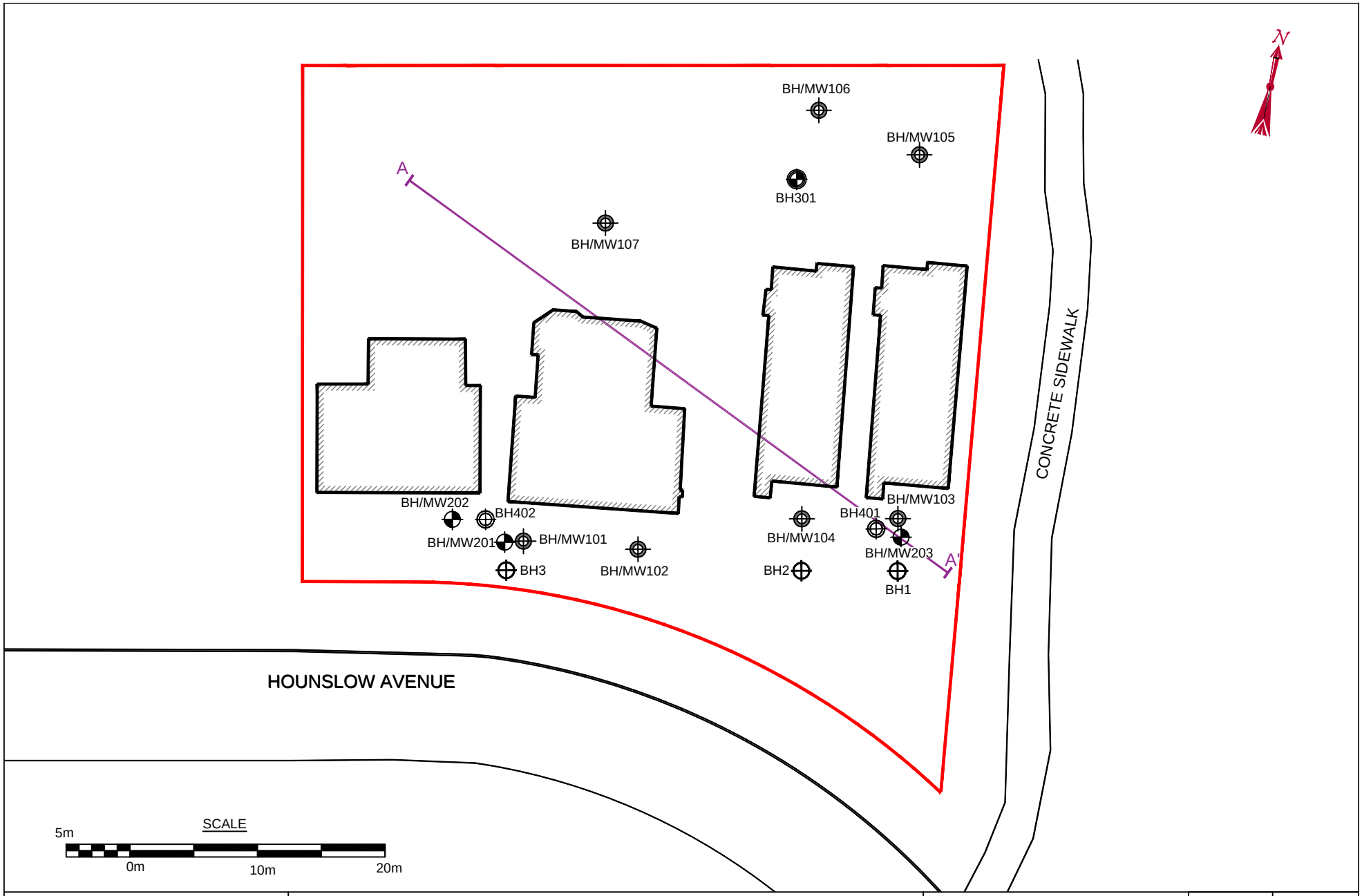
SCALE
10m 10 20 30 40
0m 50m

- SITE LOCATION PLAN IMAGERY OBTAINED FROM GOOGLE MAPS, DATED 2020
- KEY PLAN IMAGERY OBTAINED FROM OPENSTREETMAP, DATED 2023

TITLE AND LOCATION

SITE LOCATION PLAN
UPDATED GEOTECHNICAL INVESTIGATION
26-38 HOUNSLOW AVENUE, TORONTO, ONTARIO

PROJECT NO.	DWN.
BIGC-GEO-154H	E.P.
SCALE	CK.
AS NOTED	O.L.
DATE	FIG NO.
MARCH 2024	1



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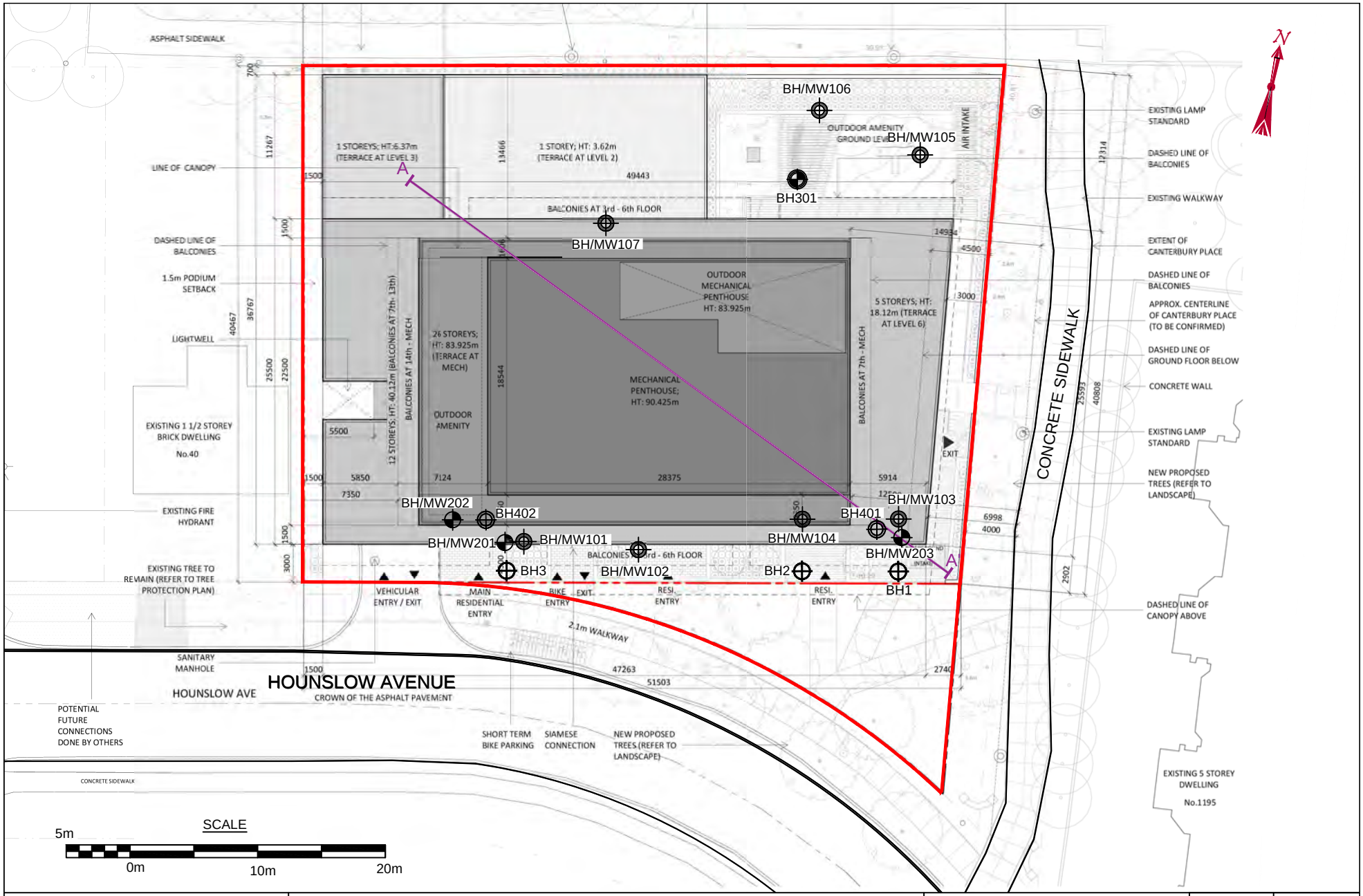
LEGEND

- SITE BOUNDARY
- PROPOSED BUILDING FOOTPRINT
- PREVIOUS BOREHOLE LOCATION (SHAD, 2016)
- BOREHOLE/MONITORING WELL LOCATION (BIG, 2019)
- BOREHOLE/MONITORING WELL LOCATION (BIG, 2017)
- BOREHOLE LOCATION (BIG, 2020)
- BOREHOLE LOCATION (BIG, 2023)
- STRATIGRAPHIC CROSS SECTION

