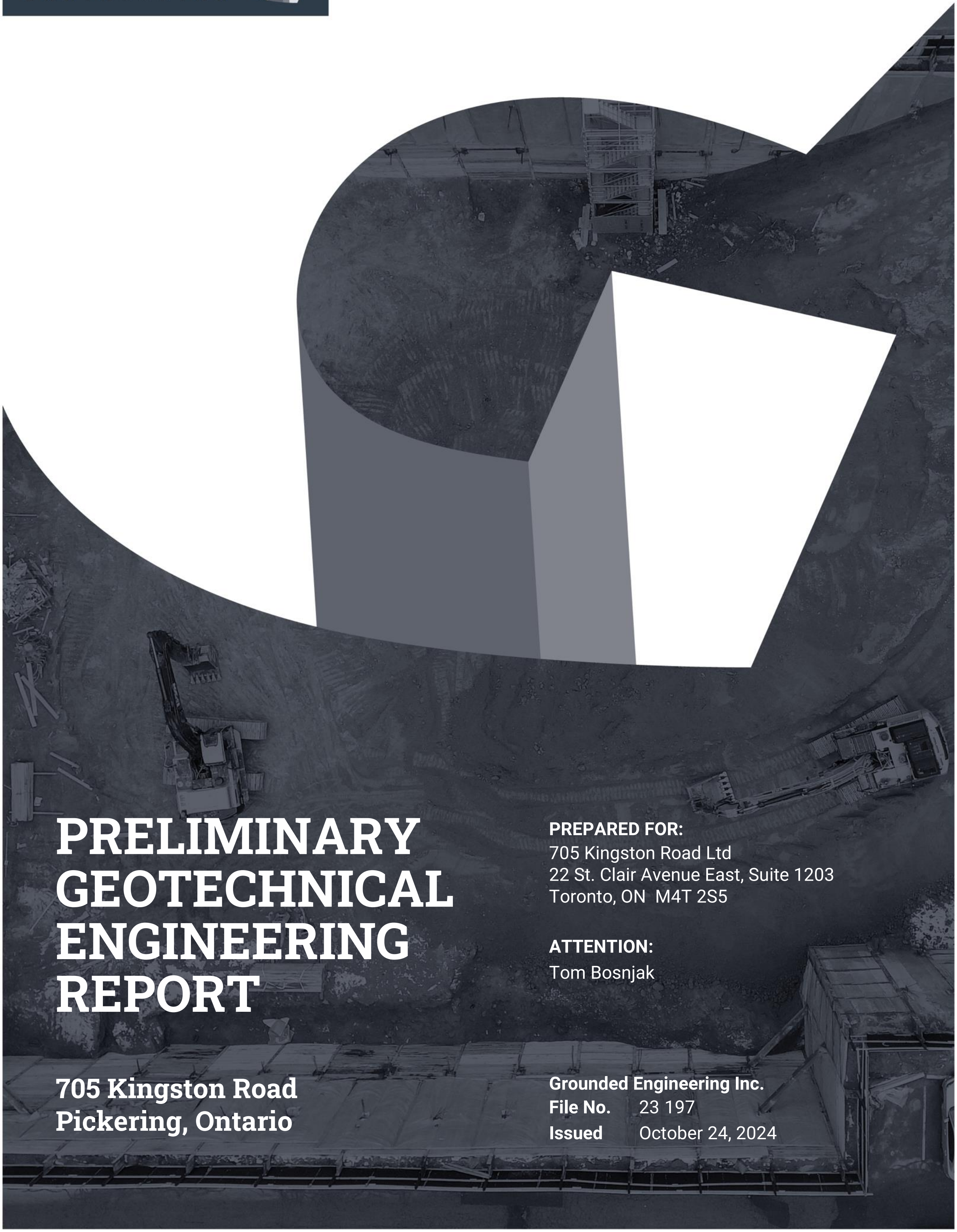

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

705 Kingston Road
Pickering, Ontario

PREPARED FOR:
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Grounded Engineering Inc.
File No. 23 197
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APPENDICES

1 Introduction

705 Kingston Road Ltd has retained Grounded Engineering Inc. to provide geotechnical engineering design advice for their proposed development at 705 Kingston Road, in Pickering, Ontario.

The proposed project includes constructing five (5) residential towers (ranging from 28 to 35 storeys) with 4-storey podiums, resting on two (2) basement levels and one (1) parking level under the whole site, set at a lowest Finished Floor Elevation (FFE) of 95.5± m.

Grounded has been provided with the following reports and drawings to assist in our geotechnical scope of work:

- Site survey, prepared by Speight, Van Nostrand & Gibson Limited (Nov. 7, 2023).
- Architectural Drawings, “705 Kingston Road”; Project 21057, dated September 4, 2024, prepared by Quadrangle Architects Limited. (Updated September 5, 2024)
- Phase II ESA, “Phase II ESA at 705 Kingston Road, Pickering, Ontario”, Project Number BRM-00011934-A0, dated July 11, 2011, prepared by EXP Services Inc.
- Phase II Environmental Site Assessment, “705 Kingston Road, Pickering, Ontario”, Project Number 12699-001, dated June 25, 2021, prepared by Cambium Inc.

Grounded has been provided with factual borehole information for the subject site from other consultants as listed above. Those borehole logs are provided in a report signed and sealed by professional engineers. As such, this borehole information (appended) is taken as factual for present purposes. Unless noted, borehole labels appended with “EXP-” and “CMB-” refer to EXP’s and Cambium’s boreholes, respectively.

705 Kingston Road Ltd has retained Grounded Engineering Inc. to provide preliminary geotechnical engineering design advice, in accordance with the City of Pickering Terms of Reference for Geotechnical Study, for their proposed development at 705 Kingston Road, in Pickering, Ontario. The level of study presented in this report is consistent with the requirements for a Zoning Bylaw Amendment, Plan of Subdivision, Consent to Server, or Site Plan Control application. Additional boreholes, in-situ testing, and a detailed geotechnical engineering report will be required for detailed design and building permit purposes.

Grounded’s subsurface investigation of the site to date includes nine (9) boreholes (Boreholes 101 to 106 and 201 to 203).

Boreholes 101 to 106 were advanced from October to November 2023. A total of nine (9) monitoring wells (including nested shallow and deep wells respectively differentiated by the suffixes “-S” and “-D” in this report and the borehole logs) were install in the boreholes. Four of the monitoring wells (101, 103, 104-D, and 105-D) were decommissioned as elevated concentrations of methane were observed to be emitting from each of them.

Boreholes 201 to 203 were advanced March 2024. A total of three (3) monitoring wells were installed in these boreholes.

2 Ground Conditions

The borehole results are detailed on the attached borehole logs. Our assessment of the relevant stratigraphic units is intended to highlight the strata as they relate to geotechnical engineering. The ground conditions reported here will vary between and beyond the borehole locations.

The stratigraphic boundary lines shown on the borehole logs are assessed from non-continuous samples supplemented by drilling observations. These stratigraphic boundary lines represent transitions between soil types and should be regarded as approximate and gradual. They are not exact points of stratigraphic change.

Elevations are measured relative to geodetic datum (as established on the site survey). Approximate referenced elevations of boreholes by EXP and Cambium are taken from the site survey for discussion purposes as they were not formally reported to a geodetic datum in their respective reports. The horizontal coordinates are provided relative to the Universal Transverse Mercator (UTM) geographic coordinate system.

The existing ground surface generally slopes from Elev. 105± m in the northwest to Elev. 98± m in the southeast.

2.1 Stratigraphy

The following stratigraphy summary is based on the borehole results and the geotechnical laboratory testing. Our findings are generally consistent with those reported by the other consultants. EXP and Cambium boreholes identify a cohesionless deposit of sandy silt that is not identified as a glacial till, but has a similar composition as the sandy silt till deposit encountered in boreholes advanced by Grounded.

A subsurface profile showing stratigraphy and engineering units is appended and includes the relevant borehole and well information from the other consultants.

2.1.1 Surficial and Earth Fill

Surficial fill (pavements, aggregate, topsoil, etc.) thicknesses were observed in individual borehole locations through the top of the open borehole. Thicknesses may vary between and beyond each borehole location.

Boreholes 101 to 103, 105, 106 and 201 to 203 encountered a 25 to 100 mm thick asphalt pavement structure at ground surface. Borehole 102, 202 and 203 further encountered 15 to 25 mm of aggregate below the asphalt. Borehole 104 encountered a 190 mm thick concrete pavement structure at ground surface.

Underlying the surficial materials, the boreholes observed a layer of earth fill that extends to depths of 0.6 to 2.3 m below grade (Elev. 104.2 to 95.8 m). The earth fill varies in composition but generally consists of sands and silts with some gravel and trace clay. It contains brick fragments, rock fragments, asphalt fragments, and rootlets. The earth fill varies from brown to grey across the site and is typically moist. Due to inconsistent placement and the inherent heterogeneity of earth fill materials, the relative density of the earth fill varies.

2.1.2 Sandy Silt Till

Underlying the fill materials, all the Grounded boreholes encountered an undisturbed native glacial till deposit with a matrix of cohesionless sandy silts. This unit was encountered at depths of 0.6 to 2.3 m below grade (Elev. 104.2 to 95.8 m) and extends down to depths of 9.1 to 10.7 m below grade (Elev. 95.9 to 89.0 m).

Boreholes 106, 201 and 203 were terminated within this layer at target depths of 6.2 to 9.4 m (Elev. 95.1 to 91.7m) below existing grade.

The sandy silt till generally transitions from brown to grey at a depth of 1.6 to 4.6 m and is generally moist. Boreholes 102, 202 and 203 encountered wet soils at depths of 4.6 to 7.6 m (Elev. 96.5 to 96.0m) below existing grade. It contains occasional seams of silty sand to sand and rock fragments inferring cobbles.

Standard Penetration Test (SPT) results (N-Values) measured in the sandy silt till unit range from 34 to over 50 blows per 300 mm of penetration (“bpf”), indicating a relative density ranging from dense to very dense.

2.1.3 Clayey Silt Till

Underlying the sandy silt till, Boreholes 101 to 105 and 202 encountered an undisturbed native glacial till deposit with a matrix of cohesive clayey silts with variable sand contents (some sand to sandy). This unit was encountered at depths of 9.1 to 10.7 m below grade (Elev. 95.9 to 89.0 m). It is generally grey and moist.

Within the clayey silt till, Boreholes 101 to 104 encountered a more plastic silt and clay to clayey silt deposit. This unit was encountered at depths of 13.7 to 15.2 m below grade (Elev. 87.2 to 82.9 m) and extends down to depths of 15.2 to 18.3 m below grade (Elev. 84.8 to 82.3 m). It is generally grey and moist.

Boreholes 101 to 105 and 202 were terminated within this layer, at target depths of 10.9 to 21.6 m (Elev. 93.2 to 80.8 m) below existing grade.

SPT N-values measured in the clayey silt till range from 26 to over 50 bpf (very stiff to hard) while SPT N-values measured in the more plastic silt and clay deposit range from 18 to 49 (stiff to hard).

2.2 Groundwater

The depth to groundwater and caved soils was measured in each of the boreholes immediately following the drilling. On completion of drilling, the boreholes were filled with drill fluid (from mud rotary drilling) and cased, therefore, measuring the unstabilized groundwater level and cave after drilling was not practical.

Monitoring wells were installed in each of the boreholes, and additional shallow nested wells were installed at select borehole locations. Four of the monitoring wells (101, 103, 104-D, and 105-D) were decommissioned as elevated concentrations of methane were observed to be emitting from each of them. Stabilized groundwater levels were measured in each of the Grounded monitoring wells and any of the other consultant wells that could be located. The groundwater observations are shown on the Borehole Logs and are summarized as follows.

Borehole No.	Monitoring Well depth (m)	Strata Screened	Water Level in Well, highest (m)	
			Date	Depth/Elev.
101	21.3	Clayey Silt Till	2023-10-23	10.8 / 91.6
102-D	15.2	Clayey Silt Till / Silt and Clay	2024-10-08	3.5/ 97.1
102-S	6.1	Sandy Silt Till	2024-10-08	1.3 / 99.3
103	15.2	Clayey Silt Till / Silt and Clay	2023-10-19	Dry
104-D	15.2	Clayey Silt Till / Silt and Clay	2023-10-20	13.1 / 86.5
104-S	5.2	Fill / Sandy Silt Till	2024-10-08	1.8 / 97.8
105-D	15.2	Clayey Silt Till	2023-10-19	6.1 / 98.9
105-S	9.1	Sandy Silt Till	2024-10-08	1.9 / 103.1
106	6.7	Sandy Silt Till	2024-10-08	1.3 / 97.3
201	9.1	Sandy Silt Till	2024-10-08	7.1 / 97.4
202	10.7	Sandy Silt Till	2024-10-08	3.8 / 100.3
203	6.1	Sandy Silt Till	2024-10-08	0.04 / 101.0
EXP-BH/MW101	6.1	Silt Till	2011-06-16	Dry
EXP-BH/MW102	6.1	Silt Till	2011-06-16	Dry
EXP-BH/MW103	6.1	Silty Sand	2011-06-16	1.9 / 96.5
CMB-BH101	5.2	Sandy Silt	2021-06-08	Dry
CMB-BH102	6.1	Sandy Silt	2021-06-08	2.2 / 101.4
CMB-BH103	4.6	Sandy Silt	2023-10-19	2.2 / 97.6

CMB-BH104	4.6	Fill / Sandy Silt	2021-06-08	1.7 /96.6

Groundwater levels fluctuate with time depending on the amount of precipitation and surface runoff, and may be influenced by known or unknown dewatering activities at nearby sites.

The groundwater table varies with the elevation of the site. At the northwest portion of the site, the groundwater table was observed to be as high as Elev. 103± m. It slopes down to Elev. 96± m in the east-southeast portion of the site. The sandy silt till has a relatively low permeability and will yield only minor seepage in the long term. There is also groundwater in the lower clayey silt till. This deposit also has a lower permeability and will also yield only minor seepage in the long term.

Grounded has prepared a hydrogeological report for this site (File No. 23-197).

2.3 Corrosivity and Sulphate Attack

Three (3) soil samples were submitted for corrosivity testing parameters (pH, Resistivity, Electrical Conductivity, Redox Potential, Sulphate, Sulphide and Chloride). The Certificate of Analyses and interpretation sheet is appended.

The soil samples were analysed for soluble sulphate concentration and compared to the Canadian Standard CAN3/CSA A23.1-M94 Table 3, *Additional Requirements for Concrete Subjected to Sulphate Attack*. Corrosivity parameters are also used for assessing soil corrosivity applicable to cast iron alloys, according to the 10-point soil evaluation procedure described in the American Water Work Association (AWWA) C-105-18 standard[1].

The analytical results only provide an indication of the potential for corrosion. The results of this analysis are in reference to only the soil samples collected from specific locations, and soil chemistry may vary between and beyond the locations of the analysed samples. In summary:

- All of the samples have negligible sulphate concentrations.
- All of the samples scored less than 10 points and corrosion protective measures are therefore not recommended for cast iron alloys.

2.4 Pressuremeter Testing

In situ pressuremeter testing (PMT) was conducted by Grounded Engineering using an N-size Texam Pressuremeter. Our equipment is lab calibrated before every project, and field calibrated on each day of field testing. The raw data is corrected for membrane stiffness and system volume loss to obtain a corrected plot of probe pressure versus change in probe volume, from which we

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[1] ANSI/AWWA C105/A21.5-18, Appendix A

obtain a pressuremeter modulus. Calibrations and data correction are in accordance with ASTM D4719. The field test data are appended.

The PMT modulus is converted to an equivalent Young's modulus using the following simplified relationship:

$$\boldsymbol{E_{PMT}} \,/\, \alpha = \boldsymbol{E}$$

E_{PMT} = Pressuremeter Modulus (MPa)
α = Menard Factor (unitless)
E = Young's Modulus (MPa)
E_{ur} = Young's Modulus, unload-reload (MPa)

Alpha is interpreted using a first principles derivation which assumes the soil around a pressuremeter behaves according to the general orthotropic elastic equations. This is compared to the results given by the Menard table and the Pressiorama chart, as well as the methods for PMT Young's Modulus interpretation outlined by Mair and Wood[2] and others. As such, the Young's Modulus reported is interpreted based on engineering judgement for present purposes.

The detailed pressuremeter test results are appended, and the estimated Young's Modulus results are also shown on the attached Borehole Logs and Subsurface Profile. The test results are summarized as follows:

Borehole	Depth of Test (m)	Elevation of Test (m)	E (MPa)	E_{ur} (MPa)	Engineering Unit
101	11.4	91.0	102	175	Clayey Silt Till
101	14.5	87.9	127	220	Clayey Silt Till
101	17.5	84.9	67	129	Silt and Clay

A measurement of the lateral earth pressure coefficient (K_0) is also made directly from the PMT data. This measurement likely represents $K_{0\text{-OCR}}$ and not the real design K_0 values (in the unload-reload condition for example), as reported by many including Alpan[3], Hamouche et al.[4], and Mayne and Kulhawy[5]. It is also heavily affected by borehole disturbance in the pre-bored PMT application (Mair and Wood). This data is appended for regulatory review purposes only.

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[2] Mair, R.J. and Wood, D.M. (1987) Pressuremeter Testing: Methods and interpretation, CIRIA/Butterworths, London.

[3] Alpan, I. (1967) The Empirical Evaluation of the Coefficient K_0 and K_{0R}

[4] Hamouche, K.K., Leroueil, S., Roy, M., and Lutenegger, A.J. (1995) In Situ Evaluation of K_0 in Eastern Canada Clays, in *Can Geotech J. **32**: 677-688.*

[5] Mayne, P.W., and Kulhawy, F.H. (1982) K_0-OCR Relationships in Soil, in *Journal ASCE, **108** (GT6), 851-72.*

3 Preliminary Geotechnical Engineering Recommendations

Based on the factual data summarized above, preliminary geotechnical engineering recommendations are provided. These preliminary recommendations must be supplemented and confirmed by additional boreholes, wells, and a detailed geotechnical engineering report at the detailed design stage.

This report assumes that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards, and guidelines of practice. If there are any changes to the site development features, or there is any additional information relevant to the interpretations made of the subsurface information with respect to the geotechnical analyses or other recommendations, then Grounded should be retained to review the implications of these changes with respect to the contents of this report.

3.1 Preliminary Foundation Design Parameters

The proposed project includes constructing five (5) residential towers (ranging from 28 to 35 storeys) with 4-storey podiums, all resting on two (2) basement levels and one (1) parking level, set at a lowest Finished Floor Elevation (FFE) of 95.5± m.

The following foundation options have been considered in our analysis.

- Conventional spread footings
- Preliminary raft foundation

3.1.1 General Foundation Recommendations

It will be necessary to dewater the site to a minimum 1.2 m below the lowest excavation elevation prior to excavation to preserve the in situ integrity of the native soils. If the subsurface is not dewatered prior to excavation, the native soils will become disturbed by the ingress of groundwater and the recommendations for bearing capacity below will not be valid.