TITLE AND LOCATION

BOREHOLE/MONITORING WELL LOCATION PLAN
UPDATED GEOTECHNICAL INVESTIGATION
26-38 HOUNSLOW AVENUE,
TORONTO, ONTARIO

PROJECT NO.	DWN.
BIGC-GEO-154H	E.P.
SCALE	CK.
AS NOTED	O.L.
DATE	FIG NO.
MARCH 2024	2A



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LEGEND

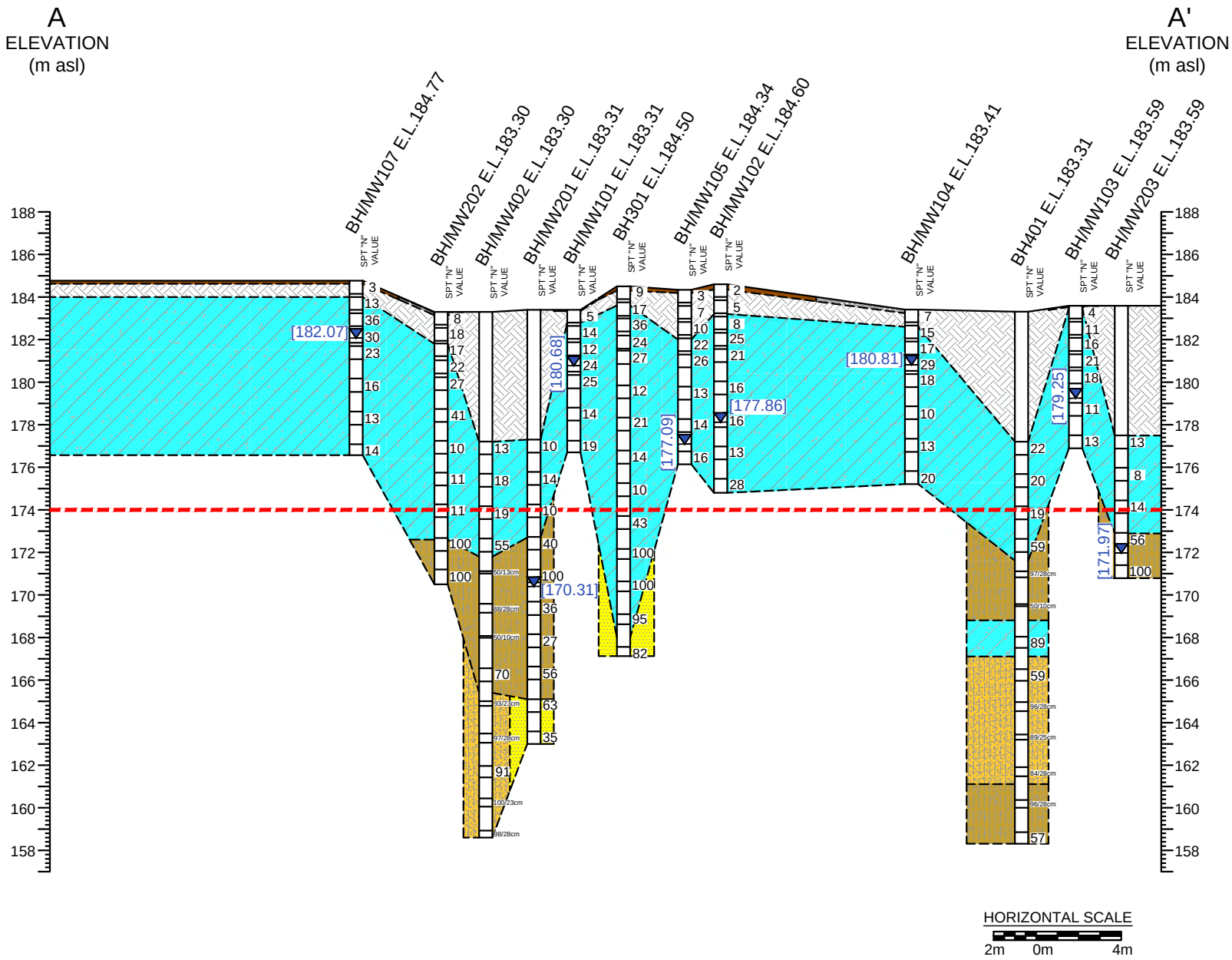
- SITE BOUNDARY
- PROPOSED BUILDING FOOTPRINT
- PREVIOUS BOREHOLE LOCATION (SHAD, 2016)
- BOREHOLE/MONITORING WELL LOCATION (BIG, 2019)
- BOREHOLE/MONITORING WELL LOCATION (BIG, 2017)
- BOREHOLE LOCATION (BIG, 2020)
- BOREHOLE LOCATION (BIG, 2023)
- STRATIGRAPHIC CROSS SECTION

AERIAL SITE PLAN, DRAWING NUMBER A 1.00, PREPARED BY STUDIO JCI, DATED MARCH 25, 2024

TITLE AND LOCATION

BOREHOLE/MONITORING WELL LOCATION PLAN
UPDATED GEOTECHNICAL INVESTIGATION
26-38 HOUNSLOW AVENUE, TORONTO, ONTARIO

PROJECT NO.	DWN.
BIGC-GEO-154H	E.P.
SCALE	CK.
AS NOTED	O.L.
DATE	FIG NO.
MARCH 2024	2B



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LEGEND

- GRANULAR
- ASPHALT
- FILL
- TOPSOIL
- SILTY CLAY / CLAYEY SILT TILL
- SILTY SAND / SANDY SILT TILL
- SILTY SAND
- SAND
- WATER LEVEL
- [xx.xx] WATER LEVEL MEASUREMENT
- APPROXIMATE FOUNDATION LEVEL

TITLE AND LOCATION

STRATIGRAPHIC SOIL PROFILE A-A'

UPDATED GEOTECHNICAL INVESTIGATION

26-38 HOUNSLOW AVENUE, TORONTO, ONTARIO

PROJECT NO.	DWN.
BIGC-GEO-154H	E.P.
SCALE	CK.
AS NOTED	O.L.
DATE	FIG NO.
MARCH 2024	3

Appendix B – Notes to Record of Boreholes
Detailed Records of Borehole Logs

NOTES TO RECORD OF BOREHOLES

DRILLING METHOD	
SSA	Solid Stem Auger
HSA	Hollow Stem Auger
WB	Wash Boring

SAMPLE TYPE	
SS	Split Spoon
AS	Auger Flight Sample
TW	Thin Wall Open
TP	Thin Wall Piston
WS	Washed Sample
VT	Vane Test
GS	Grab Sample
RC	Rock Core
PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually
CC	Continuous Core

LABORATORT DATA	
W	Water Content
W_p	Plastic Limit
W_l	Liquid Limit
γ	Natural Unit Weight (kN/m^3)
C_u	Undrained Shear Strength (kPa)
PP	Pocket Penetrometer
UC	Unconfined Compression
UU	Unconsolidated Undrained
CU	Consolidated Undrained
CD	Consolidated Drained
TOV	Total Organic Vapors

STANDARD PENETRATION TEST (SPT 'N'): The number of blows required to advance a standard 51 mm outer diameter split spoon sampler to penetrate 0.3 m distance into the undisturbed ground in a borehole driven by means of a 63.5 kg hammer falling freely from a distance of 0.76m.

DYNAMIC CONE PENETRATION TEST (DCPT): The number of blows required to advance a 51 mm diameter – 60 degree cone fitted to the end of the drill rods to penetrate 0.3 m distance into the undisturbed ground driven by 475 Joules driving energy per blow.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR RELATIVE DENSITY

CONSISTENCY: Cohesive soils are described on the basis of their undrained shear strength (Cu) or 'N' values as follows:

N (blows/0.3m)	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	>30
Consistency	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
Cu (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200

RELATIVE DENSITY: Cohesionless soils are described on the basis of their relative density as indicated by 'N' values as follows:

N (blows/0.3m)	0 - 4	4 - 10	10 - 30	30 - 50	>50
Relative Density	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH

RECOVERY: Sum of the lengths of all recovered rock core pieces divided by the total length of the core run (expressed as a percent).

ROCK QUALITY DESIGNATION (RQD): Sum of the lengths of intact rock core pieces, 100 mm or more in lengths, divided by the total length of the core run (expressed as a percent). Classifications of a rock based on the RQD value are as follows:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
Quality	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50 Millimeters	50 - 300 Millimeters	0.3 – 1.0 Metres	1.0 – 3.0 Metres	> 3.0 Metres
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

RECORD OF BOREHOLE No. BH401

Project Number:	BIGC-GEO-154H	Drilling Location:	See borehole location plan	Logged by:	CE
Project Client:	26 28 36 & 38 Hounslow Avenue, Toronto, ON	Drilling Method:	115 mm Mud Rotary Drilling	Compiled by:	VB
Project Name:	Geotechnical and Hydrogeological Investigations	Drilling Machine:	Track Mounted Drill	Reviewed by:	RM
Project Location:	26 28 36 & 38 Hounslow Avenue, Toronto, ON	Date Started:	Aug 14, 23	Date Completed: Aug 14, 23	Revision No.: 0, 9/22/23

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING		
Lithology Plot	DESCRIPTION Geodetic Ground Surface Elevation: 183.31 m	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane: △ Intact ▲ Remould; Nilcon Vane: ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid 20 40 60 80	INSTRUMENTATION INSTALLATION	COMMENTS
	CONTINUOUS AUGER DRILLING TO 6.10 m bgs					0	183				
	177.21					1	182				
	SILTY CLAY TILL: trace sand, trace gravel, grey, moist, very stiff to hard 6.1	SS	1	100	22	2	181	○	○11		
						3	180				
		SS	2	100	20	4	179	○	○12		
						5	178				
		SS	3	92	19	6	177	○	○13		Gr: 0%, Sa: 29%, Si: 51%, Cl: 20% LL: 20%, PI: 8%
						7	176				
		SS	4	95	59	8	175	○	○10		
	171.61					9	174				
	SILTY SAND TILL: trace clay, trace gravel, grey, moist, very dense 11.7	SS	5	100	97/28 cm	10	173	○	97/28 cm ○8		
						11	172				
						12	171				
						13					

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

Scale: 1 : 68

Continued on Next Page

RECORD OF BOREHOLE No. BH401

Project Number: BIGC-GEO-154H | Drilling Location: See borehole location plan | Logged by: CE

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	SILTY SAND TILL: trace clay, trace gravel, grey, moist, very dense	SS	6	100	50/10 cm	14	169	50 / 10 cm	13		
	168.81										
	SILTY CLAY TILL: trace sand, trace gravel, grey, moist, hard 14.5	SS	7	100	89	15	168		11		
	167.11					16					
	SILTY SAND: grey, moist, very dense 16.2	SS	8	100	59	17	167		24 / 15		
		SS	9	100	96/28 cm	18	166	96 / 28 cm	10		Gr: 0%, Sa: 67%, Si: 30%, Cl: 3%
		SS	10	100	89/25 cm	19	165	89 / 25 cm	10		
		SS	11	100	84/28 cm	20	164	84 / 28 cm	14		
	161.11					21	163				
	SILTY SAND TILL: trace gravel, trace clay, grey, moist, very dense 22.2	SS	12	66	96/28 cm	22	162	96 / 28 cm	17		
	grey	SS	13	87	57	23	161		18 / 8		
	158.32					24	160				
	End of Borehole 25.0						159				

Notes:
1. Borehole open upon completion of drilling.
1. Ground water level could not be measured due to mud rotary drilling.

Scale: 1 : 68

RECORD OF BOREHOLE No. BH/MW402

Project Number:	BIGC-GEO-154H	Drilling Location:	See borehole location plan	Logged by:	CE
Project Client:	26 28 36 & 38 Hounslow Avenue, Toronto, ON	Drilling Method:	115 mm Mud Rotary Drilling	Compiled by:	VB
Project Name:	Geotechnical and Hydrogeological Investigations	Drilling Machine:	Track Mounted Drill	Reviewed by:	RM
Project Location:	26 28 36 & 38 Hounslow Avenue, Toronto, ON	Date Started:	Aug 15, 23	Date Completed: Aug 15, 23	Revision No.: 0, 9/22/23

Geodetic Ground Surface Elevation: 183.30 m

CONTINUOUS AUGER DRILLING TO 6.10 m bgs

177.20

CLAYEY SILT TILL: trace sand, trace gravel, grey, moist, stiff to hard — 6.1

high plasticity

171.80

SILTY SAND TILL: trace clay, trace gravel, grey, moist, very dense — 11.5

Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	COMMENTS
SS	1	95	13	6	177		12	
SS	2	100	18	8	175		12	
SS	3	100	19	9	174		13	
SS	4	95	55	11	172		10	Gr: 1%, Sa: 28%, Si: 52%, Cl: 19% LL: 19%, Pl: 6%
SS	5	100	50/13 cm	12	171	50 / 13 cm	14	

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

Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading (parts per million (ppm)) 100 200 300 400; Lower Explosive Limit (LEL) W_P W W_L; Plastic Liquid; 20 40 60 80

INSTRUMENTATION INSTALLATION

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

Groundwater depth observed on 08/17/2023 at a depth of: 20.13 m.

Scale: 1 : 68

Continued on Next Page

RECORD OF BOREHOLE No. BH/MW402

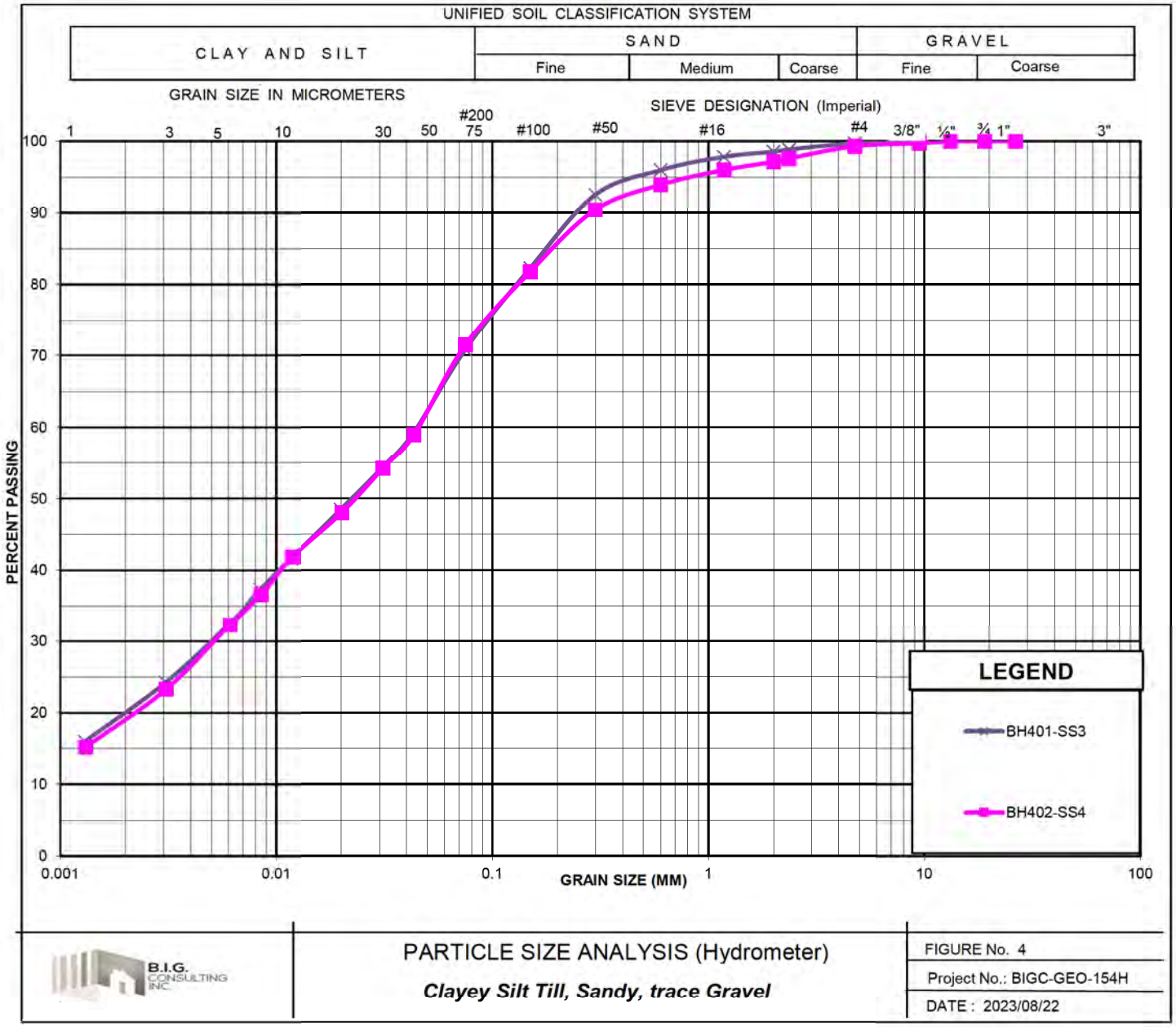
Project Number: **BIGC-GEO-154H** Drilling Location: **See borehole location plan** Logged by: **CE**

DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
SILTY SAND TILL: trace clay, trace gravel, grey, moist, very dense					13	170				
	SS	6	88	88/28 cm	14	169	88 / 28 cm	7		Gr: 1%, Sa: 42%, Si: 46%, Cl: 11%
	SS	7	100	50/10 cm	15	168	50 / 10 cm	7		
clayey silt/silty clay layer, 300 mm thick, grey, moist, hard	SS	8	95	70	16	167		11, 13		
165.40 **SILTY SAND:** brown, moist, very dense 17.9	SS	9	57	93/23 cm	17	166	93 / 23 cm	17		
	SS	10	95	97/28 cm	18	165	97 / 28 cm	17		
	SS	11	81	91	19	164		14		Gr: 0%, Sa: 83%, Si: 14%, Cl: 3%
silt layer, 300 mm thick, brown, moist	SS	12	66	100/23 cm	20	163	100 / 23 cm	3, 16		
158.64 **End of Borehole** 24.7	SS	13	100	98/28 cm	21	162	98 / 28 cm	14		
					22	161				
					23	160				
					24	159				

Notes:
1. Borehole open upon completion of drilling.
1. Ground water level reading at 20.13 m bgs on August 17, 2023.