Footings stepped from one elevation to another should be offset at a slope not steeper than 7 vertical to 10 horizontal. This requirement exists to avoid undermining adjacent footings at the higher elevation.

The lowest levels of unheated underground parking structures two or more levels deep are, although unheated, still warmer than typical outdoor winter temperatures in the Greater Toronto Area. Interior foundations with 900 mm of frost cover perform adequately, as do perimeter foundations with 600 mm of frost cover. Where foundations are next to ventilation shafts or are exposed to typical outdoor temperatures, 1.2 m of earth cover (or equivalent insulation) is required for frost protection.

The founding subgrade must be cleaned of all unacceptable materials and approved by Grounded prior to pouring concrete for the footings. Such unacceptable materials may include disturbed or caved soils, ponded water, or similar as indicated by Grounded during founding subgrade inspection. During the winter, adequate temporary frost protection for the footing bases and concrete must be provided if construction proceeds during freezing weather conditions.

3.1.2 Spread Footings

Foundations made for the proposed P1 level will bear on undisturbed very dense or hard glacial till below Elev. 95.5 m. Conventional spread footings made to bear on this soil may be designed using a maximum factored geotechnical resistance at ULS of 900 kPa. The maximum geotechnical reaction at SLS is 700 kPa, for an estimated total settlement of 25 mm.

The capacities provided above is based on an individual spread footing foundations that are 1.0 to 3.5 m wide and embedded a minimum of 1.0 m below FFE. These requirements apply in conjunction with the above recommended geotechnical resistance regardless of loading considerations. The geotechnical reaction at SLS refers to an estimated settlement which for practical purposes is linear and non-recoverable. Differential settlement is related to column spacing, column loads, and footing sizes. Spread footings spaced less than 1 times the width of the footing may be subject to additional settlement cause by group effects and must be reviewed by Grounded.

These parameters are based only on a preliminary geotechnical investigation. They must be supplemented and confirmed by additional boreholes, wells, and a detailed geotechnical engineering report at the detailed design stage.

3.1.3 Raft Foundation

For the following preliminary raft foundation discussion, a raft underlying Building 2 is considered. Considering a lowest P1 FFE of 95.5± m, it is assumed that a raft would be founded around 1.5 m lower (Elev. 94.0± m), on very dense cohesionless till.

The preliminary raft design parameters assume a uniform load at the base of the raft. In reality, *raft loads are non-uniform*; they are typically highest at the core and lowest at the perimeter. The preliminary parameters below are provided as the initial step in determining raft feasibility (a structural task). The detailed design process is described below.

Bulk excavation to underside of raft elevation (Elev. 94± m) will induce a reduction in effective stress of about 75 kPa, which is the unload stress. Utilizing preliminary/measured soil stiffness parameters, analysis of a uniformly loaded raft foundation shows that a uniform total applied SLS bearing pressure of 170 kPa (incorporating a 0.9 factor as per the CFEM 5th edition) at the base of the raft will generate an estimated 25± mm of settlement. Similarly, a uniform geotechnical reaction at SLS of 300 kPa will generate an estimated 50± mm of settlement.

The modulus of subgrade reaction for design of a raft slab is a function of the size of the raft, the applied load, and whether loading is within the recompression range or the virgin range. On the basis of our preliminary stiffness parameters and the assumption of uniform raft loading, the preliminary moduli of subgrade reaction appropriate for 17.5 x 43± m raft design at this site is 5,000 kPa/m.

These parameters are based on assumed Young's Moduli (virgin and unload-reload) for some of the load-bearing strata, and can likely be improved by additional in situ testing of the Young's Modulus within the critical portions of the zone of influence of the raft, in additional boreholes.

The maximum factored geotechnical resistance of the Building 2 raft foundation at ULS is 2,000 kPa.Detailed raft design is an iterative process between the structural and the geotechnical engineer. Once a draft structural design is completed by the structural engineer, the resulting non-uniform raft pressure distribution is provided to us (typically as a contour plot of SLS pressures). Grounded then models that non-uniform pressure distribution to more accurately estimate the settlement at each point under the raft. The resulting estimated settlement distribution is then sent back to the structural engineer to assess the total and differential settlements under the raft, as well as lateral impacts on adjacent footings and structures. The structural design is then modified as required.

During construction, the subgrade at founding elevation should be cut neat, inspected, and immediately protected by a mud slab (lean concrete) to provide a working surface. The subsurface must not be proof rolled as this activity would further weaken these soils. The raft slab is then constructed on top of the mud slab. Prior to pouring the mud mat and foundation, the foundation subgrade must be cleaned of all deleterious materials such as softened, disturbed or caved materials, or standing water. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the raft foundation base and concrete must be provided.

Differential settlement is related to real non-uniform raft load distribution and must be assessed as part of the detailed design process. Impacts to adjacent structures caused by settlement within the raft's lateral zone of influence will also need to be reviewed by the structural engineer.

Tiedown Anchors for Rafts

If deemed necessary by the structural engineer, micropile tiedowns can be designed to resist uplift. One or more prototype anchors must be performance-tested to demonstrate the anchor capacity and validate design assumptions for these permanent tiedowns, per OPSS 942.07.12.05.02.

In the very dense / hard subgrade below founding elevation, post-grouted micropile ground anchors in tension can be designed using a maximum factored geotechnical resistance at ULS of 70 kN/m of adhered anchor length (at a nominal diameter of 150 mm). This capacity is provided assuming that a site-specific tension load test is performed, implying a resistance factor of 0.6. Following the load test, the micropile capacity can be re-evaluated and potentially improved.

Micropile anchors are made with high-strength hot-rolled threadbar conforming to ASTM A615 or CSA G30.18. For permanent installations they should be made within grouted HDPE corrugated sheaths to provide "double corrosion protection". Industry-standard grout cover may be used as a corrosion protection mechanism, subject to a review of the corrosivity and sulphate attack data.

Helical pile anchors are also feasible, subject to consultation from the design-build contractor. The project geotechnical information should be provided to a specialist design/build contractor to assess the feasibility of this foundation system and to determine probable helical pile refusal/installation depths. Adequate corrosion protection must be provided.

In addition to designing the anchors for grout-soil adhesion capacity, as a second uplift check, tie-down anchors must also be designed to a depth sufficient to engage the necessary bulk unit weight of soil and/or rock. Soil anchors are made to engage a 30-45 degree cone of soil per anchor, measured from vertical[6]. The anchor spacing and overlapping zones of influence must be considered. A typical detail is appended.

3.2 Seismic Site Classification

The Ontario Building Code (2012) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration, and the site classification.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the 30 metres of the site stratigraphy below spread footing/grade beam elevation, where shear wave velocity (v_s) measurements have been taken. Alternatively, the classification is estimated from the rational analysis of undrained shear strength (s_u) or penetration resistance (N-values) according to the OBC and National Building Code of Canada.

Below the nominal founding elevations of 94.5 ± m and 94.0 m for spread footings and raft foundations respectively, the boreholes observe very dense cohesionless till, and/or hard cohesive till. The cohesionless till has average N values of over 50 blows per 300 mm penetration, while the underlying cohesive till has an average undrained shear strength greater than 100 kPa. Based on this information, the site designation for seismic analysis is **Class C**, per Table 4.1.8.4.A of the Ontario Building Code (2012). Tables 4.1.8.4.B and 4.1.8.4.C. of the same code provide the applicable acceleration- and velocity-based site coefficients.

We have estimated the site designation based on quantitative analysis of penetration resistance (N-values) with assumed N-values for the soil stratigraphy beyond the investigation depth. Site-

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[6] FHWA. "Geotechnical Engineering Circular No. 4, Ground Anchors and Anchored Systems." Publication No. FHWA-IF-99-015, June 1999, Figure 54.

specific Multichannel Analysis of Surface Waves (MASW) testing is expected to be required in the next version of the OBC, anticipated in January 2025.

3.3 Earth Pressure Design Parameters

At this site, the design parameters for structures subject to unbalanced earth pressures such as basement walls and retaining walls are shown in the table below.

Stratigraphic Unit	γ	φ	K_a	K_o	K_p
Compact Granular Fill Granular 'B' (OPSS.MUNI 1010)	21	32	0.31	0.47	3.25
Existing Earth Fill	19	30	0.33	0.50	3.00
Sandy Silt Till	21	36	0.26	0.41	3.85
Clayey Silt Till	21	32	0.31	0.47	3.25

γ = soil bulk unit weight (kN/m^3)
φ = internal friction angle (degrees)
K_a = active earth pressure coefficient (Rankine, dimensionless)
K_o = at-rest earth pressure coefficient (Rankine, dimensionless)
K_p = passive earth pressure coefficient (Rankine, dimensionless)

These earth pressure parameters assume that grade is horizontal behind the retaining structure. If retained grade is inclined, these parameters do not apply and must be re-evaluated.

The following equation can be used to calculate the unbalanced earth pressure imposed on walls:

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

P = horizontal pressure (kPa) at depth h
h = the depth at which P is calculated (m)
K = earth pressure coefficient
h_w = height of groundwater (m) above depth h
γ = soil bulk unit weight (kN/m^3)
γ' = submerged soil unit weight (γ - 9.8 kN/m^3)
q = total surcharge load (kPa)

If the wall backfill is drained such that hydrostatic pressures on the wall are effectively eliminated, this equation simplifies to:

$$P = K[\gamma h + q]$$

Where walls are made directly against shoring, prefabricated composite drainage panel covering the blind side of the wall is used to provide drainage. Water from the composite drainage panel is collected and discharged through the basement wall in solid ports directly to the sumps. This is discussed in Section 3.5.

The possible effects of frost on retaining earth structures must be considered. In frost-susceptible soils, pressures induced by freezing pore water are basically irresistible. Insulation typically addresses this issue. Alternatively, non-frost-susceptible backfill may be specified.

Foundation resistance to sliding is proportional to the friction between the subgrade and the base of the footing. The factored geotechnical resistance to friction (**R$_f$**) at ULS provided in the following equation:

$$R_f = \Phi N \tan \varphi$$

R_f = frictional resistance (kN)
Φ = reduction factor per per CFEM 5th Ed. (0.8 for cohesionless soils or rock; 0.6 for cohesive soils)
N = normal load at base of footing (kN)
φ = internal friction angle (see table above)

3.4 Slab on Grade Design Parameters

At the proposed lowest P1 elevation, the undisturbed native soils will provide adequate subgrade for the support of a conventional slab on grade. The modulus of subgrade reaction for slab-on-grade design supported by undisturbed native soils is 60,000 kPa/m. Design parameters for the raft are provided in Section 3.1.

A permanent drainage system including subfloor drains is required (see section below). The slab on grade must be provided with a drainage layer and capillary moisture break, which is achieved by forming the slab on a minimum 300 mm thick layer of 19 mm clear stone (OPSS.MUNI 1004) vibrated to a dense state.

The drainage layer must be separated from the cohesionless till using a non-woven geotextile (with an apparent opening size of less than 0.250 mm and a tear resistance of more than 200 N) with a minimum 600 mm overlap. The stone drainage layer is then placed over the geotextile. Without this filtering layer, fines from the underlying sand subgrade will enter the drainage layer potentially resulting in loss of ground, loss of slab support, and clogging of the subfloor drainage system.

Given the nature of the soils at this site, recompaction or proof rolling of the undisturbed native subgrade will weaken these materials. These activities should be specifically prohibited when preparing native subgrade. The subgrade should be cut neat and inspected by Grounded prior to placement of the capillary moisture break and construction of the slab. Disturbed or otherwise unacceptable material (as determined by Grounded) must be subexcavated and replaced with Granular B (OPSS.MUNI 1010) compacted to a minimum of 98% SPMDD. The slab on grade should not be placed on frozen subgrade, to prevent excessive settlement of the slab as the subgrade thaws. Areas of frozen subgrade should be removed during subgrade preparation.

3.5 Long-Term Groundwater and Seepage Control

To limit seepage to the extent practicable, exterior grades adjacent to foundation walls should be sloped at a minimum 2 percent gradient away from the wall for 1.2 m minimum.

Perimeter and subfloor drainage systems are required for the underground structure. Subfloor drainage collects and removes the seepage that infiltrates under the floor. Perimeter drainage collects and removes seepage that infiltrates at the foundation walls. Perimeter drainage must be collected and conveyed directly to the building sumps, and not discharged into the subfloor drainage system, the granular layer, or beneath the floor slab.

Subfloor drainage pipes are to be spaced at a maximum 6 m (measured on-centres).

The walls of the substructure are to be fully drained to eliminate hydrostatic pressure. Where drained basement walls are made directly against shoring, prefabricated composite drainage panel covering the blind side of the wall is used to provide drainage. Seepage from the composite drainage panel is collected and discharged through the basement wall in solid ports directly to the sumps.

Although the basement will be made as a drained structure, the relative humidity at the interface between the foundation wall and the soil/shoring system will still be 100%. A layer of waterproofing placed between the drainage layer and the foundation wall is recommended to protect interior finishes and reinforcing steel from moisture. The building science engineer should confirm this and can provide further advice, as well as specifications for waterproofing products.

Typical basement drainage details are appended.

The perimeter and subfloor drainage systems are critical structural elements since they eliminate hydrostatic pressure from acting on the basement walls and floor slab. The sumps that ensure the performance of these systems must have a duplexed pump arrangement providing 100% redundancy, and they must be on emergency power. The sumps should be sized by the mechanical engineer to adequately accommodate the estimated volume of water seepage.

The permanent dewatering requirements are provided in Grounded’s Hydrogeological Report (File No. 23-197).

If any water is to be discharged to the storm or sanitary sewers, the Region of Durham will require Discharge Agreements to be in place.

4 Considerations for Construction

4.1 Excavations

Excavations must be carried out in accordance with the *Occupational Health and Safety Act – Regulation 213/91 – Construction Projects (Part III - Excavations, Section 222 through 242).* These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. For practical purposes:

- The earth fill is a Type 3 soil
- The native soils are Type 2 soils

In accordance with the regulation's requirements, the soil must be suitably sloped and/or braced where workers must enter a trench or excavation deeper than 1.2 m. Safe excavation slopes (of no more than 3 m in height) by soil type are stipulated as follows, per Section 234:

Soil Type	Base of Slope	Steepest Slope Inclination
1	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
2	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	from bottom of trench	1 horizontal to 1 vertical
4	from bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 239 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes. Any excavation slopes greater than 3 m in height should be checked by Grounded for global stability issues.

Larger obstructions (e.g. buried concrete debris, other obstructions) not directly observed in the boreholes are likely present in the earth fill. Similarly, larger inclusions (e.g. cobbles and boulders) may be encountered in the native soils. The size and distribution of these obstructions cannot be predicted with boreholes, as the split spoon sampler is not large enough to capture particles of this size. Provision must be made in excavation contracts to allocate risks associated with the time spent and equipment utilized to remove or penetrate such obstructions when encountered.

Excess soil is governed by Ontario Regulation 406/19: On-Site and Excess Soil Management (ESM). The Project Leader (typically the owner) may be required to file a notice in the excess soil registry and a Qualified Person (within the meaning of O.Reg. 153/04) may be required to prepare the associated planning documents and/or develop and implement a tracking system in accordance with the Soil Rules, to track each load of excess soil during its transportation and deposit before removing excess soil from the project area.

4.2 Short-Term Groundwater Control

Considerations pertaining to groundwater discharge quantities and quality are discussed in Grounded's hydrogeological report for the site, under separate cover.

The groundwater table varies with the elevation of the site. At the northwest portion of the site, the groundwater table was observed to be as high as Elev. 103.± m. It slopes down to Elev. 96± m in the east-southeast portion of the site.

Within the zone of excavation, the earth fill will permit the free flow of water when wet. Within the native tills, below the ground water table, both permeability and grain size distribution vary. On this basis, groundwater must be dewatered to 1.2 m below footings. Delays in excavation may occur as the seepage is controlled and these delays should be anticipated in the construction schedule.

The Region of Durham will require a Discharge Agreement in the short term, if any water is to be discharged to the storm or sanitary sewers during construction.

4.3 Earth-Retention Shoring Systems

No excavation shall extend below the foundations of existing adjacent structures without adequate alternative support being provided.

Excavation zone of influence guidelines are appended.

Continuous interlocking caisson wall shoring is to be used where the excavation must be constructed as a rigid shoring system. Caisson wall shoring preserves the support capabilities and integrity of the soil beneath existing foundations of adjacent buildings, in a state akin to the at-rest condition. Otherwise, excavations can be supported using conventional soldier pile and lagging walls with dewatering prior to and during construction.

4.3.1 Lateral Earth Pressure Distribution

If the shoring is supported with a single level of earth anchor or bracing, a triangular earth pressure distribution like that used for the basement wall design is appropriate.

Where multiple rows of lateral supports are used to support the shoring walls, research has shown that a distributed pressure diagram more realistically approximates the earth pressure on a shoring system of this type, when restrained by pre-tensioned anchors. A multi-level supported shoring system can be designed based on an earth pressure distribution with a maximum pressure defined by:

$$\boldsymbol{P = 0.65\ K[\gamma H + q] + \gamma_w h_w}$$

P = maximum horizontal pressure (kPa)
K = earth pressure coefficient (see Section 3.3)
H = total depth of the excavation (m)
h_w = height of groundwater (m) above the base of excavation
γ = soil bulk unit weight (kN/m3)
q = total surcharge loading (kPa)

Where shoring walls are drained to effectively eliminate hydrostatic pressure on the shoring system (e.g. pile and lagging walls), $\boldsymbol{h_w}$ is equal to zero. For the design of impermeable shoring, the groundwater table slopes form approximately Elev. 103± m on the northwest portion of site to approximately Elev. 96± m on the east-southeast portion of the site. There is infiltrated stormwater perched in the earth fill and upper native soils which may accumulate behind a caisson wall. This hydrostatic pressure needs to be accounted for in shoring design. In cohesionless soils, the lateral earth pressure distribution is rectangular.

4.3.2 Soldier Pile Toe Embedment

Due to the variance across site, soldier pile toes will be made in both the very dense cohesionless till and the hard cohesive till units. Soldier pile toes resist horizontal movement due to the passive earth pressure acting on the toe below the base of excavation.

There are zones of soil in the subgrade that are wet, cohesionless, and permeable. Augered holes for piles made into these soils will be prone to caving and blowback. Temporarily cased holes are required to prevent borehole caving during installations in drilled holes. To prevent groundwater issues (groundwater inflow, caving and blowback into the drill holes, disturbance to placed concrete, etc.) during drilling and installation, construction methods such as utilizing temporary liners, pre-advancing liners deeper than the augered holes, mud/slurry/polymer drilling techniques, tremie pour concrete, or other methods as deemed necessary by the shoring contractor are required. Concrete for shoring piles and fillers must be placed by tremie method wherever there is more than 300 mm of water or fluid at the base of the drill hole.