Scale: 1 : 68

Appendix C – Laboratory Test Results



B.I.G. CONSULTING INC.

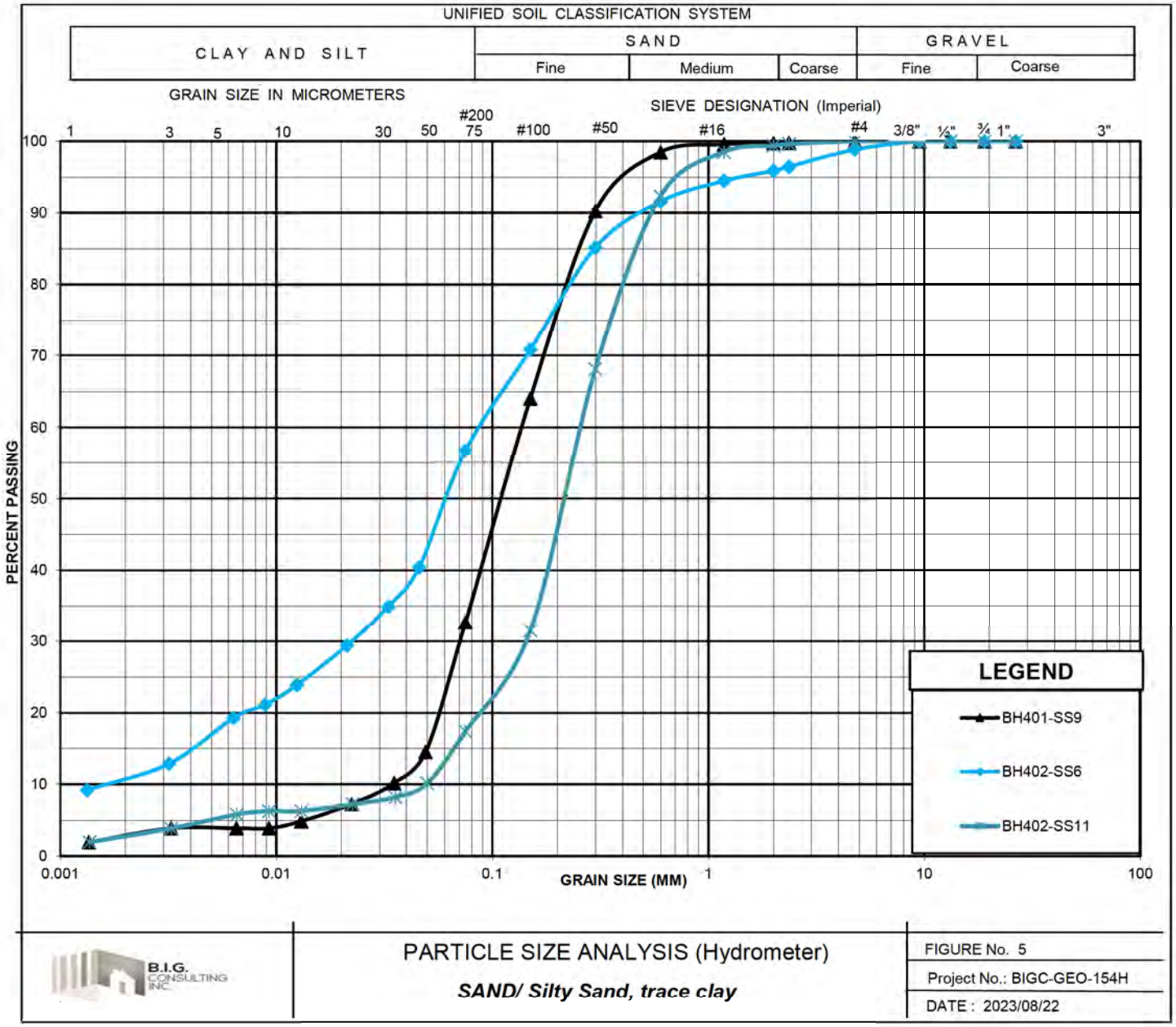
PARTICLE SIZE ANALYSIS (Hydrometer)

Clayey Silt Till, Sandy, trace Gravel

FIGURE No. 4

Project No.: BIGC-GEO-154H

DATE : 2023/08/22



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PARTICLE SIZE ANALYSIS (Hydrometer)

SAND/ Silty Sand, trace clay

FIGURE No. 5

Project No.: BIGC-GEO-154H

DATE : 2023/08/22

B.I.G CONSULTING INC.

PLASTICITY CHART

Job #	:	BIGC-GEO-154H	Lab #	:	
Project Client:			Technician	:	CG
Project	:	Updated Geotechnical/Hydrogeological Investigations	Supervisor	:	SS
Location	:	26-38 Hounslow Avenue, Toronto, Ontario	Date	:	08/21/2023

TEST RESULTS

Specimen #	Sample #	Depth (m)	LL%	PL%	PI	Clay%	W%	Classification	Remarks
BH401	SS3	9.5	20	12	8			CL	Native
BH402	SS4	11.0	19	13	6			CL-ML	Native

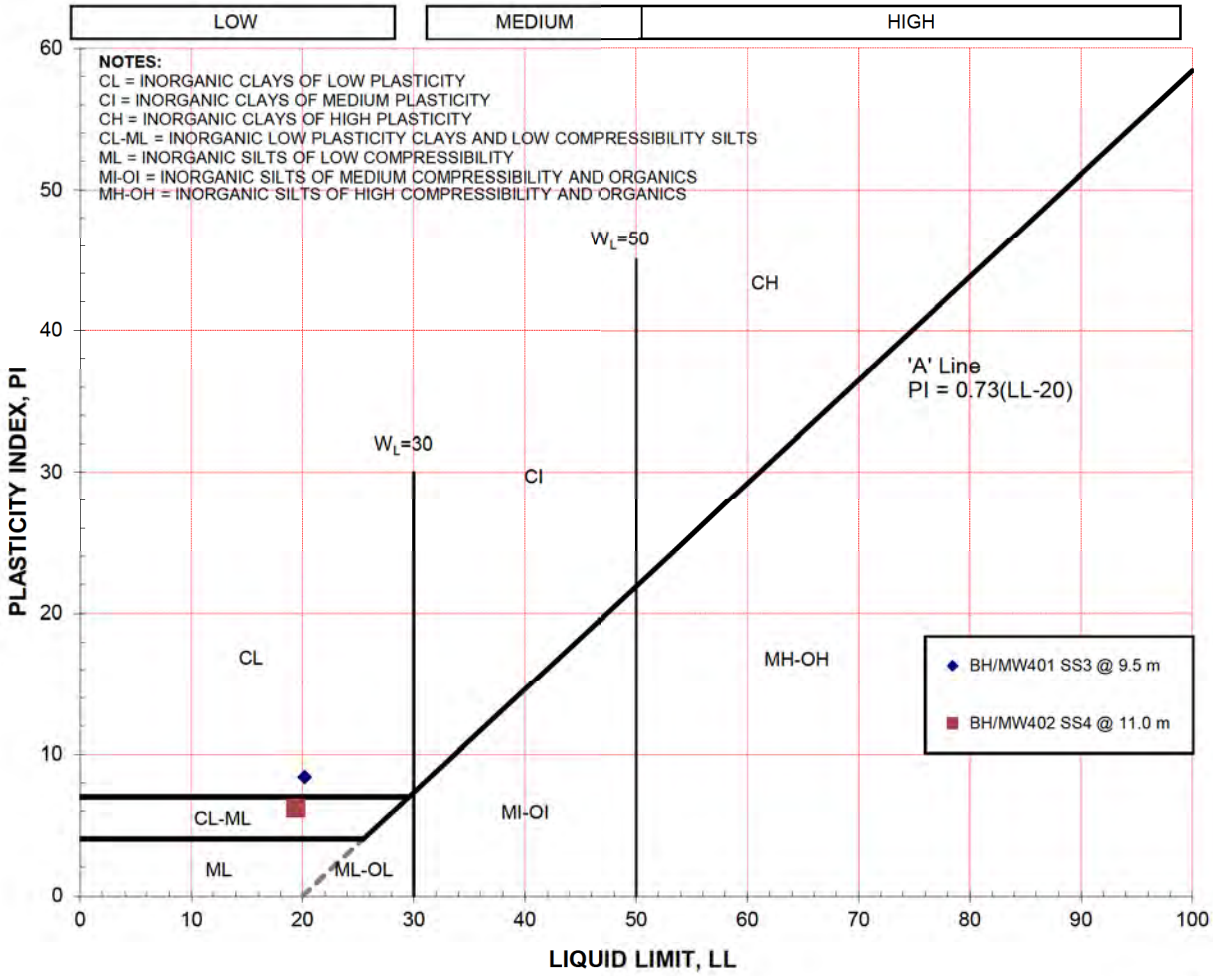

FIGURE - 6

Appendix D – Previous Borehole Logs

RECORD OF BOREHOLE No. BH301

Project Number:	BIGC-ENV-154F	Drilling Location:	See Borehole Location Plan	Logged by:	SKS
Project Client:	Mattamy Homes	Drilling Method:	200 mm Hollow Stem Augering	Compiled by:	SS
Project Name:	Geotechnical Investigation	Drilling Machine:	CME 75 Track Mounted	Reviewed by:	
Project Location:	26-38 Hounslow Avenue, Toronto	Date Started:	20 Oct 20	Date Completed: 20 Oct 20	Revision No.: 0, 22/10/20

Geodetic Ground Surface Elevation: 184.50 m

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)
	TOPSOIL: 230 mm (184.27)						
	FILL: clayey silt, trace sand, trace gravel, trace organics, dark brown, very moist, stiff (0.2 / 183.60)	SS	1	46	9		
	CLAYEY SILT/SILTY CLAY TILL: trace to some sand, trace gravel, brown, moist, stiff to hard (0.9)	SS	2	41	17	1	183
		SS	3	67	36	2	
		SS	4	84	24	3	182
		SS	5	100	27		181
	grey					4	
		SS	6	100	12	5	180
	medium plasticity	SS	7	100	21	6	179
	high plasticity	SS	8	100	14	7	178
		SS	9	100	10	8	177
		SS	10	92	43	9	176
		SS	11	67	100	10	175
		SS	12	50	100	11	174
						12	173
						13	172
						14	171
						15	170

FIELD TESTING

Penetration Testing: ○ SPT ● DCPT

MTO Vane: △ Intact ▲ Remould

Nilcon Vane: ◇ Intact ◆ Remould

* Undrained Shear Strength (kPa): 20 40 60 80

LAB TESTING

★ Rinse pH Values: 2 4 6 8 10 12

Soil Vapour Reading △ parts per million (ppm): 100 200 300 400

▲ Lower Explosive Limit (LEL): W_P W W_L

Plastic Liquid: 20 40 60 80

Depth (m)	Soil Vapour Reading (ppm)	Undrained Shear Strength (kPa)
0	20	
1	9	
2	10	
3	12	
4	12	
5	11	
6	12	
7	13	
8	13	
9	12	
10	11	
11	8	

INSTRUMENTATION INSTALLATION

COMMENTS

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▽ Groundwater depth on completion of drilling: Dry m.

Scale: 1 : 79

Continued on Next Page

RECORD OF BOREHOLE No. BH301

Project Number: BIGC-ENV-154F | Drilling Location: See Borehole Location Plan | Logged by: SKS

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
	CLAYEY SILT/SILTY CLAY TILL: trace to some sand, trace gravel, brown, moist, stiff to hard	SS	13	67	95	16	169				
	168.00						168				
	SAND: fine grained, trace silt, brown, damp, very dense 16.5	SS	14	92	82	17					
	167.13										
	End of Borehole 17.4										

Notes:
1. Borehole open and dry upon completion of drilling.

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

LAB TESTING: Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading parts per million (ppm) 100 200 300 400; Lower Explosive Limit (LEL) W_P W W_L Plastic Liquid 20 40 60 80

Scale: 1 : 79

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RECORD OF BOREHOLE No. BH/MW201

METRIC 1 OF 1

PROJ. NO. BIGC-ENV-154E | LOCATION 26-38 Hounslow Avenue, Toronto | ORIGINATED BY S.M.

DATUM GEODETIC | BOREHOLE TYPE Continous flight, 8 inches, Hollow Stem Auger | COMPILED BY

PROJ. NAME Preliminary Geotechnical Investigation | DATE 2019.10.02 - 2019.10.02 | 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
183.31											
0.0	**DIRECT DRILL TO 6.1m**										
177.2											
6.1	**CLAYEY SILT TILL:** grey, moist, stiff - trace gravel between 6.1m to 6.71m		1	SS1	10				○		
			2	SS2	14				○		
			3	SS3	10				○		
172.6											
10.7	**SANDY SILT TILL:** trace clay, grey, moist, dense		4	SS4	40				○		
	- silt layers from 12.2m to 12.8m -very dense below 12.2m		5	SS5	100				○		
			6	SS6	36				○		
	- trace gravel between 15.2m to 16.8m		7	SS7	27				○		
	-clayey silt layers		8	SS8	56				○		
165.0											
18.3	**SAND:** brown, damp to moist, very dense		9	SS9	63				○		
162.9			10	SS10	35				○		
20.4	**Borehole terminated at 20.42 m** Notes: 1. Well dry upon completion of drilling 2. Open to 13.3 upon completion of drilling 3. Water level at 13 m (Elev. 170.31 m), taken on October 9, 2019										

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

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RECORD OF BOREHOLE No. BH/MW202

METRIC 1 OF 1

PROJ. NO. BIGC-ENV-154E | LOCATION 26-38 Hounslow Avenue, Toronto | ORIGINATED BY S.M.

DATUM GEODETIC | BOREHOLE TYPE Continous flight, 8 inches, Hollow Stem Auger | COMPILED BY

PROJ. NAME Preliminary Geotechnical Investigation | DATE 2019.10.02 - 2019.10.02 | 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
183.30											
183.2	**ASPHALT:** 25mm		1	SS1	8						
183.2	**GRANULAR:** 150mm										
	FILL: clayey silt, trace gravel, trace brick, brown, moist		2	SS2	18						
181.8											
1.5	**CLAYEY SILT TILL:** trace gravel, oxidized fissures, brown, moist, very stiff		3	SS3	17						
			4	SS4	22						
			5	SS5	27						
	- grey between 4.9m to 5.0m		6	SS6	41						
	- grey, stiff below 6.1m		7	SS7	10						
	- very moist between 7.6m to 9.1m - some stones between 7.6m to 10.7		8	SS8	11						
			9	SS9	11						
172.6											
10.7	**SANDY SILT TILL:** grey, moist, very dense		10	SS10	100						
			11	SS11	100						
170.5											
12.8	**Borehole terminated at 12.8 m** Notes: 1. Well dry upon completion of drilling 2. Open to 10.7m upon completion of drilling 3. Well dry on October 9, 2019										

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

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

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RECORD OF BOREHOLE No. BH/MW203

METRIC 1 OF 1

PROJ. NO. BIGC-ENV-154E LOCATION 26-38 Hounslow Avenue, Toronto ORIGINATED BY S.M.

DATUM GEODETIC BOREHOLE TYPE Continous flight, 8 inches, Hollow Stem Auger COMPILED BY

PROJ. NAME Preliminary Geotechnical Investigation DATE 2019.10.02 - 2019.10.02 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
183.59											
0.0	**DIRECT DRILL TO 6.1m**										
177.5											
6.1	**CLAYEY SILT TILL:** trace gravel, moist, stiff		1	SS1	13				○		
	- moist to very moist between 7.6m to 9.1m		2	SS2	8				○		
			3	SS3	14				○		
172.9											
10.7	**SANDY SILT TILL:** grey, moist, very dense - some gravel between 10.7m to 12.2m		4	SS4	56				○		
170.8			5	SS5	100				○		
12.8	**Borehole terminated at 12.8 m**										

Notes:
1. Well dry upon completion of drilling
2. Open to 12.39m upon completion of drilling
3. Water level at 11.62 m (Elev. 171.97 m), taken on October 9, 2019