4.3.3 Lateral Bracing Elements

The shoring system at this site will require lateral bracing. If feasible, the shoring system should be supported by pre-stressed soil anchors (tiebacks) extending into the subgrade of the adjacent properties. To limit the movement of the shoring system as much as is practically possible, tiebacks are installed and stressed as excavation proceeds. The use of tiebacks through adjacent properties requires the consent (through encroachment agreements) of the adjacent property owners.

In the very dense cohesionless till (extending to Elev. 95.9 to 89.0 m), it is expected that post-grouted anchors can be made such that an anchor will safely carry up to 80 kN/m of adhered anchor length (at a nominal borehole diameter of 150 mm).

At least one prototype anchor per tieback level must be performance-tested to 200% of the design load to demonstrate the anchor capacity and validate design assumptions. Given the potential variability in soil conditions or installation quality, all production anchors must also be proof-tested to 133% of the design load.

Both the very dense and hard till below the proposed FFE is suitable for the placement of raker foundations. Raker footings established on very dense and hard soils at an inclination of 45 degrees can be designed for a maximum factored geotechnical resistance at ULS of 400 kPa.

4.4 Site Work

To better protect wet undisturbed subgrade, excavations exposing wet soils must be cut neat, inspected, and then immediately protected with a skim coat of concrete (i.e. a mud mat). Wet sands are susceptible to degradation and disturbance due to even mild site work, frost, weather, or a combination thereof.

The effects of work on site can greatly impact soil integrity. Care must be taken to prevent this damage. Site work carried out during periods of inclement weather may result in the subgrade becoming disturbed, unless a granular working mat is placed to preserve the subgrade soils in their undisturbed condition. Subgrade preparation activities should not be conducted in wet weather and the project must be scheduled accordingly.

If site work causes disturbance to the subgrade, removal of the disturbed soils and the use of granular fill material for site restoration or underfloor fill will be required at additional cost to the project.

It is construction activity itself that often imparts the most severe loading conditions on the subgrade. Special provisions such as end dumping and forward spreading of earth and aggregate fills, restricted construction lanes, and half-loads during placement of the granular base and other work may be required, especially if construction is carried out during unfavourable weather.

Adequate temporary frost protection for the founding subgrade must be provided if construction proceeds in freezing weather conditions. The subgrade at this site is susceptible to frost damage. The slab on grade should not be placed on frozen subgrade, to prevent excess settlement of the slab as the subgrade thaws. Areas of frozen subgrade should be removed during subgrade preparation. Depending on the project context, consideration should be given to frost effects (heaving, softening, etc.) on exposed subgrade surfaces.

4.5 Engineering Review

By issuing this preliminary report, Grounded Engineering has assumed the role of Geotechnical Engineer of Record for this site. Grounded should be retained to review the structural engineering drawings prior to issue or construction to ensure that the recommendations in this report have been appropriately implemented.

All foundation installations must be reviewed in the field by Grounded, the Geotechnical Engineer of Record, as they are constructed. The on-site review of foundation installations and the condition of the founding subgrade as the foundations are constructed is as much a part of the geotechnical engineering design function as the design itself; it is also required by Section 4.2.2.2 of the Ontario Building Code. If Grounded is not retained to carry out foundation engineering field review during construction, then Grounded accepts no responsibility for the performance or non-performance of the foundations, even if they are constructed in general conformance with the engineering design advice contained in this report.

Strict procedures must be maintained during construction to maintain the integrity of the subgrade to the extent possible. The design advice in this report is based on an assessment of the subgrade support capabilities as indicated by the boreholes. These conditions may vary across the site depending on the final design grades and therefore, the preparation of the subgrade should be monitored by Grounded at the time of construction to confirm material quality, and thickness.

A visual pre-construction survey of adjacent lands and buildings is recommended to be completed prior to the start of any construction. This documents the baseline condition and can prevent unwarranted damage claims. Any shoring system, regardless of the execution and design, has the potential for movement. Small changes in stress or soil volume can cause cracking in adjacent buildings.

5 Limitations and Restrictions

Grounded should be retained to review the structural and geostructural engineering drawings prior to issue or construction to ensure that the recommendations in this report have been appropriately implemented.

This preliminary geotechnical engineering report is intended for due diligence purposes only. At detailed design, additional boreholes, groundwater monitoring wells, and updated detailed geotechnical engineering advice are required. Once completed, the future detailed geotechnical engineering report by Grounded Engineering would then supersede this preliminary report. Note that preliminary findings can vary significantly from the findings of a detailed comprehensive study.

5.1 Investigation Procedures

The geotechnical engineering analysis and advice provided here are based in part on factual data obtained from investigations at this site conducted by other consultants as described above, as well as the factual borehole information observed and recorded by Grounded. This previous consultant subsurface information is provided in a professional engineer's signed and sealed geotechnical report, and as such this borehole information is taken as factual for present purposes.

The geotechnical engineering analysis and advice provided are also based on the factual borehole information observed and recorded by Grounded. The investigation methodology and engineering analysis methods used to carry out this scope of work are consistent with Grounded's standard of practice as well as other reasonable and prudent geotechnical consultants, working under similar conditions and constraints (time, financial and physical).

Borehole drilling services were provided to Grounded by a specialist professional contractor. The drilling was observed and recorded by Grounded's field supervisor on a full-time basis. Drilling was conducted using conventional drilling rigs equipped with hollow stem augers and mud rotary drilling equipment. As drilling proceeded, groundwater observations were made in the boreholes. Based on examination of recovered borehole samples, our field supervisor made a record of borehole and drilling observations. The field samples were secured in air-tight clean jars and bags and taken to the Grounded soil laboratory where they were each logged and reviewed by the geotechnical engineering team and the senior reviewer.

The Split-Barrel Method technique (ASTM D1586) was used to obtain the soils samples. The sampling was conducted at conventional intervals and not continuously. As such, stratigraphic interpolation between samples is required and stratigraphic boundary lines do not represent exact depths of geological change. They should be taken as gradual transition zones between soil types.

A carefully conducted, fully comprehensive investigation and sampling scope of work carried out under the most stringent level of oversight may still fail to detect certain ground conditions. As such, users of this report must be aware of the risks inherent in using engineered field investigations to observe and record subsurface conditions. As a necessary requirement of working with discrete test locations, Grounded has assumed that the conditions between test locations are the same as the test locations themselves, for the purposes of providing geotechnical engineering advice.

It is not possible to design a field investigation with enough test locations that would provide complete subsurface information, nor is it possible to provide geotechnical engineering advice that completely identifies or quantifies every element that could affect construction, scheduling, or tendering. Contractors undertaking work based on this report (in whole or in part) must make their own determination of how they may be affected by the subsurface conditions, based on their own analysis of the factual information provided and based on their own means and methods. Contractors using this report must be aware of the risks implicit in using factual information at discrete test locations to infer subsurface conditions across the site and are directed to conduct their own investigations as needed.

5.2 Site and Scope Changes

Natural occurrences, the passage of time, local construction, and other human activity all have the potential to directly or indirectly alter the subsurface conditions at or near the project site. Contractual obligations related to groundwater or stormwater control, disturbed soils, frost protection, etc. must be considered with attention and care as they relate to potential site alteration.

This report provides preliminary geotechnical engineering advice intended for use by the owner and their retained design team. These preliminary interpretations, design parameters, advice, and discussion on construction considerations are not complete. A detailed site-specific geotechnical investigation must be conducted by Grounded during detailed design to confirm and update the preliminary recommendations provided here.

5.3 Report Use

The authorized users of this report are 705 Kingston Road Ltd and their design team, for whom this report has been prepared. Grounded Engineering Inc. maintains the copyright and ownership of this document. Reproduction of this report in any format or medium requires explicit prior authorization from Grounded Engineering Inc.

The local municipal/regional governing bodies may also make use of and rely upon this report, subject to the limitations as stated.

6 Closure

If the design team has any questions regarding the discussion and advice provided, please do not hesitate to have them contact our office. We trust that this report meets your requirements at present.

For and on behalf of our team,

GROUNDED
ENGINEERING

LICENSED PROFESSIONAL ENGINEER
J. J. HUNTER
100513420
24/10/2024
PROVINCE OF ONTARIO

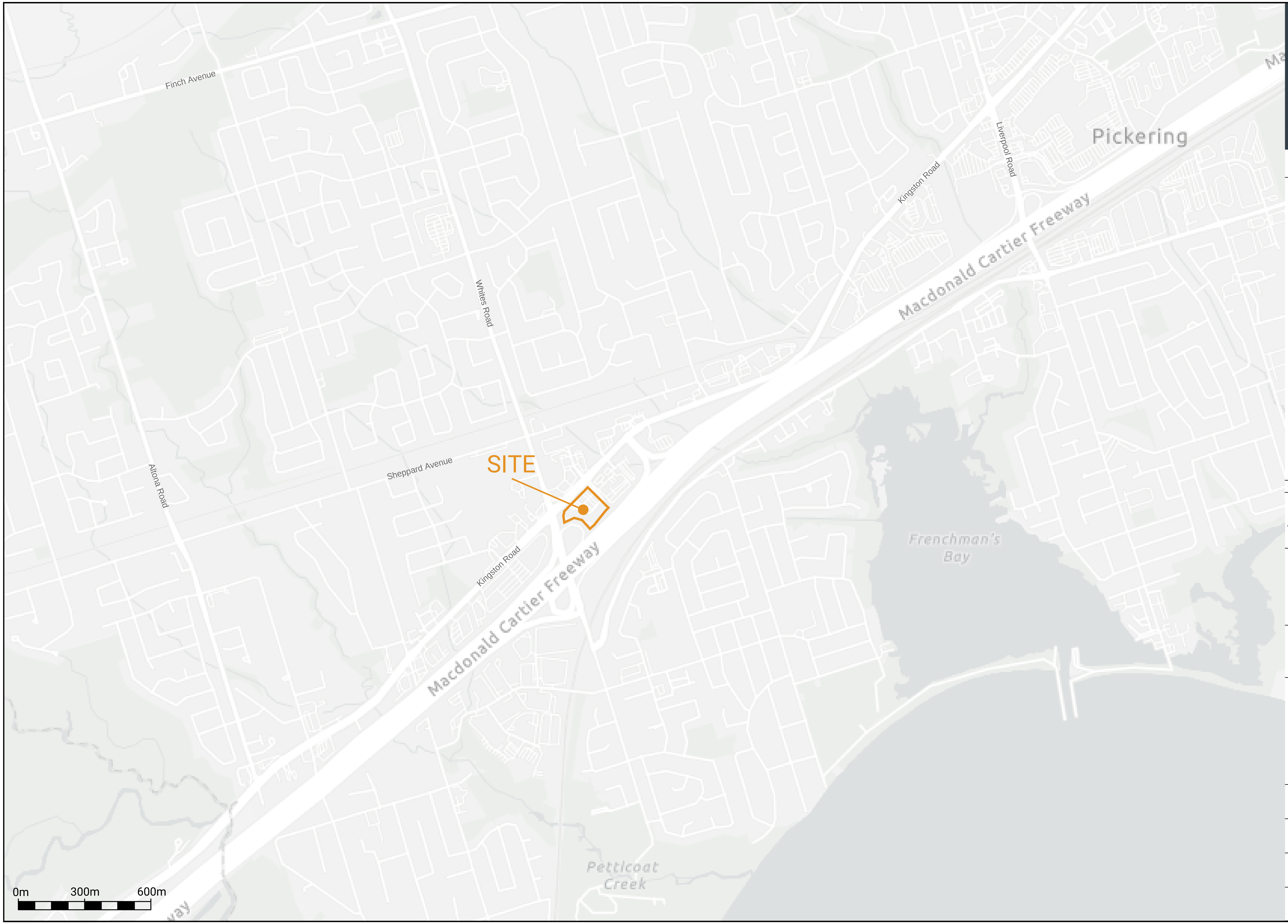
Ruth Schoenhardt, B.ASc
Project Coordinator

Jory Hunter, P.Eng.
Team Lead, Geotechnical Engineering

LICENSED PROFESSIONAL ENGINEER
J. J. CROWDER
100077148
2024-10-24
PROVINCE OF ONTARIO

Jason Crowder, Ph.D., P.Eng.
Principal

FIGURES



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www.groundedeng.ca

LEGEND

— APPROXIMATE PROPERTY BOUNDARY

Note

Reference

ArcGIS Online, 2024.

Project

705 KINGSTON RD, PICKERING, ONTARIO

Figure Title

SITE LOCATION PLAN

North

TRUE
PROJECT

Date

OCTOBER 2024

Scale

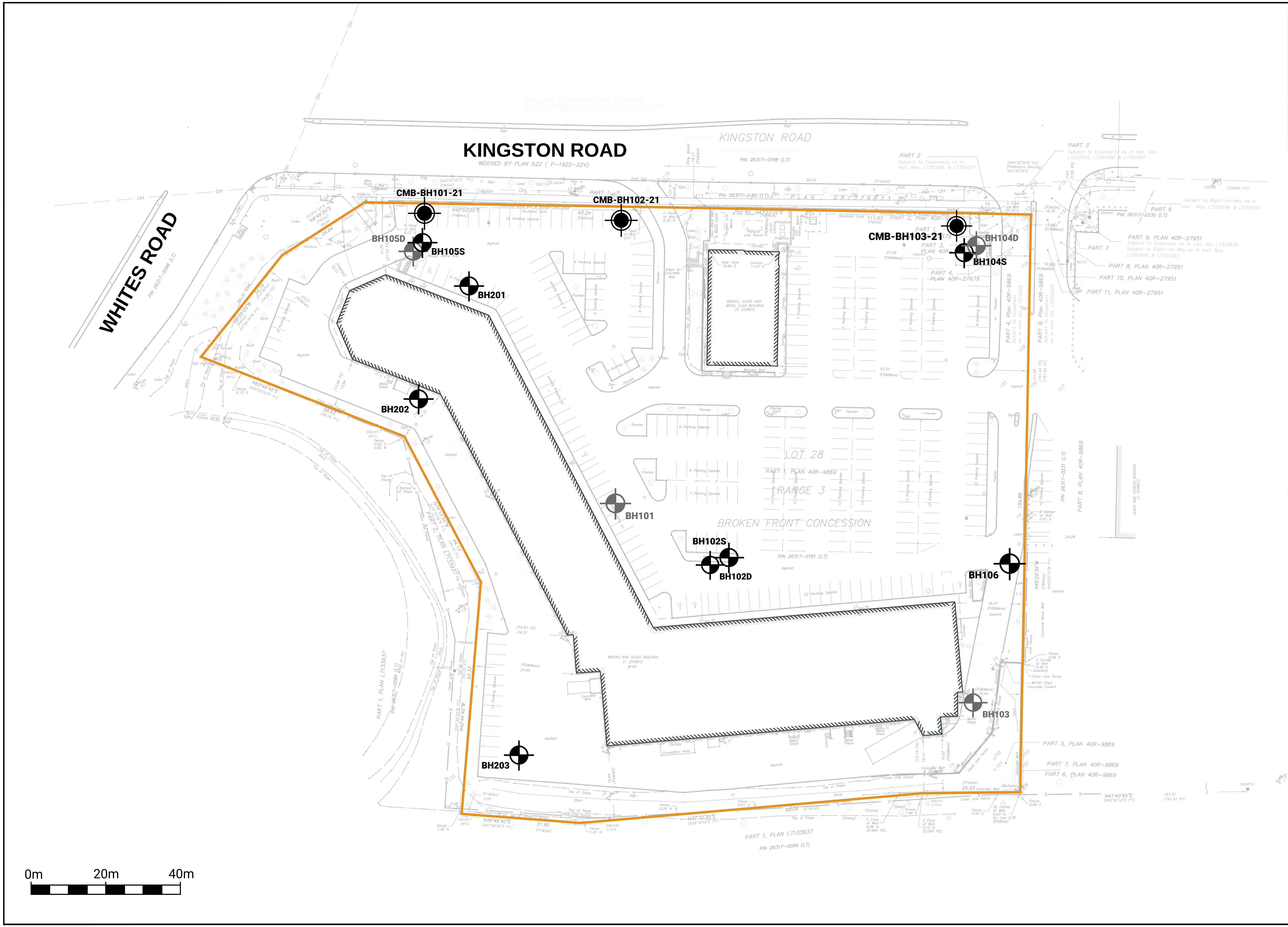
AS INDICATED

Job No

23-197

Figure No

FIGURE 1



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LEGEND

- ▬ APPROXIMATE PROPERTY BOUNDARY
- ▨ EXISTING BUILDING STRUCTURE
- ⊕ MONITORING WELL/BOREHOLE BY GROUNDED
- ⊕ MONITORING WELL/BOREHOLE DECOMISSIONED DUE TO METHANE
- ⊕ MONITORING WELL/BOREHOLE BY OTHERS

Note

Reference
Survey Drawing no. 220-0094.
Prepared by SPEIGHT, VAN NOSTRAND & GIBSON LIMITED.
Date not listed.
Received - July 27, 2023

Project

705 KINGSTON RD, PICKERING, ONTARIO

Figure Title

BOREHOLE AND MONITORING WELL LOCATIONS PLAN - EXISTING CONDITIONS

North

TRUE
PROJECT

Date
OCTOBER 2024

Scale
AS INDICATED

Job No
23-197

Figure No
FIGURE 2

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LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- EXISTING BUILDING STRUCTURE
- MONITORING WELL/BOREHOLE BY GROUNDED
- MONITORING WELL/BOREHOLE DECOMISSIONED DUE TO METHANE
- MONITORING WELL/BOREHOLE BY OTHERS

Note

Reference
Survey Drawing no. 220-0094.
Prepared by SPEIGHT, VAN NOSTRAND & GIBSON LIMITED.
Date not listed.
Received - July 27, 2023