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

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BOREHOLE LOG

BH/MW 101

Datum: Geodetic

Client: Mattamy Homes

Project #: BIG-ENV-154

Project Name: Hydrogeological Investigation

Drilling Date: 29/03/17

Site Address: 26-36 Hounslow Avenue, North York, Ontario

DEPTH BELOW GRADE (m)	ELEVATION (m)	STRATIGRAPHY	STRATIGRAPHY DESCRIPTION	SAMPLE ID	TOV (ppm)	N VALUES	RECOVERY (%)	LAB ANALYSIS	MONITORING WELL DETAILS
0	183.31								
	~183.3		**Paving Stones**: 60 mm						
			FILL: silty sand to clayey silt, some to trace gravel, brown, moist	SS1		5	83		
	~182.7		**CLAYEY SILT TILL**: trace gravel, brown, moist, stiff to very stiff						
1				SS2		14	100		
			-----Oxidized fissures						
2				SS3		12	100		
				SS4		24	100		~180.7
3			-----Grey with increasing plasticity below 2.9 m						
				SS5		25	100		
4			-----Wet seam						
5				SS6		14	100		
6				SS7		19	5		
	~176.6		**BH Terminated 6.7 m.** Open to 6.1 m Dry upon completion Water level at 2.62 m on 09/05/17 Water level at 2.63 m on 17/05/17						

BIG_ENVIRONMENTAL BIG-ENV-154.GPJ 30/5/17

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BOREHOLE LOG

BH/MW 102

Datum: Geodetic

Client: Mattamy Homes

Project #: BIG-ENV-154

Project Name: Hydrogeological Investigation

Drilling Date: 29/03/17

Site Address: 26-36 Hounslow Avenue, North York, Ontario

DEPTH BELOW GRADE (m)	ELEVATION (m)	STRATIGRAPHY	STRATIGRAPHY DESCRIPTION	SAMPLE ID	TOV (ppm)	N VALUES	RECOVERY (%)	LAB ANALYSIS	MONITORING WELL DETAILS
0	184.60								
	~184.3		**Topsoil**: 250 mm						
			FILL: clayey silt, trace gravel, organics, organic staining, brown, moist, stiff to very stiff	SS1		2	70		
1				SS2		5	92		
	~183.2		**CLAYEY SILT TILL**: trace gravel, trace organics/organic staining in upper levels, oxidized fissures, brown, moist, stiff to very stiff.						
2				SS3		8	100		
				SS4		25	100		
3				SS5		21	100		
			-----Grey, increasing plasticity below 3.7 m						
4									
				SS6		16	100		
5									
6				SS7		16	100		~178.1
7									
			-----becoming stiff below 7.6 m	SS8		13	100		
8			-----Wet seam at 7.9 m						
9			-----hard below 9.1 m	SS9		28	100		
	~174.8		**BH Terminated 9.8 m.** Open to 9.1 m Dry upon completion Water level at 6.74 m on 09/05/17 Water level at 6.48 m on 17/05/17						

BIG_ENVIRONMENTAL BIG-ENV-154.GPJ 30/5/17

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BOREHOLE LOG

BH/MW 103

Client: Mattamy Homes

Datum: Geodetic

Project Name: Hydrogeological Investigation

Project #: BIG-ENV-154

Site Address: 26-36 Hounslow Avenue, North York, Ontario

Drilling Date: 29/03/17

DEPTH BELOW GRADE (m)	ELEVATION (m)	STRATIGRAPHY	STRATIGRAPHY DESCRIPTION	SAMPLE ID	TOV (ppm)	N VALUES	RECOVERY (%)	LAB ANALYSIS	MONITORING WELL DETAILS
0	183.59								
	~183.5		**Paving Stones**: 60 mm						
	~183.4		**Granular FILL**: 100 mm	SS1		4	70		
			CLAYEY SILT TILL: trace gravel, brown, moist, stiff to very stiff						
1			------ Oxidized Fissures.	SS2		11	100		
2				SS3		16	100		
				SS4		21	100		
3			------ Grey, very stiff to stiff below 3.0 m						
				SS5		18	100		
4									~179.3
				SS6		11	100		
5									
6				SS7		13	100		
	~176.9		-------Wet seam at 6.4 m.						
			BH Terminated 6.7 m. Open to 6.7 m Dry upon completion Water level at 4.22 m on 09/05/17 Water level at 4.34 m on 17/05/17						

BIG_ENVIRONMENTAL BIG-ENV-154.GPJ 30/5/17

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BOREHOLE LOG

BH/MW 104

Datum: Geodetic

Client: Mattamy Homes

Project #: BIG-ENV-154

Project Name: Hydrogeological Investigation

Drilling Date: 01/05/17

Site Address: 26-36 Hounslow Avenue, North York, Ontario

DEPTH BELOW GRADE (m)	ELEVATION (m)	STRATIGRAPHY	STRATIGRAPHY DESCRIPTION	SAMPLE ID	TOV (ppm)	N VALUES	RECOVERY (%)	LAB ANALYSIS	MONITORING WELL DETAILS
0	183.41								
	~183.3		**Paving Stone:** 60 mm						
	~183.2		**Granular:** 170 mm	SS1		7	50		
			POSSIBLE FILL: clayey silt, trace gravel, brown, moist, firm						
	~182.6		**CLAYEY SILT TILL:** trace gravel, brown, damp, stiff to very stiff	SS2		15	50		
1									
			-----oxidized fissures below 1.5 m to 4.6 m	SS3		17	100		
2									
				SS4		29	100		~180.8
3									
				SS5		18	100		
			-----grey below 3.7 m						
4									
			-----moist, stiff below 4.6 m	SS6		10	100		
5			-----wet seam at 5.2 m						
6				SS7		13	83		
7									
			-----very stiff below 7.6 m	SS8		20	100		
8	~175.2		**BH Terminated 8.2 m**						
			Open to 7.6 m						
			Dry upon completion						
			Water level at 2.92 m on 09/05/17						
			Water level at 2.60 m on 17/05/17						

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BOREHOLE LOG

BH/MW 105

Datum: Geodetic

Client: Mattamy Homes

Project #: BIG-ENV-154

Project Name: Hydrogeological Investigation

Drilling Date: 01/05/17

Site Address: 26-36 Hounslow Avenue, North York, Ontario

DEPTH BELOW GRADE (m)	ELEVATION (m)	STRATIGRAPHY	STRATIGRAPHY DESCRIPTION	SAMPLE ID	TOV (ppm)	N VALUES	RECOVERY (%)	LAB ANALYSIS	MONITORING WELL DETAILS
0	184.34								
	~184.2		**Topsoil:** 150 mm						
			POSSIBLE FILL: clayey silt, trace gravel, organics, trace of asphalt, oxidized, brown, moist, soft to stiff	SS1		3	50		
1				SS2		7	100		
				SS3		10	100		
2									
	~182.0		**CLAYEY SILT TILL:** trace gravel, oxidized fissures, brown, moist, very stiff	SS4		22	100		
3				SS5		26	100		
4									
			-----grey, stiff below 4.6 m	SS6		13	100		
5									
6				SS7		14	100		
7									~177.1
			-----very stiff below 7.6 m	SS8		16	100		
8	~176.1		**BH Terminated 8.2 m** Open to 7.6 m Dry upon completion Water level at 7.34 m on 09/05/17 Water level at 7.25 m on 17/05/17						

BIG_ENVIRONMENTAL BIG-ENV-154.GPJ 30/5/17

BROWNFIELD INVESTMENT GROUP INC.
250 Vaughan Valley Boulevard, Unit 2
Vaughan, Ontario L4H 3C3
Telephone: 416-214-4880
Email: info@brownfieldigi.com
Web: www.brownfieldigi.com

BOREHOLE LOG

BH/MW 106

Datum: Geodetic

Client: Mattamy Homes

Project #: BIG-ENV-154

Project Name: Hydrogeological Investigation

Drilling Date: 01/05/17

Site Address: 26-36 Hounslow Avenue, North York, Ontario

DEPTH BELOW GRADE (m)	ELEVATION (m)	STRATIGRAPHY	STRATIGRAPHY DESCRIPTION	SAMPLE ID	TOV (ppm)	N VALUES	RECOVERY (%)	LAB ANALYSIS	MONITORING WELL DETAILS
0	184.50								
	~184.4		**Topsoil:** 100 mm						
			POSSIBLE FILL: clayey silt, trace gravel, organics, rootlets, brown, moist, firm to stiff	SS1		5	40		
1				SS2		13	100		
	~183.0								
			CLAYEY SILT TILL: trace gravel, oxidized, mottled brown, moist, very stiff	SS3		19	100		
2				SS4		17	100		
3				SS5		18	100		
4									
			-----grey below 4.6 m	SS6		16	100		
5									
6			-----stiff below 6.1 m	SS7		11	100		~178.1
7									
			-----very stiff below 7.6 m	SS8		16	100		
8	~176.3								
			BH Terminated 8.2 m Open to 7.6 m Dry upon completion Water level at 6.93 m on 09/05/17 Water level at 6.43 m on 17/05/17						