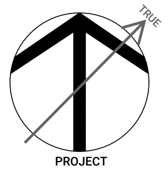
Project

705 KINGSTON RD, PICKERING, ONTARIO

Figure Title

BOREHOLE AND MONITORING WELL LOCATIONS PLAN - EXISTING CONDITIONS

North

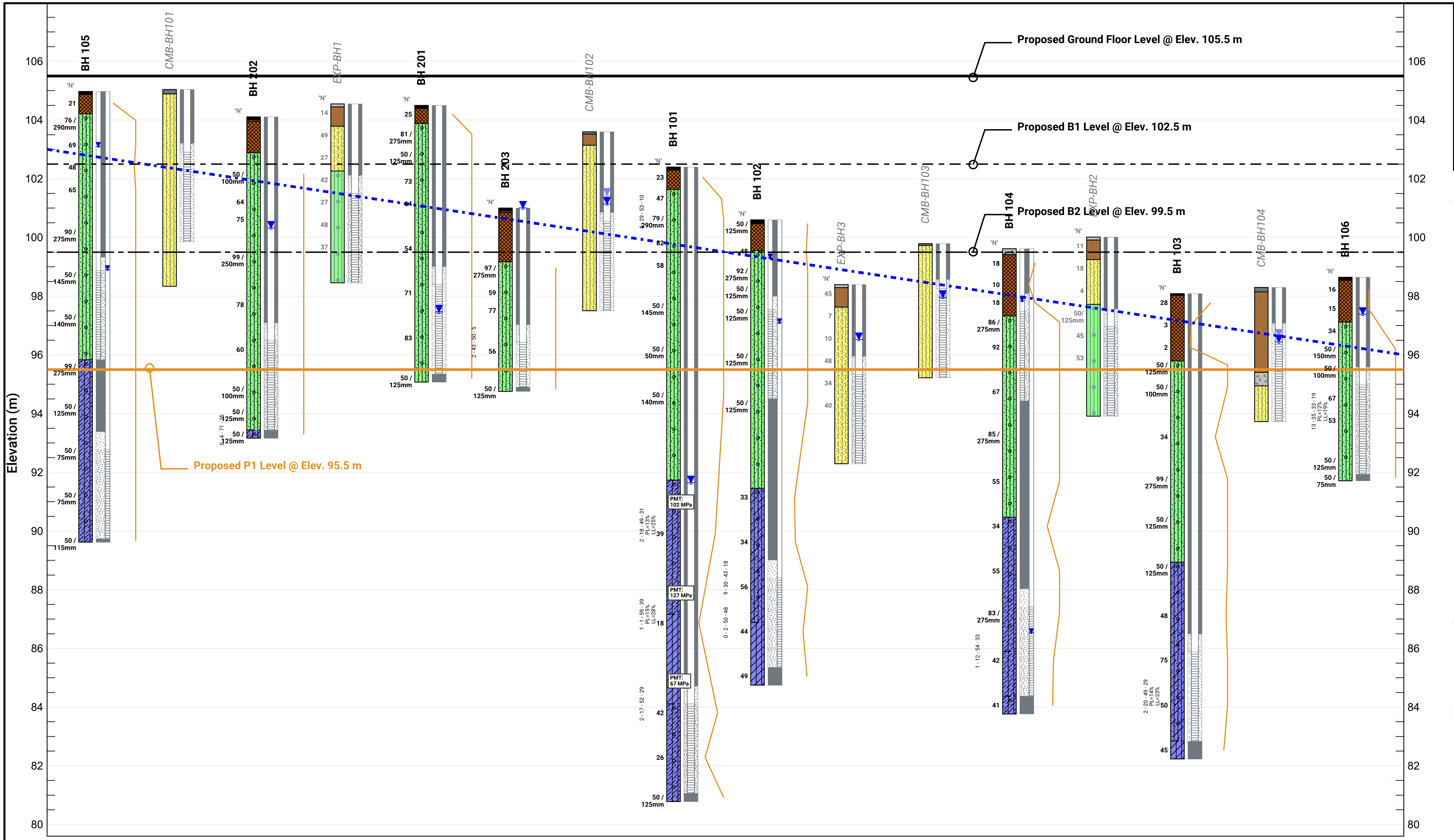


Date
OCTOBER 2024

Scale
AS INDICATED

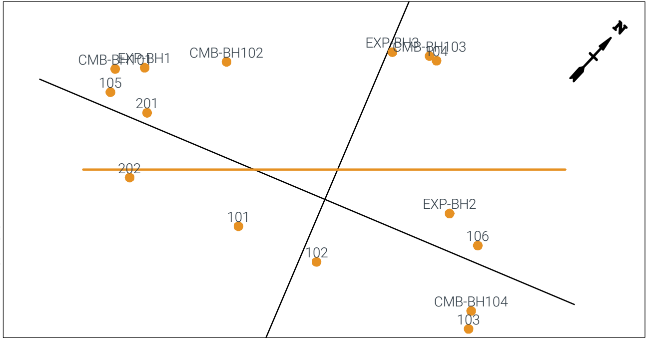
Job No
23-197

Figure No
FIGURE 3



SITE MAP

Alignment: TEMP ENVIRO FENCE



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Boreholes Equally Spaced

BOREHOLE STRATIGRAPHY LEGEND

■	Asphalt	▨	Silt and Clay	▨	Clayey Silt
▩	Fill	▨	Aggregate	▨	Sandy Silt
▨	Sandy Silt Till	▨	Clayey Silt Till (sandy)	▨	Silty Sand
▨	Clayey Silt Till	▨	Concrete	▨	Silty Till

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LEGEND

🟫	FILL
🟧	GRAVELS (gravel to gravelly sand)
🟨	SILT TO SAND (not till)
🟩	COHESIONLESS TILLS
🟪	COHESIVE SOILS (clayey silt to clay, incl. tills)
🟦	DISTURBED/REWORKED/ORGANIC
BH 101	BOREHOLES BY GROUNDED
T-BH7	BOREHOLES BY OTHERS

▽	water level, unstabilized
▼	water level, stabilized (latest)
▼	water level, stabilized (highest)

Project

705 KINGSTON ROAD
PICKERING, ONTARIO

Figure Title

SUBSURFACE PROFILE

TEMP ENVIRO FENCE

Date

OCTOBER 2024

Scale

AS INDICATED

Job No

23-197

Figure No

FIGURE 4

APPENDIX A

BOREHOLE LOG TERMINOLOGY

GROUNDED ENGINEERING

SAMPLING/TESTING METHODS

SS: split spoon sample

AS: auger sample

GS: grab sample

FV: shear vane

DP: direct push

PMT: pressuremeter test

ST: shelby tube

CORE: soil coring

RUN: rock coring

SYMBOLS & ABBREVIATIONS

MC: moisture content

LL: liquid limit

PL: plastic limit

NP: non-plastic

γ: soil unit weight (bulk)

G_s: specific gravity

S_u: undrained shear strength

▽ unstabilized water level

▼ water level measurement

▼ highest water level measurement

ENVIRONMENTAL SAMPLES

M&I: metals and inorganic parameters

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

VOC: volatile organic compound

PHC: petroleum hydrocarbon

BTEX: benzene, toluene, ethylbenzene and xylene

PPM: parts per million

FIELD MOISTURE (based on tactile inspection)

DRY: no observable pore water

MOIST: inferred pore water, not observable (i.e. grey, cool, etc.)

WET: visible pore water

COHESIONLESS

Relative Density	N-Value
Very Loose	<4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

COHESIVE

Consistency	N-Value	Su (kPa)
Very Soft	<2	<12
Soft	2 - 4	12 - 25
Firm	4 - 8	25 - 50
Stiff	8 - 15	50 - 100
Very Stiff	15 - 30	100 - 200
Hard	>30	>200

COMPOSITION

Term	% by weight
trace silt	<10
some silt	10 - 20
silt***y***	20 - 35
sand ***and*** silt	>35

ASTM STANDARDS

ASTM D1586 Standard Penetration Test (SPT)
Driving a 51 mm O.D. split-barrel sampler ("split spoon") into soil with a 63.5 kg weight free falling 760 mm. The blows required to drive the split spoon 300 mm ("bpf") after an initial penetration of 150 mm is referred to as the N-Value.

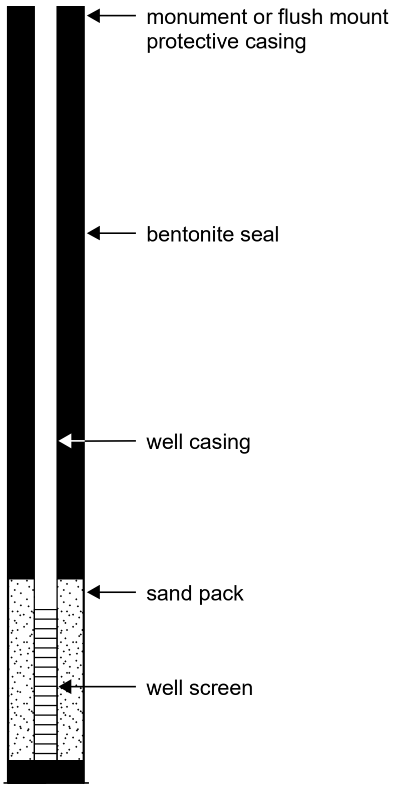
ASTM D3441 Cone Penetration Test (CPT)
Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.

ASTM D2573 Field Vane Test (FVT)
Pushing a four blade vane into soil and rotating it from the surface to determine the torque required to shear a cylindrical surface with the vane. The torque is converted to the shear strength of the soil using a limit equilibrium analysis.

ASTM D1587 Shelby Tubes (ST)
Pushing a thin-walled metal tube into the in-situ soil at the bottom of a borehole, removing the tube and sealing the ends to prevent soil movement or changes in moisture content for the purposes of extracting a relatively undisturbed sample.

ASTM D4719 Pressuremeter Test (PMT)
Place an inflatable cylindrical probe into a pre-drilled hole and expanding it while measuring the change in volume and pressure in the probe. It is inflated under either equal pressure increments or equal volume increments. This provides the stress-strain response of the soil.

WELL LEGEND



GROUNDED ENGINEERING

Date Started : Oct 11, 2023
Position : E: 651695, N: 4853499 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 101

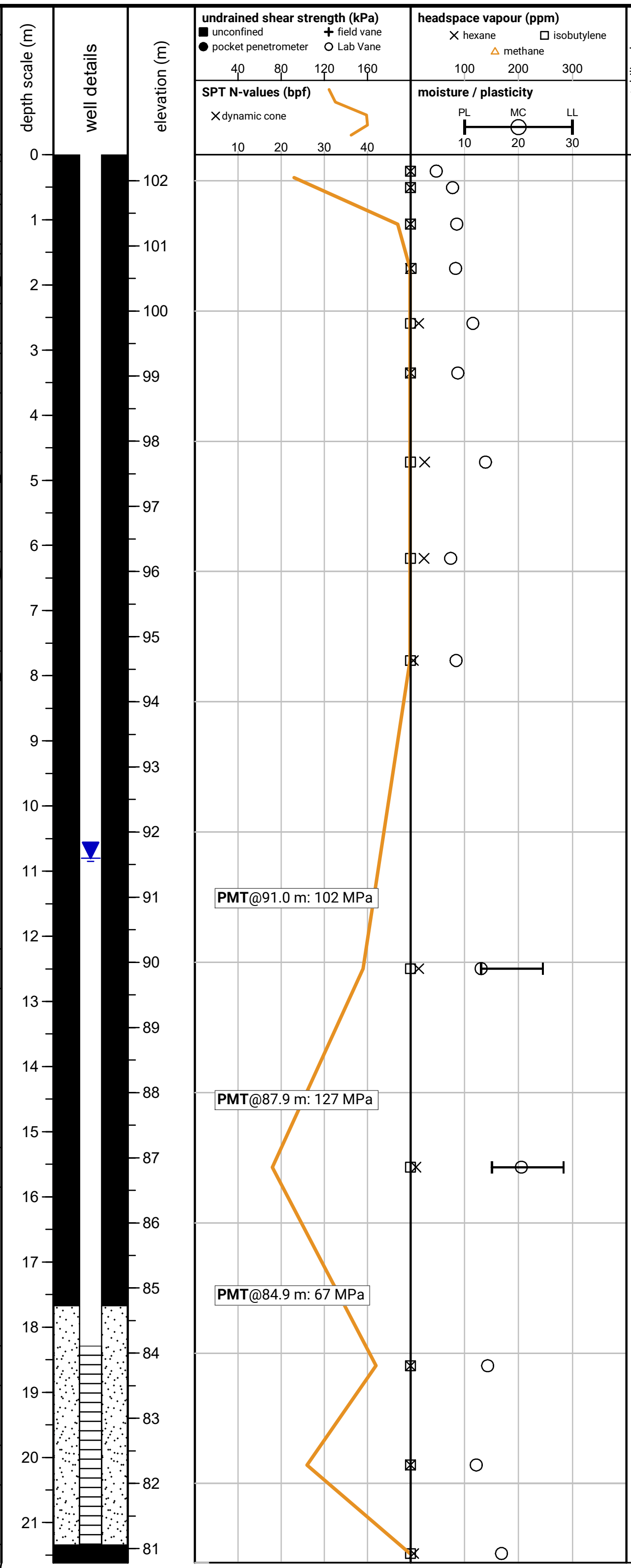
File No. : 23-197 **Project** : 705 Kingston Road, Pickering, Ontario **Client** : Plaza Partners

drill method : CME 55

hollow stem augers OD=215 mm (0 to 3.0 m)

mud rotary small OD=100 mm (3.0 to 21.6 m)

elev depth (m)	description	sample number	type	SPT N-value
102.4	**GROUND SURFACE**			
	100mm **ASPHALT**	1A	SS	23
101.6 0.8	**FILL**, sand, some gravel, some silt, trace clay, trace rock fragments, compact, grey, moist ...at 0.4 m, silty, brown	1B	SS	
		2	SS	47
	SANDY SILT, some clay, trace gravel, dense to very dense, grey, moist (GLACIAL TILL)	3	SS	79 / 290mm
		4	SS	82
		5	SS	58
		6	SS	50 / 145mm
	...at 6.1 m, trace rock fragments	7	SS	50 / 50mm
		8	SS	50 / 140mm
91.7 10.7	**CLAYEY SILT**, some sand, trace gravel, hard, grey, moist (GLACIAL TILL)	1	PMT	
		9	SS	39
		2	PMT	
87.2 15.2	**SILT AND CLAY**, trace sand, very stiff, grey, moist	10	SS	18
		3	PMT	
84.1 18.3	**CLAYEY SILT**, trace to some sand, trace gravel, very stiff to hard, grey, moist (GLACIAL TILL)	11	SS	42
		12	SS	26
80.8 21.6		13	SS	50 / 125mm



lab data and comments

grain size distribution (%) (MIT)

	GR	SA	SI	CL
SS1B: H-Ms, Metals, ORPs, PAHs				
SS2: BTEX, PHCs, VOCs	8	29	53	10
SS4: BTEX, H-Ms, Metals, ORPs, PAHs, PHCs, VOCs				
5.9m: auger grinding				
SS7: BTEX, PHCs, VOCs **6.1m:** auger grinding				
8.4m: PMT attempted and unsuccessful due to over-drilled testing pocket.				
SS9	2	18	49	31
SS10	1	1	59	39
SS11	2	17	52	29

END OF BOREHOLE

Borehole was filled with drill water upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Oct 17, 2023	18.1	84.3
Oct 19, 2023	11.8	90.6
Oct 23, 2023	10.8	91.6

file: 23-197 gint.gpj

Tech : LB | **PM** : DR/MG | **Rev** : NN

GROUNDED
ENGINEERING

Date Started : Oct 13, 2023
Position : E: 651732, N: 4853511 (UTM 17T)
Elev. Datum : Geodetic

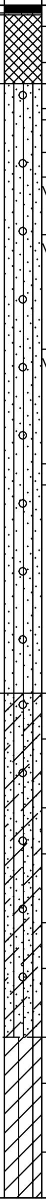
BOREHOLE LOG 102

File No. : 23-197
Project : 705 Kingston Road, Pickering, Ontario
Client : Plaza Partners

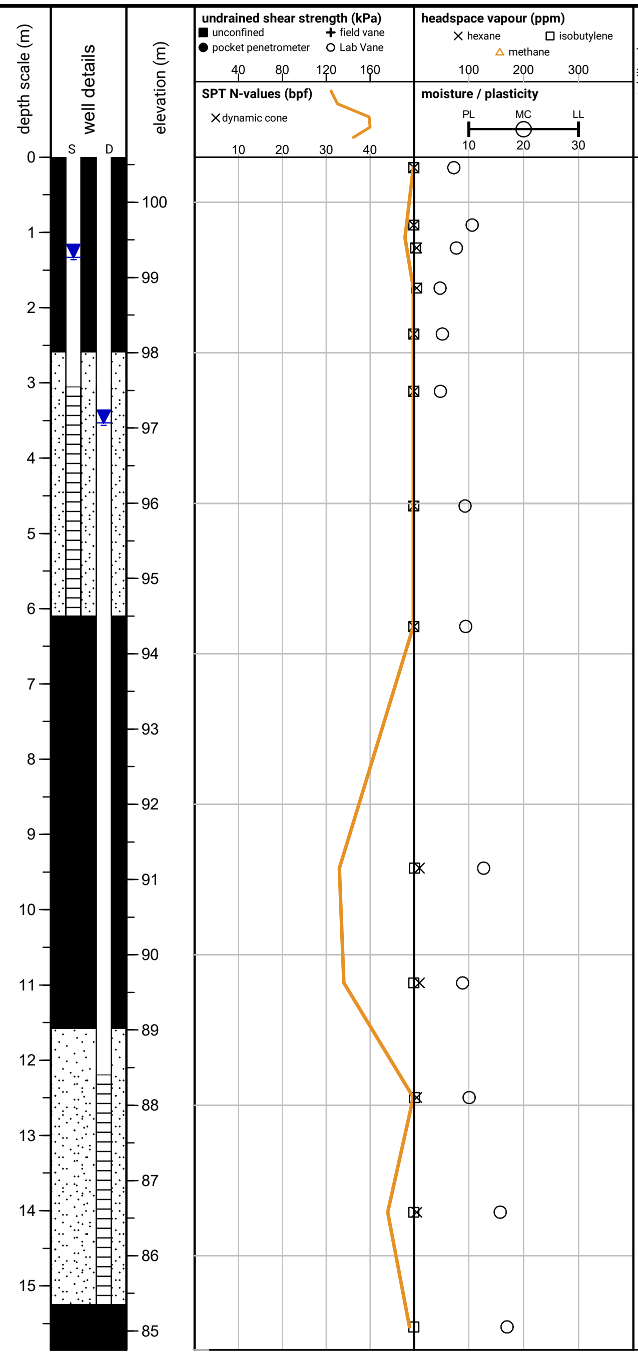
drill method : CME 55

hollow stem augers OD=215 mm (0 to 3.0 m)
mud rotary small OD=100 mm (3.0 to 15.8 m)

elev depth (m)	description
100.6	**GROUND SURFACE**
	100mm **ASPHALT**
	25mm **AGGREGATE**
99.6 1.0	**FILL**, sand, some silt, trace gravel, trace brick fragments, dense to very dense, brown to black, moist
	SANDY SILT, trace to some clay, trace gravel, trace rock fragments, dense to very dense, brown, moist (GLACIAL TILL)
	...at 3.0 m, grey
	...at 4.6 m, wet
91.5 9.1	**CLAYEY SILT**, sandy, trace gravel, hard, grey, moist (GLACIAL TILL)
	...at 12.2 m, some clay
86.9 13.7	**SILT AND CLAY**, trace sand, hard, grey, moist
84.8 15.8	



number	type	SPT N-value
1	SS	50 / 125mm
2A	SS	48
2B	SS	
3	SS	92 / 275mm
4	SS	50 / 125mm
5	SS	50 / 125mm
6	SS	50 / 125mm
7	SS	50 / 125mm
8	SS	33
9	SS	34
10	SS	56
11	SS	44
12	SS	49



unstabilized water level

lab data and comments

grain size distribution (%) (MIT)

	GR	SA	SI	CL
<u>SS2A:</u> H-Ms, Metals, ORPs, PAHs				
<u>SS3:</u> BTEX, H-Ms, Metals, ORPs, PHCs, VOCs				
<u>SS4:</u> PAHs				
<u>SS7:</u> BTEX, PHCs, VOCs				
8.4m: PMT attempted and unsuccessful due to over-drilled testing pocket.				
	9	30	43	18
13.4m: auger grinding				
	0	2	50	48

END OF BOREHOLE

Borehole was filled with drill water upon completion of drilling.

50 mm dia. monitoring well installed.

S: 50 mm dia. monitoring well installed.
D: 50 mm dia. monitoring well installed.
No. 10 screen

102-S GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Nov 3, 2023	1.7	98.9
Nov 9, 2023	1.6	99.0
Dec 7, 2023	1.6	99.0
Jan 5, 2024	1.5	99.1
Feb 28, 2024	1.3	99.3
Oct 8, 2024	1.3	99.3

102-D GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Oct 19, 2023	13.9	86.7
Oct 20, 2023	13.8	86.8
Nov 3, 2023	13.3	87.3
Nov 9, 2023	12.6	88.0
Dec 7, 2023	9.6	91.0
Jan 5, 2024	6.9	93.7
Feb 28, 2024	4.6	96.0
Oct 8, 2024	3.5	97.1

file: 23-197 gint.gpj

Tech : IH | **PM** : DR/MG | **Rev** : NN

Date Started : Oct 11, 2023
Position : E: 651804, N: 4853536 (UTM 17T)
Elev. Datum : Geodetic

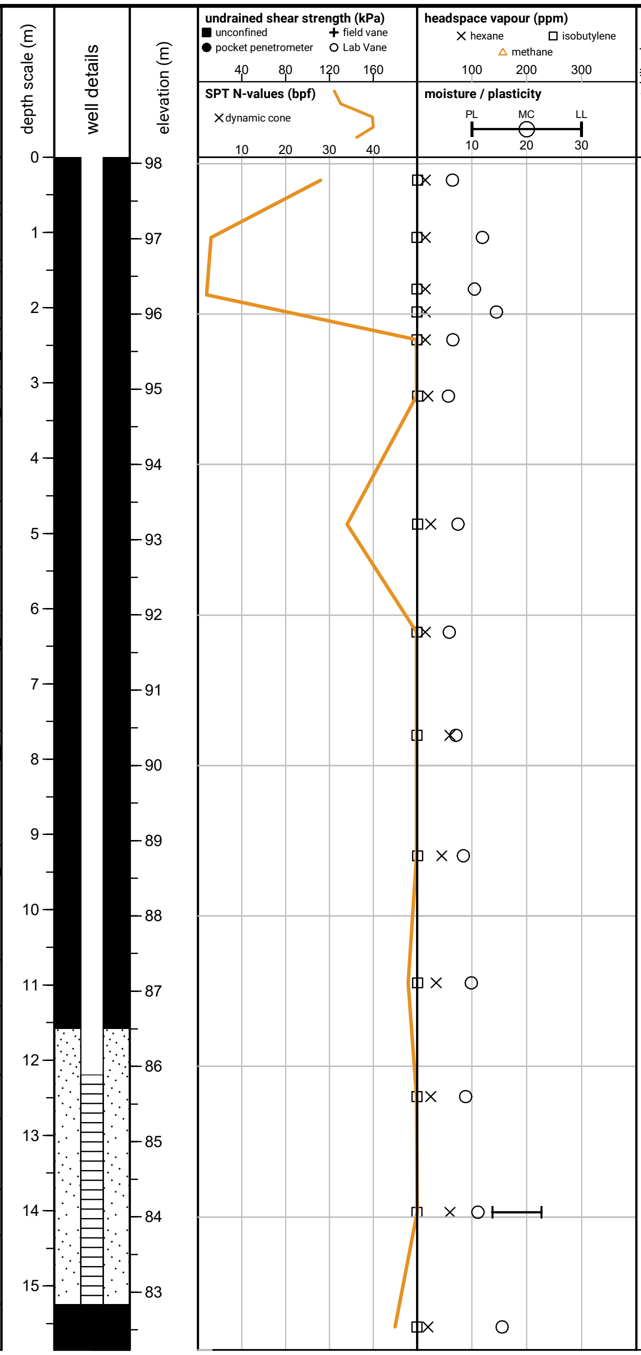
BOREHOLE LOG 103

File No. : 23-197
Project : 705 Kingston Road, Pickering, Ontario
Client : Plaza Partners

drill method : CME 55
hollow stem augers OD=215 mm

elev depth (m)	description
98.1	**GROUND SURFACE**
	50mm **ASPHALT**
95.8 2.3	**FILL**, sand and gravel, compact, brown, wet ...at 0.8 m, clayey silt, some sand, soft, moist to wet ...at 2.0 m, sand, trace gravel, very loose, wet
89.0 9.1	**SANDY SILT**, trace to some clay, trace gravel, trace rock fragments, dense to very dense, brown, moist (GLACIAL TILL) ...at 3.0 m, grey
82.9 15.2	**CLAYEY SILT**, sandy, trace gravel, hard, grey, moist (GLACIAL TILL)
82.3 15.8	**SILT AND CLAY**, trace sand, with light grey silt partings, hard, grey, moist

number	type	SPT N-value	lab data and comments
1	SS	28	
2	SS	3	SS2: PAHs
3A	SS	2	SS3A: BTEX, H-Ms, Metals, ORPs, PHCs, VOCs
3B	SS		
4	SS	50 / 125mm	
5	SS	50 / 100mm	
6	SS	34	SS6: H-Ms, Metals, ORPs, PAHs
7	SS	99 / 275mm	
8	SS	50 / 125mm	SS8: BTEX, PHCs, VOCs
9	SS	50 / 125mm	
10	SS	48	
			11.9m: auger grinding
11	SS	75	
12	SS	50	grain size distribution (%) (MIT) GR 2 SA 20 SI 49 CL 29
13	SS	45	



END OF BOREHOLE

Borehole was filled with drill water upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Oct 16, 2023	dry	n/a
Oct 17, 2023	dry	n/a
Oct 19, 2023	dry	n/a

file: 23-197 gint.gpi

Tech : IH | **PM** : DR/MG | **Rev** : NN

Date Started : Oct 10, 2023
Position : E: 651710, N: 4853616 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 104

File No. : 23-197 **Project** : 705 Kingston Road, Pickering, Ontario **Client** : Plaza Partners

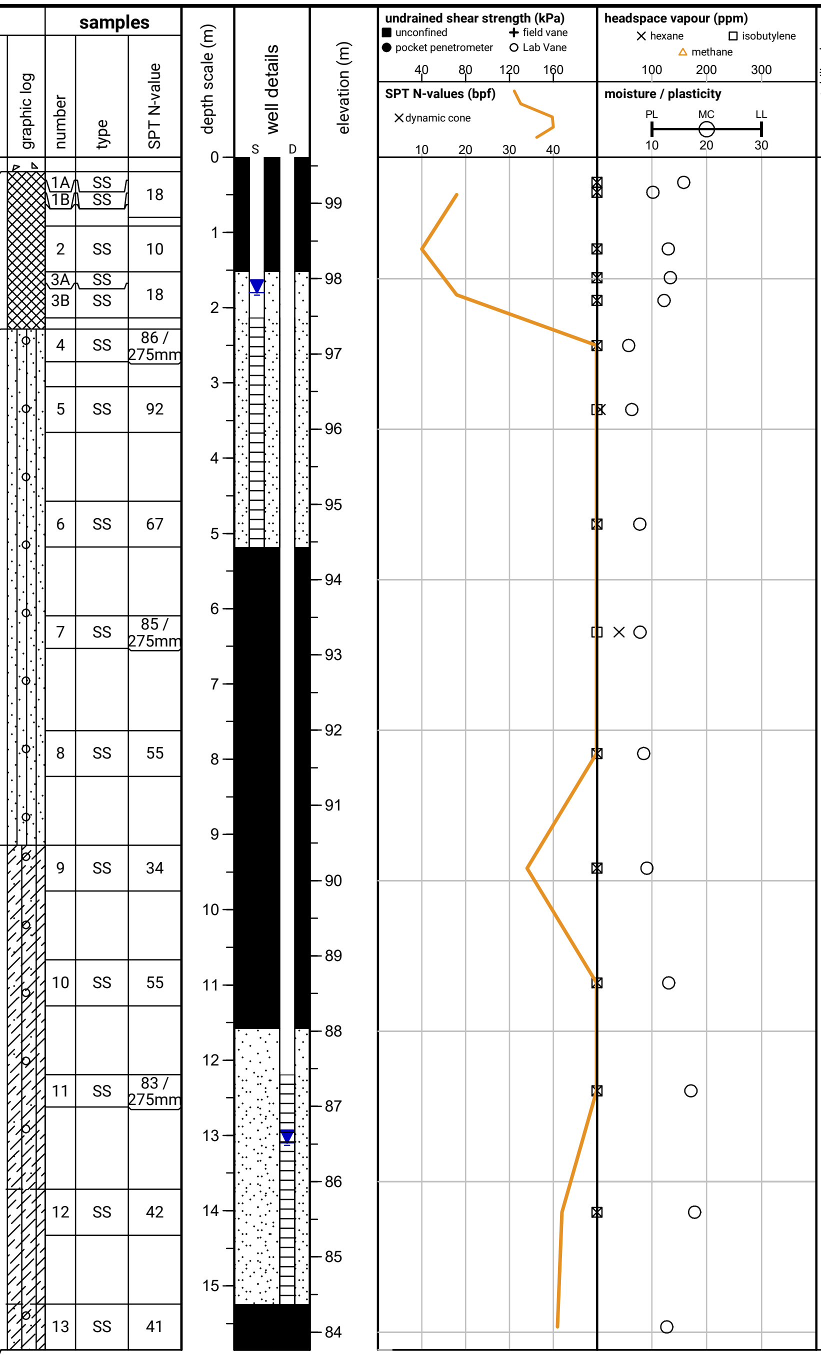
drill method : CME 55
hollow stem augers OD=215 mm (0 to 3.0 m)
mud rotary small OD=100 mm (3.0 to 15.8 m)

stratigraphy

elev depth (m)	description
99.6	**GROUND SURFACE**
	190mm **CONCRETE**
	FILL, sandy silt, some gravel, trace clay, trace rock fragments, compact, grey, wet ...at 0.3 m, clayey silt, sandy, trace gravel, trace asphalt, stiff, moist ...at 1.5 m, sand, compact, brown ...at 1.7 m, clayey silt with wet sand seams, very stiff
97.3 2.3	**SANDY SILT**, trace to some clay, trace gravel, trace rock fragments, very dense, brown, moist (GLACIAL TILL) ...at 3.0 m, grey
90.5 9.1	**CLAYEY SILT**, trace to some sand, trace gravel, hard, grey, moist (GLACIAL TILL)
85.9 13.7	**CLAYEY SILT**, some sand, trace gravel, hard, grey, moist to wet
84.4 15.2	**CLAYEY SILT**, trace to some sand, trace gravel, hard, grey, moist (GLACIAL TILL)
83.8 15.8	

samples

number	type	SPT N-value
1A 1B	SS SS	18
2	SS	10
3A 3B	SS SS	18
4	SS	86 / 275mm
5	SS	92
6	SS	67
7	SS	85 / 275mm
8	SS	55
9	SS	34
10	SS	55
11	SS	83 / 275mm
12	SS	42
13	SS	41



lab data and comments

grain size distribution (%) (MIT)

comment	GR	SA	SI	CL
<u>SS1B:</u> H-Ms, Metals, ORPs, PAHs				
<u>SS2:</u> BTEX, PHCs, VOCs				
<u>SS4:</u> H-Ms, Metals, ORPs, PAHs **2.4m:** auger grinding				
<u>SS7:</u> BTEX, PHCs, VOCs				
	1	12	54	33

END OF BOREHOLE

Borehole was filled with drill water upon completion of drilling.

50 mm dia. monitoring well installed.

S: 50 mm dia. monitoring well installed.
D: 50 mm dia. monitoring well installed.
No. 10 screen

104-S GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Oct 17, 2023	2.8	96.8
Oct 18, 2023	2.8	96.8
Oct 19, 2023	2.2	97.4
Nov 3, 2023	2.2	97.4
Nov 9, 2023	2.2	97.4
Dec 7, 2023	2.2	97.4
Jan 5, 2024	2.1	97.5
Feb 28, 2024	1.8	97.8
Oct 8, 2024	1.8	97.8

104-D GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Oct 19, 2023	14.1	85.5
Oct 20, 2023	13.1	86.5

file: 23-197 gint.gpj

Tech : LB | **PM** : DR/MG | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Oct 13, 2023
Position : E: 651611, N: 4853504 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 105

File No. : 23-197 **Project** : 705 Kingston Road, Pickering, Ontario **Client** : Plaza Partners

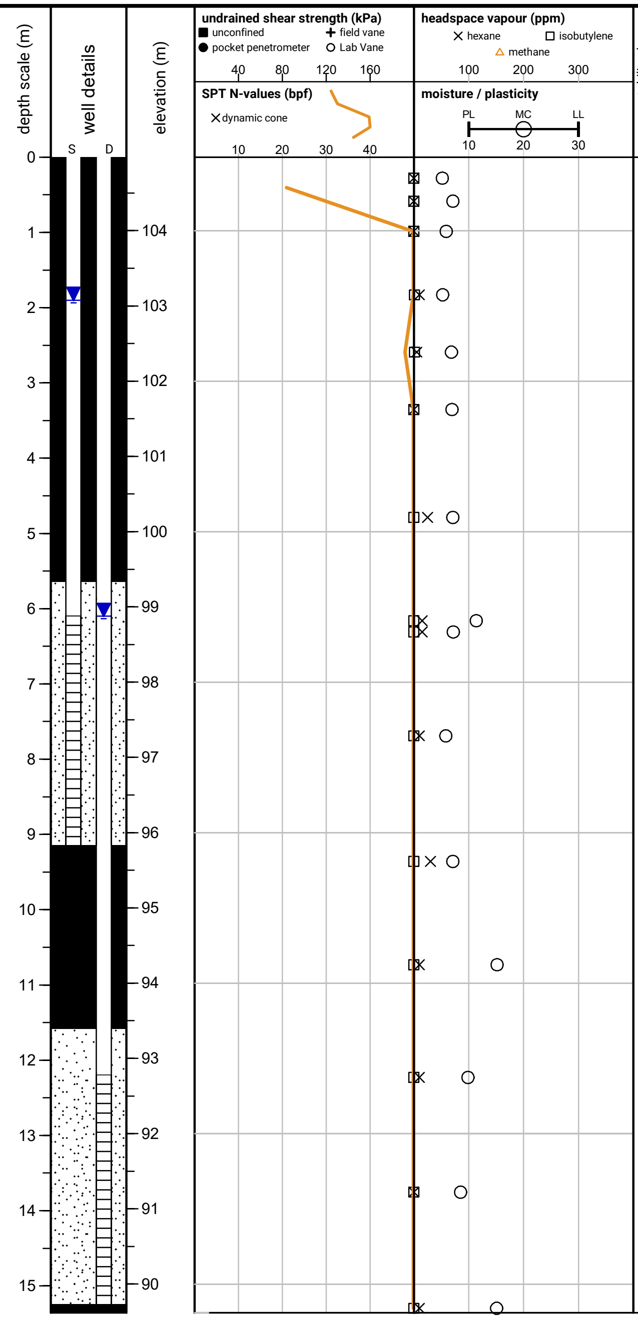
drill method : CME 55
- hollow stem augers OD=215 mm (0 to 3.0 m)
- mud rotary small OD=100 mm (3.0 to 15.4 m)

stratigraphy

elev depth (m)	description
105.0	**GROUND SURFACE**
	100mm **ASPHALT**
104.2 0.8	**FILL**, sand, trace silt, compact, grey, moist ...at 0.5 m, sand, some silt, trace gravel
	SANDY SILT, trace to some clay, trace gravel, trace rock fragments, dense to very dense, brown, moist (GLACIAL TILL) ...at 2.3 m, grey ...at 6.1 m, sand, trace silt, trace gravel
95.9 9.1	**CLAYEY SILT**, trace to some sand, trace gravel, hard, grey, moist (GLACIAL TILL) ...at 10.7 m, silt seam
89.6 15.4	...at 15.2 m, silt seam

samples

number	type	SPT N-value
1A	SS	21
1B	SS	
2	SS	76 / 290mm
3	SS	69
4	SS	48
5	SS	65
6	SS	90 / 275mm
7A	SS	50 / 145mm
7B	SS	
8	SS	50 / 140mm
9	SS	99 / 275mm
10	SS	50 / 125mm
11	SS	50 / 75mm
12	SS	50 / 75mm
13	SS	50 / 115mm



lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS1B: H-Ms, Metals, ORPs, PAHs

SS2: BTEX, PHCs, VOCs

SS3: H-Ms, Metals, ORPs, PAHs

SS7A: BTEX, PHCs, VOCs

7.6m: auger grinding **to 7.8m**

10.7m: spoon bouncing

13.7m: spoon bouncing

END OF BOREHOLE

Borehole was filled with drill water upon completion of drilling.

50 mm dia. monitoring well installed.