BIG_ENVIRONMENTAL BIG-ENV-154.GPJ 30/5/17

BROWNFIELD INVESTMENT GROUP INC.
250 Vaughan Valley Boulevard, Unit 2
Vaughan, Ontario L4H 3C3
Telephone: 416-214-4880
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BOREHOLE LOG

BH/MW 107

Datum: Geodetic

Client: Mattamy Homes

Project #: BIG-ENV-154

Project Name: Hydrogeological Investigation

Drilling Date: 01/05/17

Site Address: 26-36 Hounslow Avenue, North York, Ontario

DEPTH BELOW GRADE (m)	ELEVATION (m)	STRATIGRAPHY	STRATIGRAPHY DESCRIPTION	SAMPLE ID	TOV (ppm)	N VALUES	RECOVERY (%)	LAB ANALYSIS	MONITORING WELL DETAILS
0	184.77								
	~184.6		**Topsoil: 150 mm**						
			POSSIBLE FILL: clayey silt, trace gravel, organics, brown, moist, soft	SS1		3	90		
	~184.0								
1			**CLAYEY SILT TILL:** trace gravel, mottled brown, damp, stiff	SS2		13	90		
			-----oxidized below 1.5 m to 4.6 m, hard	SS3		36	100		
2									
			-----very stiff to hard below 2.3 m	SS4		30	100		~182.1
3			-----very stiff below 3.1 m	SS5		23	100		
4									
			-----grey below 4.6 m	SS6		16	100		
5									
6			-----stiff below 6.1 m	SS7		13	100		
7									
8				SS8		14	100		
	~176.5		**BH terminated 8.2 m** Open to 7.6 m Dry upon completion Water level at 4.80 m on 09/05/17 Water level at 2.70 m on 17/05/17						

BIG_ENVIRONMENTAL BIG-ENV-154.GPJ 30/5/17

RECORD OF BOREHOLE 1

Project No.: T16650 CLIENT: Mattamy Development Corp. ORIGINATED BY: M.Z.

DATE: July 15, 2016 LOCATION: 26 Hounslow Avenue, Toronto, ON COMPILED BY: M.Z.

DATUM: N/A BOREHOLE TYPE: Solid Stem Auger CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	"N" VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0		Ground Surface										
	0	**Paving Stone**								5		
-0.3		**Granular Fill**										
		stiff		1	SS	25	14			12		
		very stiff		2	SS	30	27			12		
	1	brown **Clayey Sandy Silt Till** occ. oxidized fissures damp tp moist, hard		3	SS	30	31			13		
	2	trace fine sand seams		4	SS	30	34			12		
	3			5	SS	35	33			12		
	4	grey moist, very stiff		6	SS	28	21			14		
	5											
	6	damp to moist		7	SS	41	24			13		
	7											

RECORD OF BOREHOLE 1

Project No.: T16650 CLIENT: Mattamy Development Corp. ORIGINATED BY: M.Z.

DATE: July 15, 2016 LOCATION: 26 Hounslow Avenue, Toronto, ON COMPILED BY: M.Z.

DATUM: N/A BOREHOLE TYPE: Solid Stem Auger CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	"N" VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	grey **Clayey Sandy Silt Till** occ. oxidized fissures damp to moist, very stiff		8	SS	41	27			13		
	9	occ. sand seams		9	SS	35	23			11		
	10	damp, hard		10	SS	46	59			10		
-10.4		**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry										
	11											
	12											
	13											
	14											
	15											

RECORD OF BOREHOLE 2

Project No.: T16650 CLIENT: Mattamy Development Corp. ORIGINATED BY: M.Z.

DATE: July 15, 2016 LOCATION: 28 Hounslow Avenue, Toronto, ON COMPILED BY: M.Z.

DATUM: N/A BOREHOLE TYPE: Solid Stem Auger CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	"N" VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0		Ground Surface										
-0.2	0	**Paving Stone**								4		
		Granular Fill		1	SS	41	5			15		
		brown **Clayey Sandy Silt Fill** occ. topsoil, occ. organic stains damp										
-0.9	1	brown **Clayey Sandy Silt Till** occ. oxidized fissures damp, very stiff		2	SS	30	15			15		
	2			3	SS	25	20			13		
				4	SS	30	26			13		
	3			5	SS	35	27			13		
	4	grey moist, stiff		6	SS	30	13			15		
-5.2	5	stiff		7	SS	35	14			13		
	6	grey **Clayey Silt Till** damp, very stiff		8	SS	46	20			11		
	7											

RECORD OF BOREHOLE 2

Project No.: T16650 CLIENT: Mattamy Development Corp. ORIGINATED BY: M.Z.

DATE: July 15, 2016 LOCATION: 28 Hounslow Avenue, Toronto, ON COMPILED BY: M.Z.

DATUM: N/A BOREHOLE TYPE: Solid Stem Auger CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	"N" VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	grey **Clayey Silt Till** damp, very stiff		9	SS	10	21			12		
	9			10	SS	25	25	July 15, 2016		12		
-9.8												
	10	grey **Clayey Sandy Silt Till** damp, hard		11	SS	41	64			8		
-10.4		**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: 9.9m										
	11											
	12											
	13											
	14											
	15											

RECORD OF BOREHOLE 3

Project No.: T16650 CLIENT: Mattamy Development Corp. ORIGINATED BY: M.Z.

DATE: July 15, 2016 LOCATION: 36 Hounslow Avenue, Toronto, ON COMPILED BY: M.Z.

DATUM: N/A BOREHOLE TYPE: Solid Stem Auger CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

SOIL PROFILE				SAMPLES					DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	"N" VALUES	GROUND WATER CONDITIONS				
0.0		Ground Surface										
	0	**Paving Stone**								2		
-0.3		**Granular Fill**		1	SS	43	8			10		
		mottled brown **Sandy Silt Fill** some clay, occ. gravel some organic stains, damp										
-0.7										2		
	1	**Granular Fill**		2	SS	25	10					
-1.4												
		mottled brown **Sandy Silt Fill** occ. rootlets, some stone fragments damp								16		
-1.9				3	SS	33	18			13		
	2	brown **Clayey Sandy Silt Till** occ. oxidized fissures damp, very stiff										
				4	SS	35	28			11		
	3											
				5	SS	35	29			13		
	4											
		grey trace sand seams moist, hard		6	SS	30	40			14		
	5	damp to moist						July 15, 2016				
	6	sand interbeddings		7	SS	35	27			11		
		damp, very stiff										
	7											

RECORD OF BOREHOLE 3

Project No.: T16650 CLIENT: Mattamy Development Corp. ORIGINATED BY: M.Z.

DATE: July 15, 2016 LOCATION: 36 Hounslow Avenue, Toronto, ON COMPILED BY: M.Z.

DATUM: N/A BOREHOLE TYPE: Solid Stem Auger CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
83 Citation Dr, Unit 9,
Vaughan, Ontario, L4K 2Z6

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	"N" VALUES	GROUND WATER CONDITIONS
	8	grey **Clayey Sandy Silt Till** damp, hard		8	SS	25	34	
	9	damp to moist very stiff		9	SS	46	24	
-10.4	10	damp, hard		10	SS	46	67	
	11	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: 5.2m						
	12							
	13							
	14							
	15							