S: 50 mm dia. monitoring well installed.
D: 50 mm dia. monitoring well installed.
No. 10 screen

105-S GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Nov 3, 2023	7.3	97.7
Nov 9, 2023	6.9	98.1
Dec 7, 2023	3.1	101.9
Jan 5, 2024	2.8	102.2
Feb 28, 2024	1.9	103.1
Oct 8, 2024	1.9	103.1

105-D GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Oct 17, 2023	8.8	96.2
Oct 18, 2023	7.0	98.0
Oct 19, 2023	6.1	98.9

file: 23-197 gint.gpj

Tech : LB | **PM** : DR/MG | **Rev** : NN

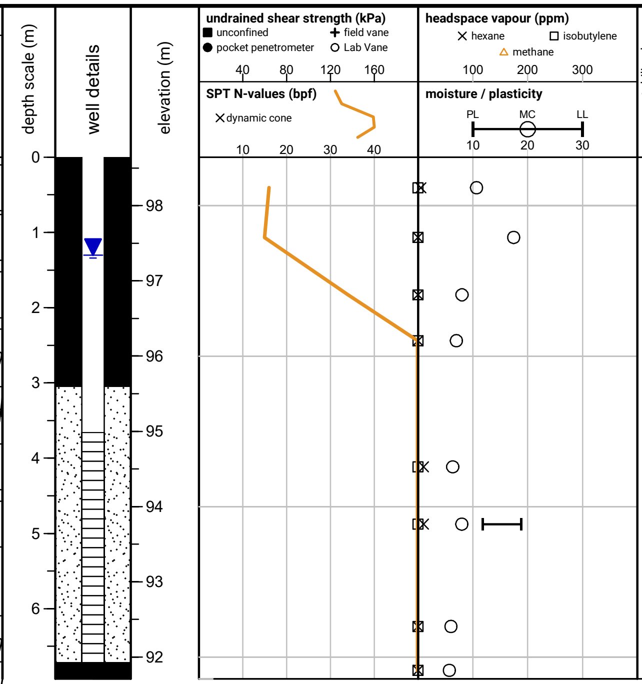
Date Started : Nov 1, 2023
Position : E: 651781, N: 4853567 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 106

File No. : 23-197 **Project** : 705 Kingston Road, Pickering, Ontario **Client** : Plaza Partners

drill method : CME 75
hollow stem augers OD=215 mm

elev depth (m)	description	number	type	SPT N-value	lab data and comments
98.6	**GROUND SURFACE**				
	100mm **ASPHALT**				
	FILL, silty sand, some gravel, trace clay, compact, brown, moist	1	SS	16	
	...at 0.8 m, organic matter, trace rootlets, dark brown	2	SS	15	SS2: H-Ms, Metals, ORPs, PAHs
97.1 1.5	**SANDY SILT**, trace to some gravel, dense to very dense, brown, moist (GLACIAL TILL)	3	SS	34	SS3: BTEX, PHCs, VOCs
		4	SS	50 / 150mm	SS4: H-Ms, Metals, ORPs, PAHs
		5	SS	50 / 100mm	**3.2m:** auger grinding **to 3.4m**
	...at 3.8 m, trace clay, grey	6	SS	67	SS6: BTEX, PHCs, VOCs
	...at 4.6 m, silty sand, some clay	7	SS	53	grain size distribution (%) (MIT) GR 13 SA 35 SI 33 CL 19
	...at 6.1 m, trace rock fragments	8	SS	50 / 125mm	
91.7 6.9		9	SS	50 / 75mm	



END OF BOREHOLE

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Nov 2, 2023	dry	n/a
Nov 3, 2023	dry	n/a
Nov 9, 2023	dry	n/a
Dec 7, 2023	6.6	92.0
Jan 5, 2024	6.1	92.5
Feb 28, 2024	4.9	93.7
Mar 14, 2024	4.7	93.9
Oct 8, 2024	1.3	97.3

file: 23-197 gint.gpj

Date Started : Mar 6, 2024
Position : E: 651629, N: 4853508 (UTM 17T)
Elev. Datum : Geodetic

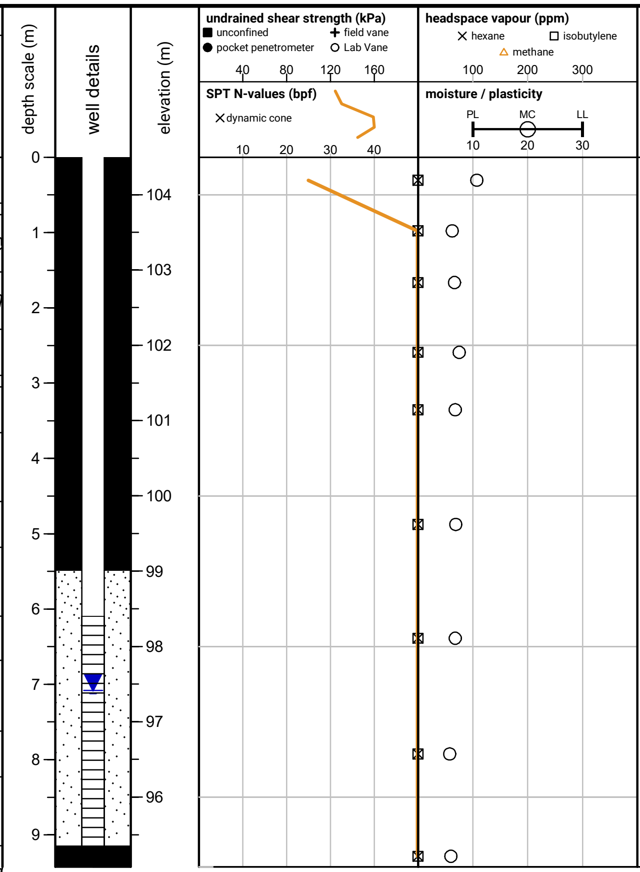
BOREHOLE LOG 201

File No. : 23-197 **Project** : 705 Kingston Road, Pickering, Ontario **Client** : Plaza Partners

drill method : CME 55

hollow stem augers OD=215 mm

elev depth (m)	description	number	type	SPT N-value
104.5	**GROUND SURFACE**			
	25mm **ASPHALT**	1	SS	25
103.9 0.6	**FILL**, silty sand, trace clay, trace to some gravel, compact, brown, moist			
	SANDY SILT, trace gravel, trace clay, moderate sweet odour, very dense, brown, moist (GLACIAL TILL) ...at 1.5 m, no odour, some gravel ...at 2.3 m, grey	2	SS	81 / 275mm
		3	SS	50 / 125mm
		4	SS	73
	...at 3.0 m, trace gravel, mild sweet odour	5	SS	64
	...at 4.6 m, no odour	6	SS	54
		7	SS	71
	...at 7.6 m, trace rock fragments	8	SS	83
95.1 9.4		9	SS	50 / 125mm



unstabilized water level

lab data and comments

grain size distribution (%) (MIT)

GR SA SI CL

SS2: VOCs

SS5: VOCs

SS8: VOCs

END OF BOREHOLE

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 14, 2024	dry	n/a
Oct 8, 2024	7.1	97.4

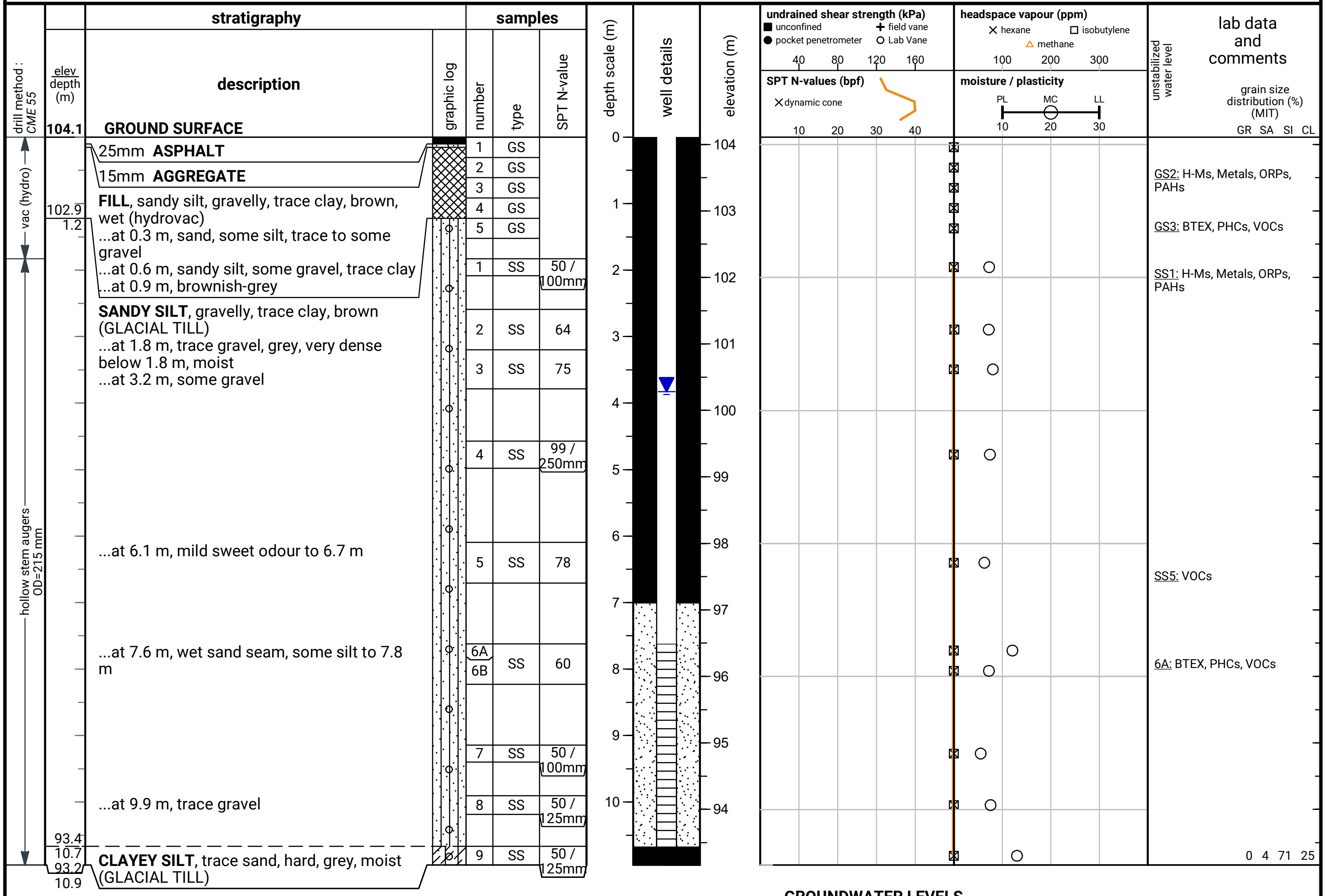
file: 23-197 gint.gpj

Tech : IH | **PM** : DR/YQ | **Rev** : NN

Date Started : Mar 6, 2024
Position : E: 651644, N: 4853481 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 202

File No. : 23-197 **Project** : 705 Kingston Road, Pickering, Ontario **Client** : Plaza Partners



elev depth (m)	description	sample number	type	SPT N-value
104.1	**GROUND SURFACE**			
	25mm **ASPHALT**	1	GS	
	15mm **AGGREGATE**	2	GS	
	FILL, sandy silt, gravelly, trace clay, brown, wet (hydrovac) ...at 0.3 m, sand, some silt, trace to some gravel ...at 0.6 m, sandy silt, some gravel, trace clay ...at 0.9 m, brownish-grey	3	GS	
		4	GS	
		5	GS	
102.9 1.2	**SANDY SILT**, gravelly, trace clay, brown (GLACIAL TILL) ...at 1.8 m, trace gravel, grey, very dense below 1.8 m, moist ...at 3.2 m, some gravel	1	SS	50 / 100mm
		2	SS	64
		3	SS	75
		4	SS	99 / 250mm
	...at 6.1 m, mild sweet odour to 6.7 m	5	SS	78
	...at 7.6 m, wet sand seam, some silt to 7.8 m	6A 6B	SS	60
		7	SS	50 / 100mm
	...at 9.9 m, trace gravel	8	SS	50 / 125mm
93.4 10.7	**CLAYEY SILT**, trace sand, hard, grey, moist (GLACIAL TILL)	9	SS	50 / 125mm
93.2 10.9				

lab data and comments:

GS2: H-Ms, Metals, ORPs, PAHs

GS3: BTEX, PHCs, VOCs

SS1: H-Ms, Metals, ORPs, PAHs

SS5: VOCs

6A: BTEX, PHCs, VOCs

GR	SA	SI	CL
0	4	71	25

END OF BOREHOLE

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

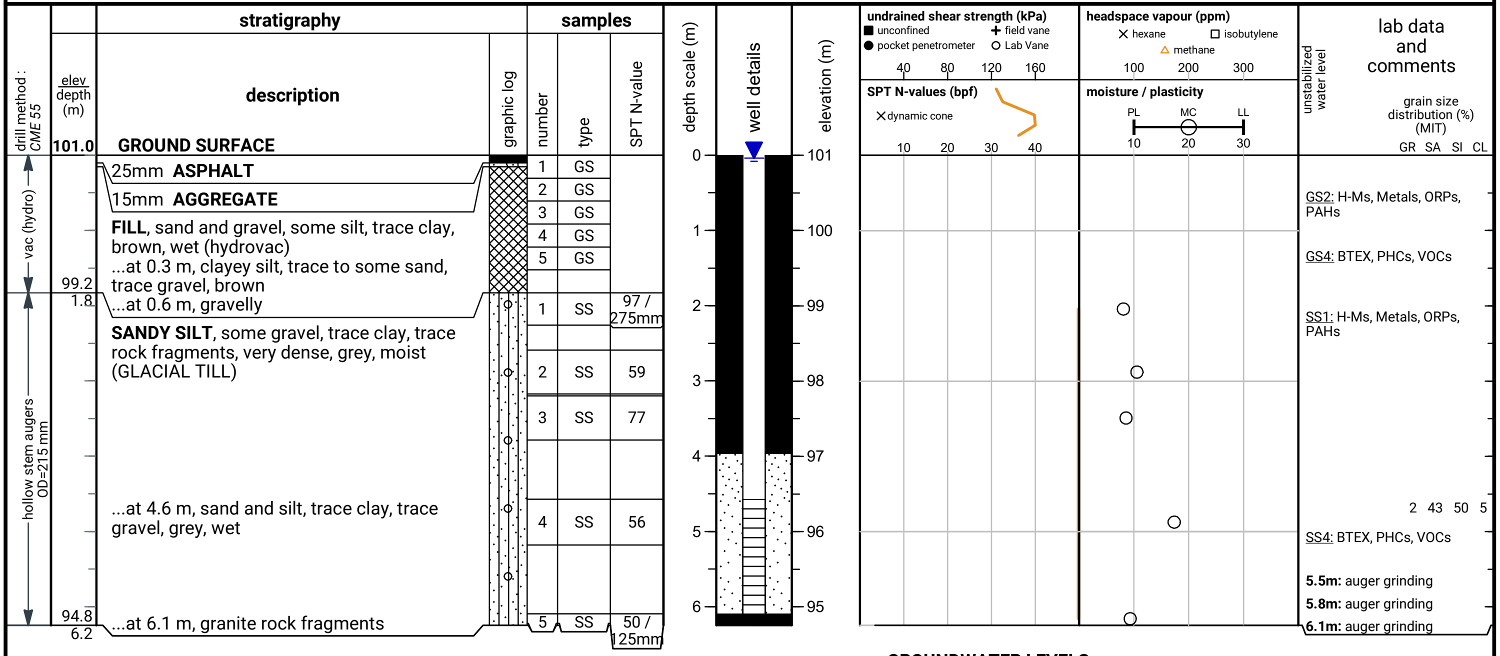
GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 14, 2024	6.3	97.8
Oct 8, 2024	3.8	100.3

Date Started : Mar 5, 2024
Position : E: 651729, N: 4853435 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 203

File No. : 23-197 **Project** : 705 Kingston Road, Pickering, Ontario **Client** : Plaza Partners



elev depth (m)	description	number	type	SPT N-value
101.0	**GROUND SURFACE**			
	25mm **ASPHALT**	1	GS	
	15mm **AGGREGATE**	2	GS	
	FILL, sand and gravel, some silt, trace clay, brown, wet (hydrovac) ...at 0.3 m, clayey silt, trace to some sand, trace gravel, brown ...at 0.6 m, gravelly	3 4 5	GS GS GS	
99.2 1.8	**SANDY SILT**, some gravel, trace clay, trace rock fragments, very dense, grey, moist (GLACIAL TILL)	1	SS	97 / 275mm
		2	SS	59
		3	SS	77
	...at 4.6 m, sand and silt, trace clay, trace gravel, grey, wet	4	SS	56
94.8 6.2	...at 6.1 m, granite rock fragments	5	SS	50 / 125mm

lab data and comments

grain size distribution (%) (MIT)

GR	SA	SI	CL
2	43	50	5

GS2: H-Ms, Metals, ORPs, PAHs
GS4: BTEX, PHCs, VOCs
SS1: H-Ms, Metals, ORPs, PAHs
SS4: BTEX, PHCs, VOCs
5.5m: auger grinding
5.8m: auger grinding
6.1m: auger grinding

END OF BOREHOLE
Refusal (obstruction in the hole)

Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

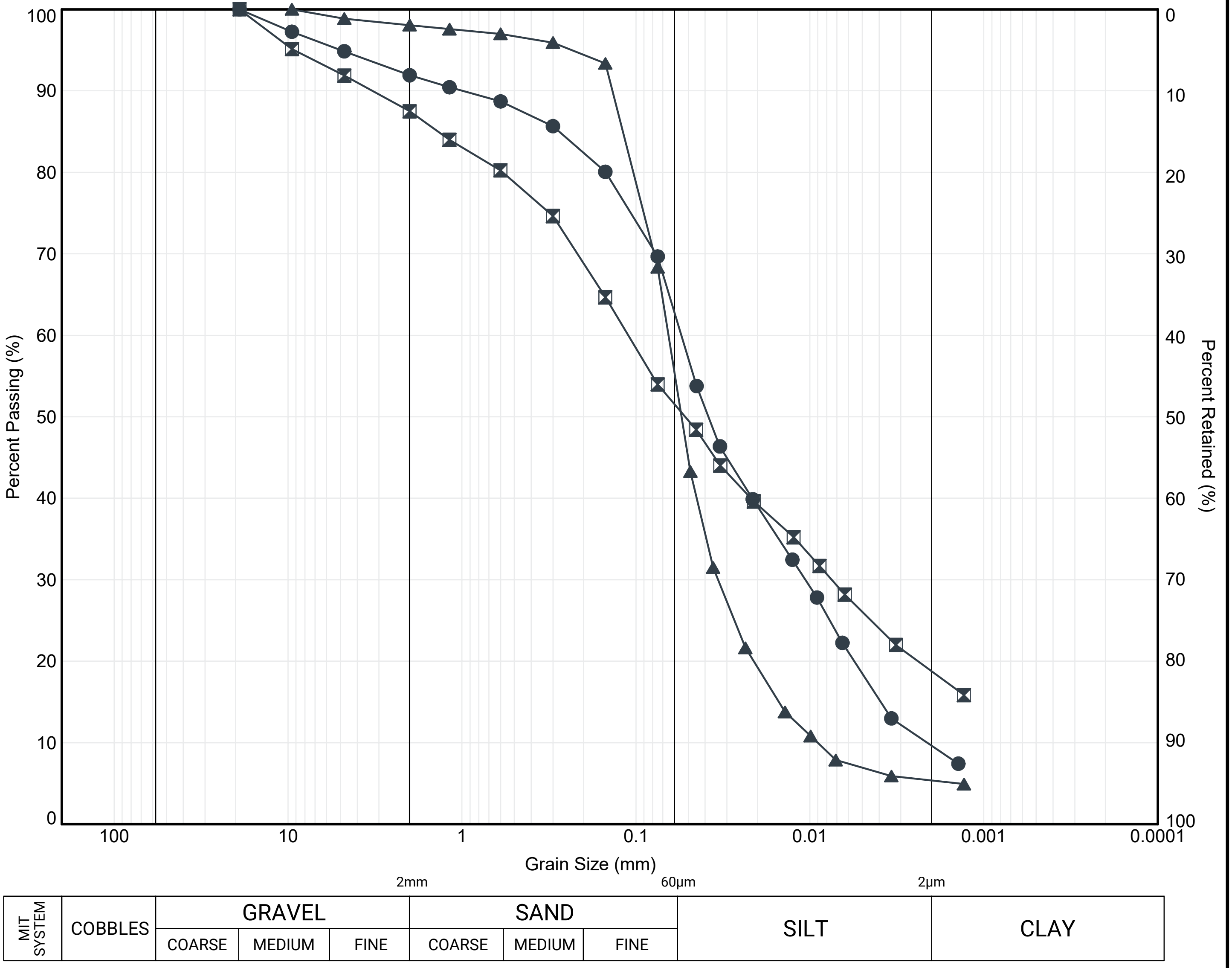
GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 14, 2024	0.8	100.2
Oct 8, 2024	0.0	101.0