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
▲ 20 40 60 80 100 ▲

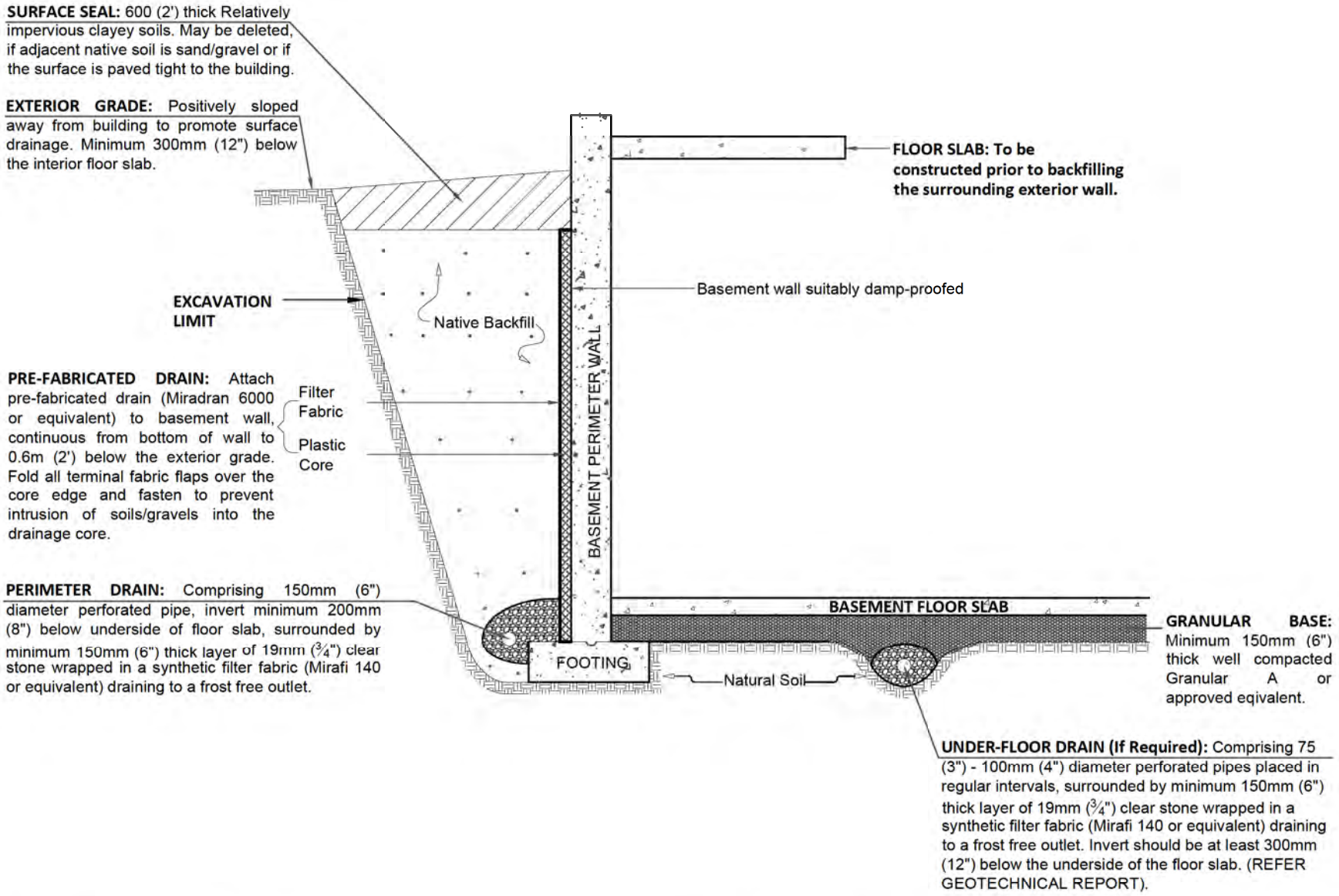
WATER CONTENT (%)
5 15 25 35

8
12
9

MONITORING WELL

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Appendix E – Permanent Perimeter & Under-floor Drainage Systems



B.I.G. CONSULTING INC.

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Mississauga, ON L4W 2Z4
Canada

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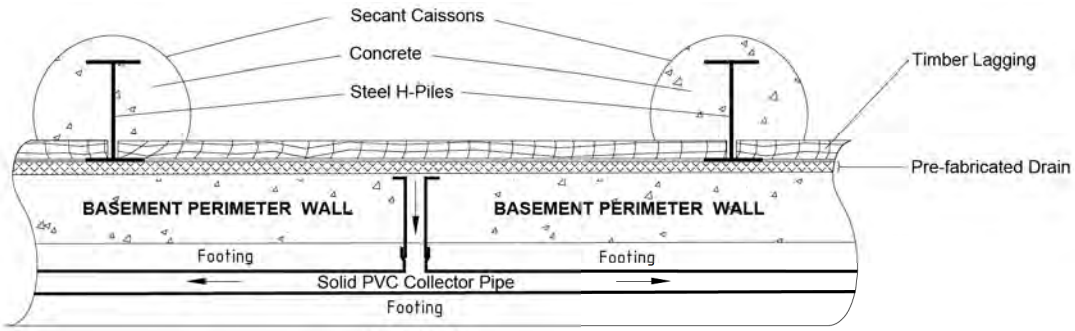
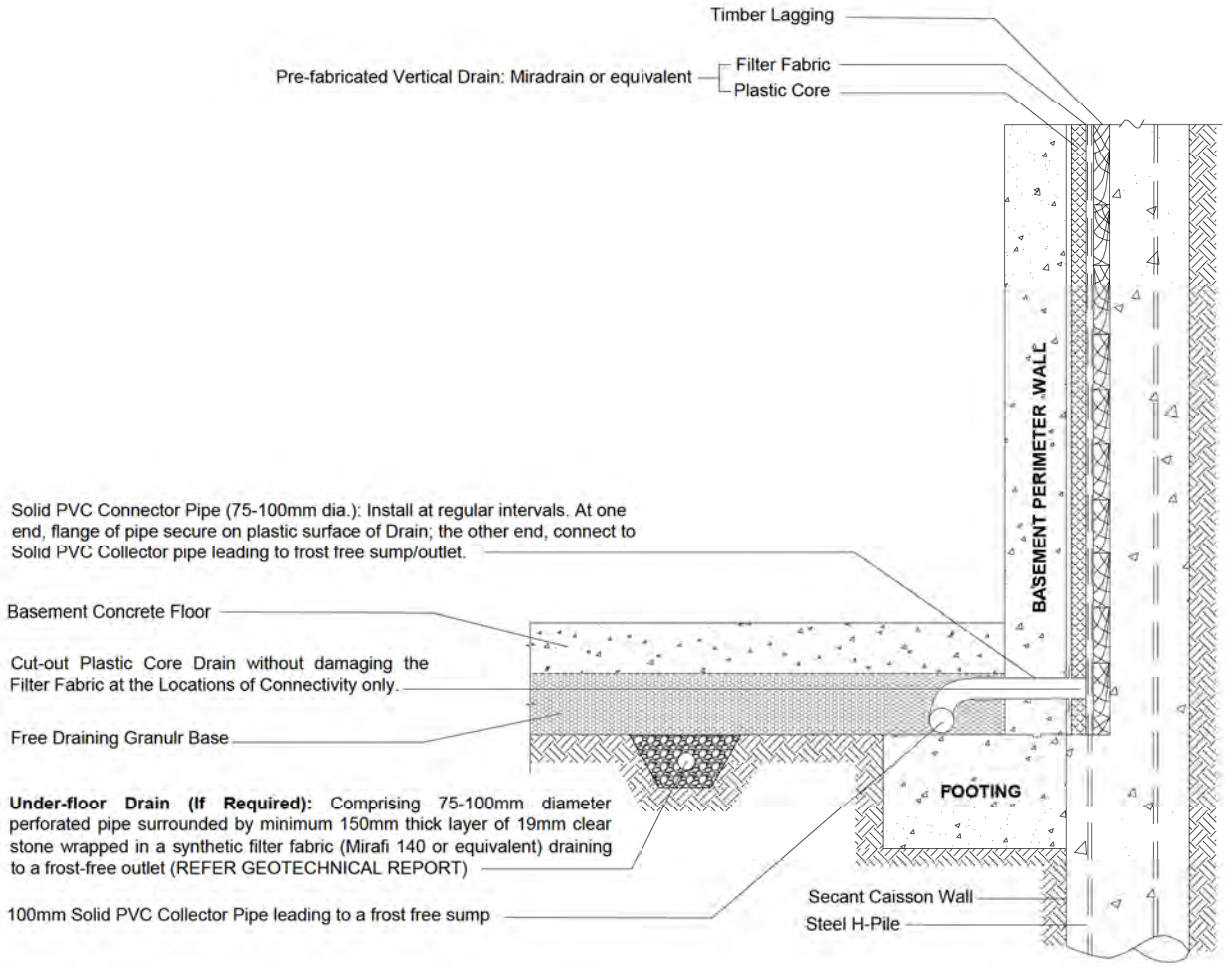
TITLE AND LOCATION

PERMANENT PERIMETER & UNDER-FLOOR DRAINAGE SYSTEM
UPDATED GEOTECHNICAL INVESTIGATION
26-38 HOUNSLOW AVENUE, TORONTO, ONTARIO

PROJECT NO.	DWN.
BIGC-GEO-154H	E.P.
SCALE	CK.
AS NOTED	O.L.
DATE	FIG NO.
MARCH 2024	7



PLAN



TYPICAL SECTION

Note:

1. A continuous blanket of prefabricated drainage system, Miradrain 6000 or ecuivalent, should extend continuously from the top of footings to approximately 1.2m below the ground surface.
2. All terminal end openings (top, bottom & sides) of drain must be covered with terminal fabic flaps and fasten to prevent intrusion of concrete and soils into the drainage core.
3. All surface joints of the Miradrain should be sealed with tape.
3. The backfill materials behind the lagging should be free draining. If wet conditions are encountered, geotextile filter fabric or straw should be used to prevent loss of ground.
4. Subfloor drainage system (if required) should keep/treat separate from the perimeter drainage system.

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TITLE AND LOCATION

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UPDATED GEOTECHNICAL INVESTIGATION
26-38 HOUNSLOW AVENUE, TORONTO, ONTARIO

PROJECT NO.	DWN.
BIGC-GEO-154H	E.P.
SCALE	CK.
AS NOTED	O.L.
DATE	FIG NO.
MARCH 2024	8