file: 23-197 gint.gpj

Page 1 of 1 **Tech** : IH | **PM** : DR/YQ | **Rev** : NN

APPENDIX B



MIT SYSTEM

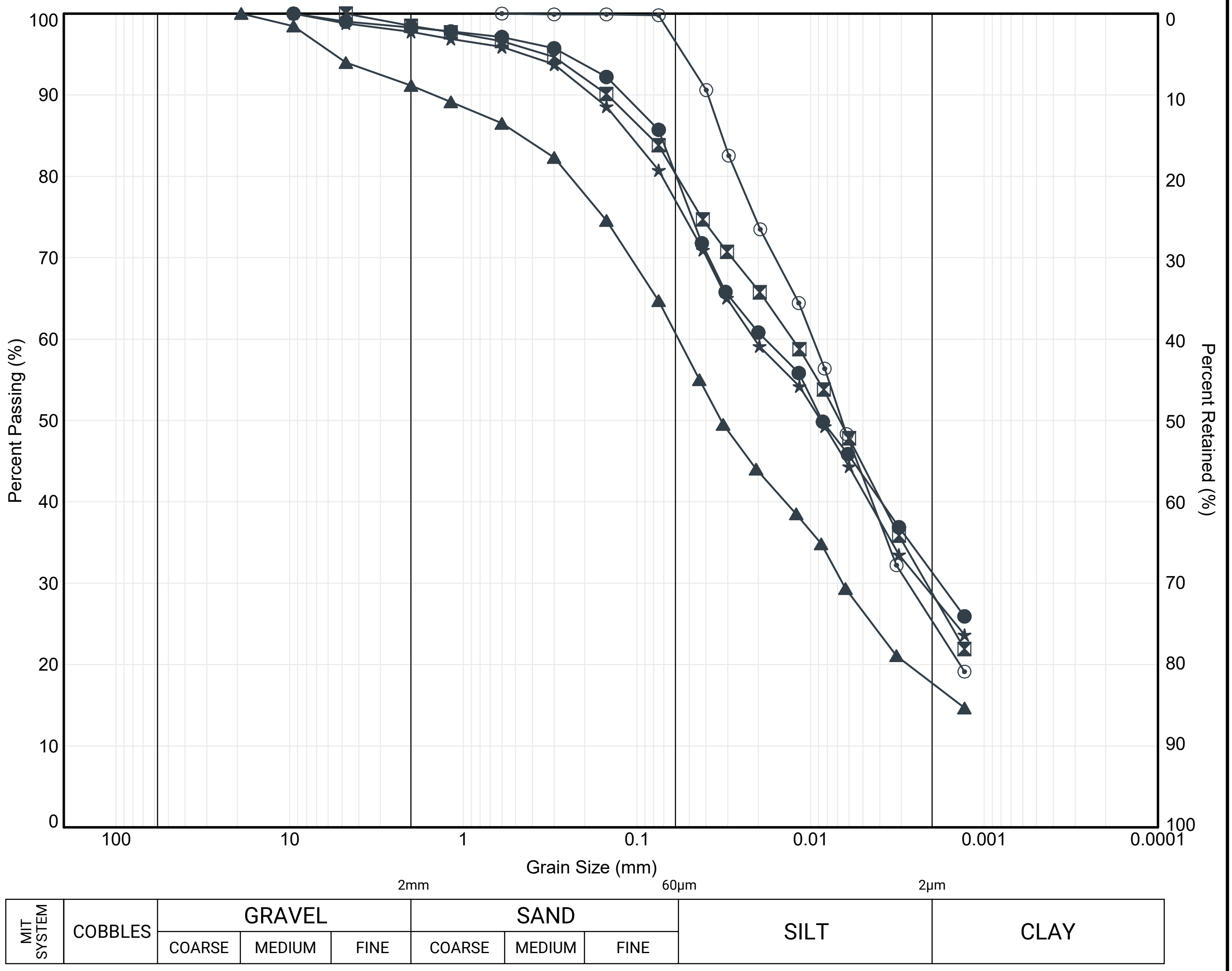
	Location	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**BH 101**	SS3	1.7	100.7	8	29	53	10
☒	**BH 106**	SS7	4.9	93.8	13	35	33	19
▲	**BH 203**	SS4	4.9	96.1	2	43	50	5

GROUNDED
ENGINEERING

Title:

GRAIN SIZE DISTRIBUTION
SANDY SILT TILL

File No.: **23-197**



					MIT SYSTEM			
	Location	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**BH 101**	SS9	12.5	89.9	2	18	49	31
⊠	**BH 101**	SS11	18.6	83.8	2	17	52	29
▲	**BH 102**	SS10	12.5	88.1	9	30	43	18
★	**BH 103**	SS12	14.0	84.1	2	20	49	29
⊙	**BH 202**	SS9	10.8	93.3	0	4	71	25

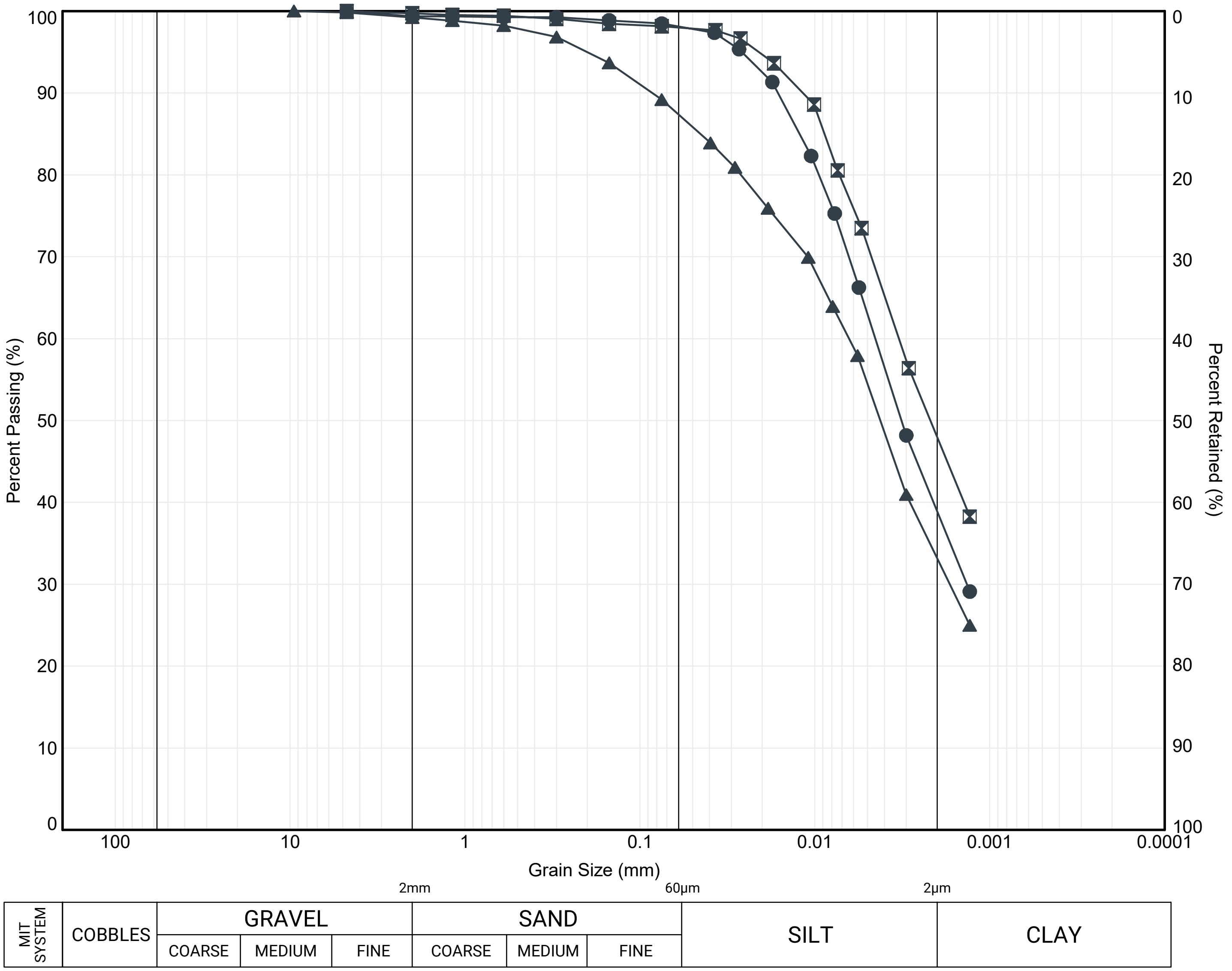
GROUNDED ENGINEERING

Title:

GRAIN SIZE DISTRIBUTION
CLAYEY SILT TILL

File No.: **23-197**

file: 23-197 gint.gpj



					MIT SYSTEM			
	Location	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**BH 101**	SS10	15.5	86.9	1	1	59	39
☒	**BH 102**	SS11	14.0	86.6	0	2	50	48
▲	**BH 104**	SS12	14.0	85.6	1	12	54	33

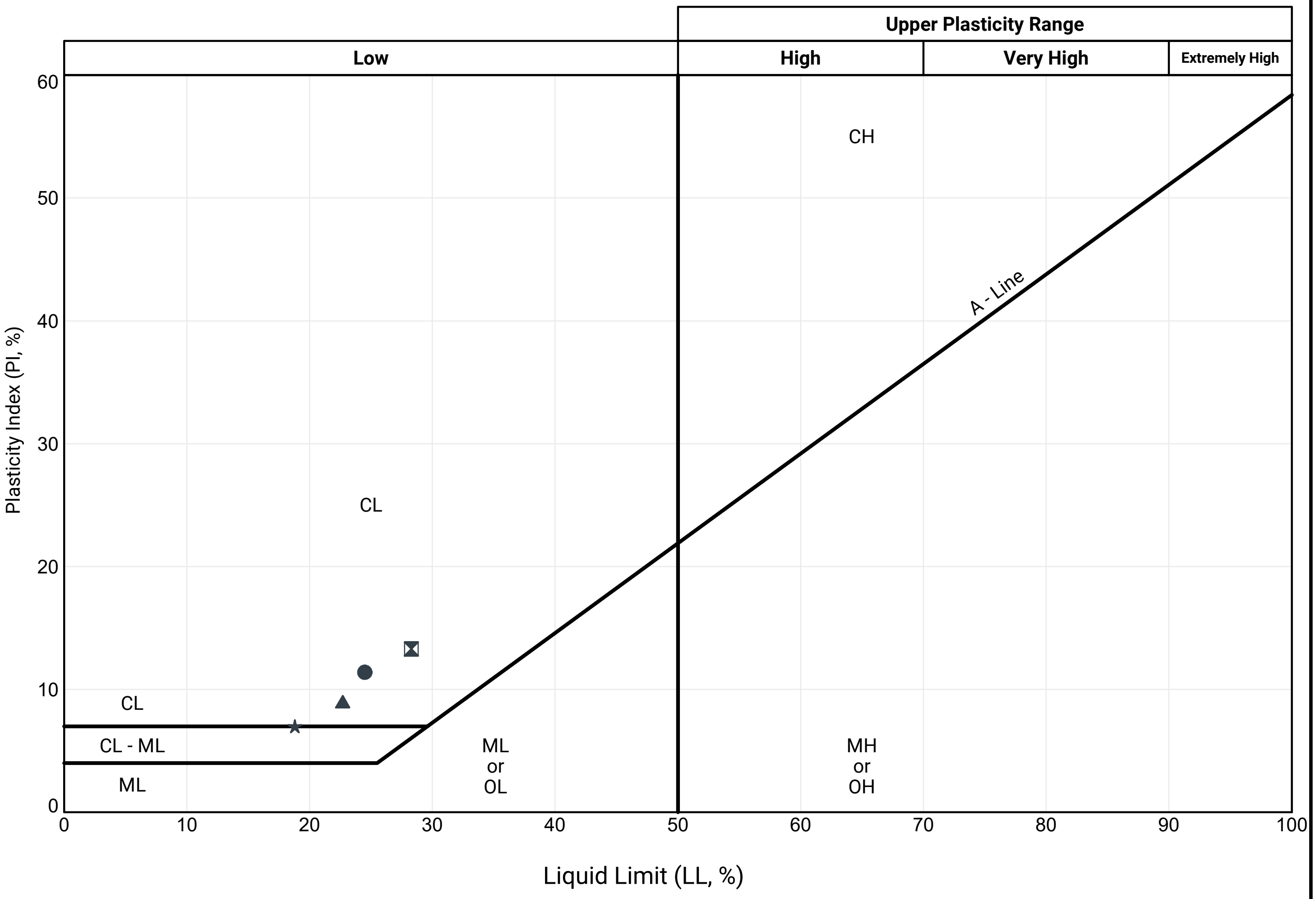
GROUNDED ENGINEERING

Title:

GRAIN SIZE DISTRIBUTION
SILT AND CLAY TO CLAYEY SILT

File No.: **23-197**

file: 23-197 gint.gpi



	Location	Sample	Depth (m)	Elev. (m)	LL (%)	PL (%)	PI (%)
●	**BH 101**	SS9	12.5	89.9	25	13	11
☒	**BH 101**	SS10	15.5	86.9	28	15	13
▲	**BH 103**	SS12	14.0	84.1	23	14	9
★	**BH 106**	SS7	4.9	93.8	19	12	7

GROUNDED
ENGINEERING

Title:

ATTERBERG LIMITS CHART

File No.: **23-197**

file: 23-197 gint.gpj

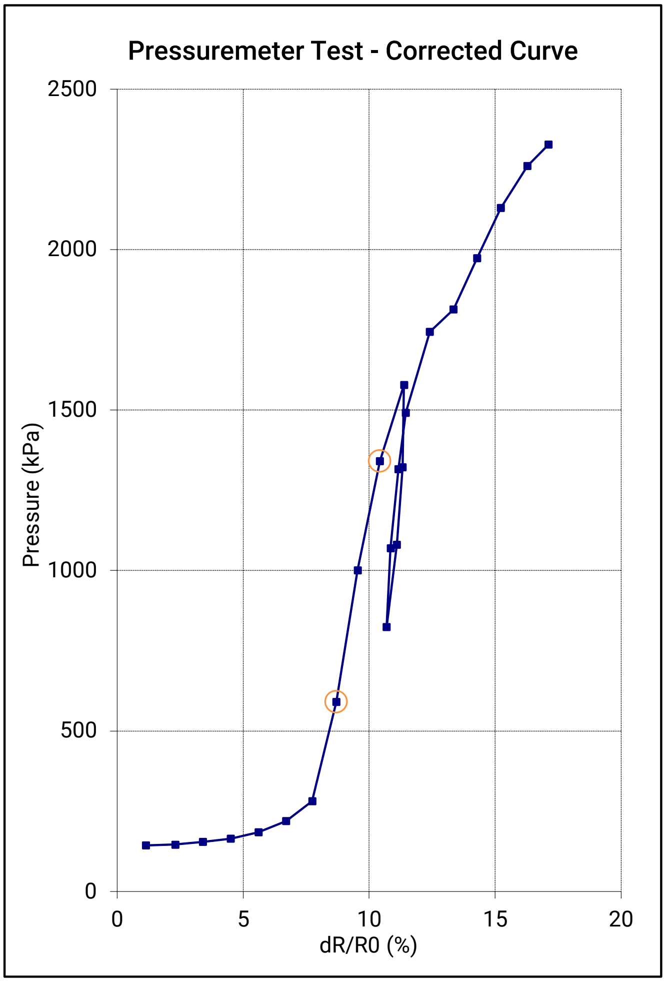
APPENDIX C

TEXAM Pressuremeter Test Results

GROUNDED
ENGINEERING

Project name:	**705 Kingston Rd**	Drilling Method:	Mud Rotary Drilling
Borehole name:	**BH101**	Test depth:	11.4 m
Test date: (dd/mm/yyyy)	11/10/2023	Test Elev:	91.0 m
Test number:	23-197 BH 101 37	Poisson's ratio:	0.33
Probe Designation	N Probe (76 mm OD)	Probe initial volume:	1718 cm^3

Raw Readings		**Corrected Readings**			
Pressure kPa	**Volume cm³**	**Pressure kPa**	**Volume cm³**	**DR/R_0 %**	
63	40.5	144	39.3	1.14	
69	81.3	146	80.1	2.30	
80	120.3	155	118.9	3.40	
92	160.1	164	158.4	4.51	
113	200.1	184	198.0	5.61	
149	240.7	219	238.0	6.70	
213	280.2	282	276.3	7.74	
524	321.6	591	312.0	8.70	◄
934	360.6	1000	343.6	9.54	
1275	400.3	1341	377.1	10.43	◄
1513	441.1	1578	413.5	11.39	
1257	434.2	1322	411.3	11.33	
1015	421.1	1080	402.5	11.10	
758	401.0	824	387.1	10.69	◄Er
1004	411.5	1070	393.1	10.85	
1251	427.7	1316	404.9	11.16	
1427	442.1	1492	416.1	11.45	◄Er
1680	483.3	1744	452.6	12.40	
1750	521.2	1814	489.3	13.35	
1911	560.9	1974	526.1	14.29	
2067	600.9	2130	563.2	15.23	
2198	644.9	2261	604.8	16.28	
2265	680.1	2328	638.8	17.12	



Pressuremeter Test - Corrected Curve

Interpreted Test Results	
Epmt:	63,269 kPa
Ep-ur	109,143 kPa
Ey:	**102 MPa**
Ey-ur:	**175 MPa**
Pl:	3,383 kPa
Ep / Pl:	18.7
Py:	1,341 kPa
Poh (est.) :	**158 kPa**
K_0 (est):	**0.89**

Time before recording readings : 15 sec.

Method for estimating Pl : 1/V vs P as per ASTM D4719

TEXAM Pressuremeter Test Results

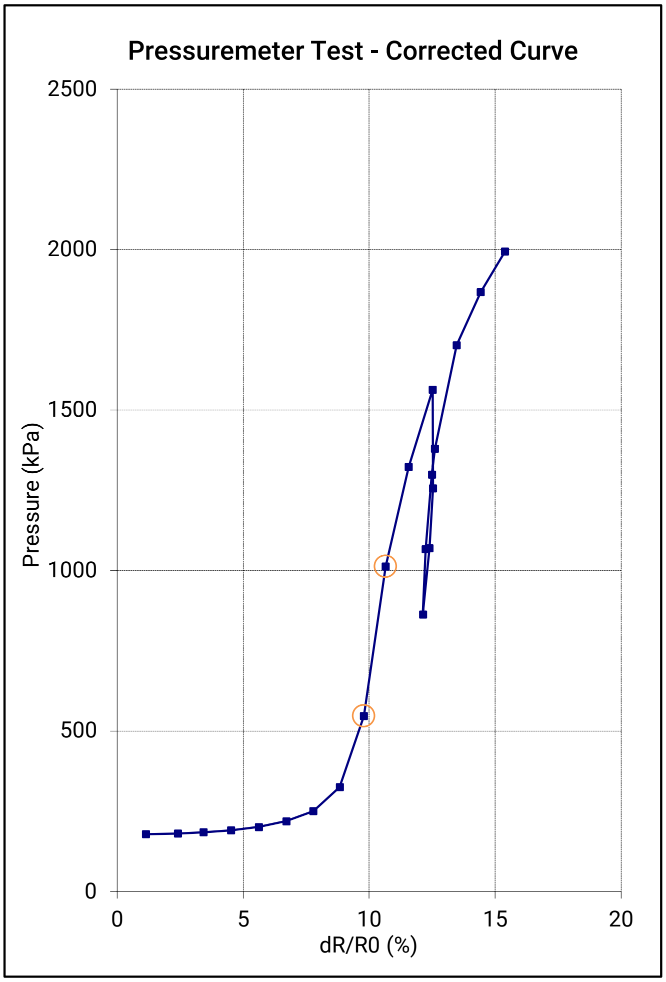
GROUNDED ENGINEERING

Project name: **705 Kingston Rd**
Borehole name: **BH101**
Test date: (dd/mm/yyyy) 11/10/2023
Test number: 23-197 BH 101 47
Probe Designation N Probe (76 mm OD)

Drilling Method: Mud Rotary Drilling
Test depth: 14.5 m
Test Elev: 87.9 m
Poisson's ratio: 0.33
Probe initial volume: 1718 cm^3

Raw Readings		Corrected Readings			
Pressure kPa	**Volume cm³**	**Pressure kPa**	**Volume cm³**	**DR/R_0 %**	
68	40.6	178	39.4	1.14	
74	85.0	181	83.8	2.41	
80	121.0	185	119.7	3.43	
88	160.0	190	158.6	4.51	
100	200.3	201	198.6	5.62	
119	240.2	219	238.3	6.71	
152	280.4	250	278.0	7.79	
228	320.7	325	316.9	8.83	
450	360.2	546	352.9	9.79	◄
917	400.5	1013	385.5	10.65	◄
1228	440.5	1323	420.4	11.56	
1470	481.2	1564	457.1	12.52	
1162	476.5	1256	457.5	12.53	
975	468.4	1069	452.5	12.40	
769	454.8	864	442.2	12.13	◄Er
972	462.3	1066	446.4	12.24	
1205	475.7	1299	456.0	12.49	
1286	481.5	1380	460.5	12.61	◄Er
1609	520.4	1702	494.0	13.47	
1775	560.5	1868	531.5	14.43	
1902	600.6	1995	569.5	15.39	

Time before recording readings : 15 sec.
Method for estimating Pl : 1/V vs P as per ASTM D4719



Interpreted Test Results

Epmt: 79,247 kPa
Ep-ur 137,385 kPa

Ey: **127 MPa**
Ey-ur: **220 MPa**

Pl: 3,422 kPa
Ep / Pl: 23.2
Py: 1,013 kPa

Poh (est.) : **192 kPa**
K_0 (est): **0.91**

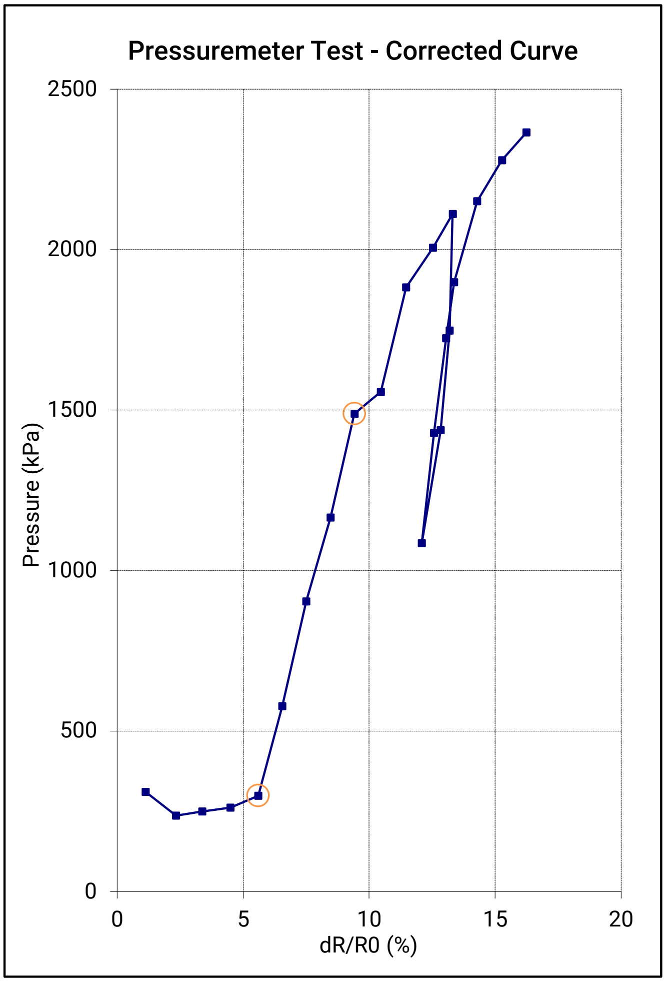
TEXAM COMPANION V.3.4.25

TEXAM Pressuremeter Test Results

GROUNDED ENGINEERING

Project name:	**705 Kingston Rd**	Drilling Method:	Mud Rotary Drilling
Borehole name:	**BH101**	Test depth:	17.5 m
Test date: (dd/mm/yyyy)	11/10/2023	Test Elev:	84.9 m
Test number:	23-197 BH 101 57	Poisson's ratio:	0.33
Probe Designation	N Probe (76 mm OD)	Probe initial volume:	1721 cm^3

Raw Readings		Corrected Readings			
Pressure kPa	Volume cm³	Pressure kPa	Volume cm³	DR/R_0 %	
170	41.7	310	38.9	1.12	
100	82.8	237	81.2	2.33	
115	120.1	250	118.3	3.38	
129	160.4	261	158.3	4.50	
167	200.8	298	198.0	5.60	◄
448	240.3	578	233.0	6.55	
776	280.7	904	268.0	7.50	
1039	320.8	1166	303.9	8.47	
1362	361.7	1488	339.4	9.42	◄
1431	402.5	1557	379.1	10.47	
1758	446.0	1883	417.3	11.46	
1883	489.4	2007	458.6	12.54	
1988	521.5	2111	489.0	13.32	
1625	510.9	1748	484.4	13.20	
1314	491.7	1438	470.2	12.83	
961	457.1	1085	441.4	12.09	◄Er
1305	481.5	1429	460.2	12.58	
1601	504.9	1724	478.7	13.05	
1775	520.2	1898	491.2	13.37	◄Er
2028	560.1	2151	527.0	14.29	
2156	601.1	2279	565.9	15.27	
2243	641.2	2366	604.6	16.24	



Time before recording readings :	15 sec.
Method for estimating Pl :	1/V vs P as per ASTM D4719

Interpreted Test Results

Epmt:	44,557 kPa
Ep-ur	86,325 kPa
Ey:	**67 MPa**
Ey-ur:	**129 MPa**
Pl:	3,137 kPa
Ep / Pl:	14.2
Py:	1,488 kPa
Poh (est.) :	**271 kPa**
K_0 (est):	**1.11**

TEXAM COMPANION V.3.4.25

APPENDIX D

NOTE: The elevations shown on this log are relative to a temporary benchmark assumed by EXP.

Log of Borehole: BH/MW 1

Project No.: BRM-00011934-A0

Project: Phase II ESA

Client: Linmar Investments Corporation Limited

Location: 705 Kingston Road, Pickering, ON

Logged By: AB

Project Manager: MS

exp Services Inc.
1595 Clark Boulevard
Brampton, Ontario

SUBSURFACE PROFILE / SAMPLE

Depth: ft 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26; m 0, 2, 4, 6

Description	Depth/Elevation (m)	Sample Number	Recovery (%)	Blows/Foot	Vapour (PPM)
Ground Surface	101.2				
Concrete **Fill** Grey/brown sand and silt, trace to some concrete and asphalt debris.	100.4	S1	40	14	0.5
SILTY SAND Grey/brown, trace to some gravel, pockets of orange oxidation, moist.		S2	50	49	0
	98.9	S3	70	27	0
SILT TILL Grey, trace gravel, trace clay, moist to wet, dense.		S4*	60	42	0
		S5	70	27	0
		S6	80	48	0
		S7	60	37	0
	95.1				
END OF BOREHOLE					

* Sample submitted for analysis

Vapour measuremens taken using a Minirae Photoionization Detector

Well Completion Details

Dry Well
June 16, 2011

Drilled By: Geo-Environmental Drilling

Drill Method: Hollow Stem Augers

Drill Date: June 13, 2011

Hole Size: 100mm

Datum TMB=100.00 (Fire hydrant, Southwest of Site)

NOTE: The elevations shown on this log are relative to a temporary benchmark assumed by EXP.

Log of Borehole: BH/MW 2

exp Services Inc.
1595 Clark Boulevard
Brampton, Ontario

Project No.: BRM-00011934-A0

Project: Phase II ESA

Client: Linmar Investments Corporation Limited

Location: 705 Kingston Road, Pickering, ON

Logged By: AB

Project Manager: MS

SUBSURFACE PROFILE

Description	Depth/Elevation (m)
Ground Surface	99.4
Concrete **Fill** Grey sand and silt, trace to some gravel, trace organic debris, moist to wet.	98.6
SANDY SILT Grey/brown, trace gravel, moist, pockets of orange oxidation.	97.1
SILT TILL Grey, trace sand, trace gravel, trace rock pieces, moist, dense.	93.3
END OF BOREHOLE	

Depth: ft 0–26; m 0–6

SAMPLE

Sample Number	Type	Recovery (%)	Blows/Foot	Vapour (PPM)
S1		50	11	0.5
S2		40	18	0.4
S3		20	4	0
S4		70	50 5"	0.1
S5*		90	45	6.5
S6		80	53	0.9

* Sample submitted for analysis

Vapour measuremens taken using a Minirae Photoionization Detector

Well Completion Details

Dry Well
June 16, 2011

Drilled By: Geo-Environmental Drilling

Drill Method: Hollow Stem Augers

Drill Date: June 13, 2011

Hole Size: 100mm

Datum TMB=100.00 (Fire hydrant, Southwest of Site)

NOTE: The elevations shown on this log are relative to a temporary benchmark assumed by EXP.

exp Services Inc.
1595 Clark Boulevard
Brampton, Ontario

Log of Borehole: BH/MW 3

Project No.: BRM-00011934-A0

Project: Phase II ESA

Client: Linmar Investments Corporation Limited

Logged By: AB

Location: 705 Kingston Road, Pickering, ON

Project Manager: MS

SUBSURFACE PROFILE				SAMPLE					
Depth ft m	Symbol	Description	Depth/Elevation (m)	Sample Number	Type	Recovery (%)	Blows/Foot	Vapour (PPM)	Well Completion Details
		Ground Surface	99.4						
0		**Concrete**		S1		50	45	0.1	
		Fill Grey sand and silt, trace to some gravel, trace organic debris, moist to wet.	98.6	S2*		40	7	0	
		SILTY SAND Grey/brown, trace gravel, moist, pockets of orange oxidation, moist to wet.		S3		60	10	0	
				S4*		70	48	0	
				S5*		60	34	0	
				S6		70	40	0	
20 ft / 6 m			93.3						
		END OF BOREHOLE							
		* Sample submitted for analysis Vapour measuremens taken using a Minirae Photoionization Detector							Water Level 1.91 m bgs June 16, 2011

Water Level
1.91 m bgs
June 16, 2011

Drilled By: Geo-Environmental Drilling

Hole Size: 100mm

Drill Method: Hollow Stem Augers

Datum TMB=100.00 (Fire hydrant, Southwest of Site)

Drill Date: June 13, 2011

APPENDIX E

Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH101

Page 1 of 1

Client: Valiant Rental Properties Ltd.
Project Name: Phase II Environmental Site Assessment
Project No.: 12699-001
Contractor: Strata Drilling Group
Method: DP, solid stem
Date Completed: May 25, 2021
Location: 705 Kingston Rd, Pickering
UTM: 17T 651608 m E, 4853498 m N
Elevation:

SUBSURFACE PROFILE

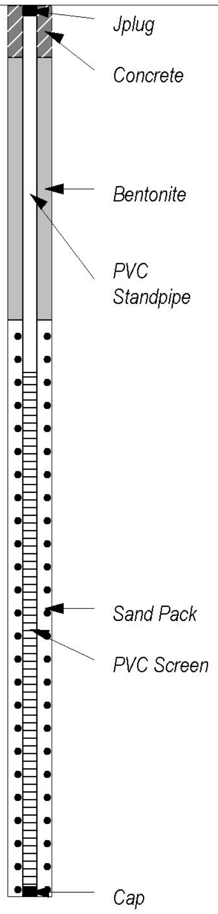
Depth (m)	Elevation (m)	Description
0	0	Asphalt: granular material
		Sandy Silt: trace clay, trace gravel, brown, stiff, moist
		-dark grey, very stiff
		-hard
		-increased moisture
		-DP refusal at 4.6 mbgs, augered to depth
		-BH terminated at 6.7 mbgs upon completion in SANDY SILT

Depth (ft): 0–24; Depth (m): 0–7; Elevation (m): 0 to -7

SAMPLING INFO

Number	Type	% Recovery	CSV (ppm)	OV (ppm)
SS1	DP	100	20	<2
SS2	DP		30	<2
SS3	DP	100	20	<2
SS4	DP		20	<2
SS5	DP	100	25	<2
SS6	DP		25	<2

Well Installation



Remarks

BH101_0.8-1.5 (PHC & BTEX)

Recorded dry on June 8, 2021

Borehole cave-in from 5 to 6.7 mbgs

Logged By: DN
Input By: LW

CAMBIUM
Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH102

Page 1 of 1

Client: Valiant Rental Properties Ltd.
Project Name: Phase II Environmental Site Assessment
Project No.: 12699-001
Contractor: Strata Drilling Group
Method: DP, solid stem
Date Completed: May 25, 2021
Location: 705 Kingston Rd, Pickering
UTM: 17T 651649 m E, 4853551 m N
Elevation:

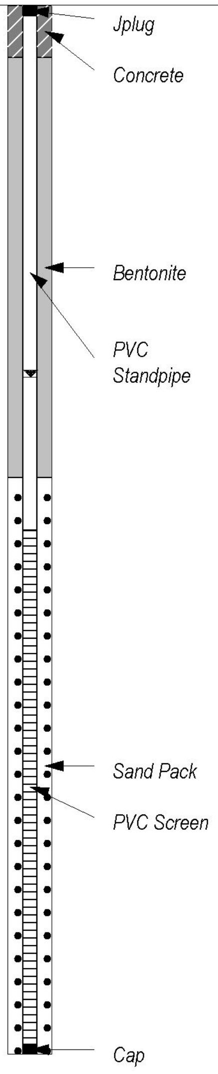
SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Description	Elevation (m)
0	0	Asphalt	0
		Fill: Sand, some gravel, trace silt, grey, loose, moist	
		Sandy Silt: trace clay, trace gravel, brown, stiff, moist	
		-increased moisture	
		-decreased moisture, hard	
		-DP refusal at 3.4 mbgs, drilled to depth	
		-grey, increased moisture/wet	
		Borehole terminated at 6.1 mbgs upon completion in SANDY SILT	

SAMPLING INFO

Number	Type	% Recovery	CSV (ppm)	OV (ppm)
SS1	DP	40	30	<2
SS2	DP		20	<2
SS3	DP	100	80	<2
SS4	DP		35	<2
SS5	DP	100	35	<2
SS6	GB		320	<2
SS7	GB		80	<2

Well Installation



Remarks

Recorded water level of 2.16 mbgs on June 8, 2021

BH102_4.0-4.6 (PHC & BTEX)

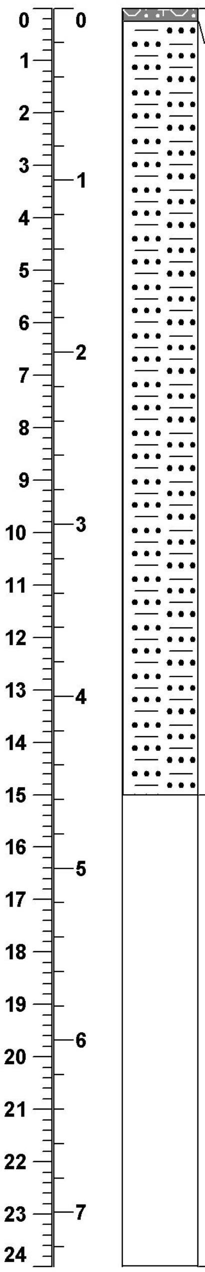
Logged By: DN
Input By: LW

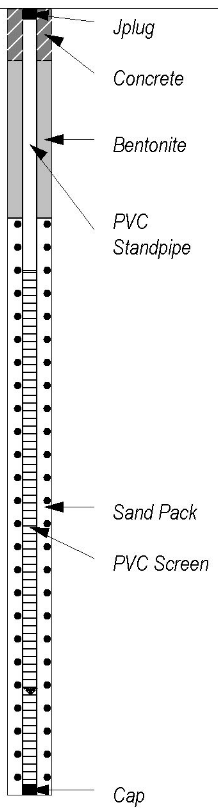
CAMBIUM
Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH103

Page 1 of 1

Client: Valiant Rental Properties Ltd.
Project Name: Phase II Environmental Site Assessment
Project No.: 12699-001
Contractor: Strata Drilling Group
Method: DP, solid stem
Date Completed: May 31, 2021
Location: 705 Kingston Rd, Pickering
UTM: 17T 651687 m E, 4853583 m N
Elevation:





SUBSURFACE PROFILE					SAMPLING INFO						
Depth (ft)	Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0	0		Asphalt: some sand and gravel	0							
			Sandy Silt: trace clay, low plasticity, dark grey, medium-dense, moist		SS1	DP	40	<1	<2		
			-wet and soft		SS2	DP	100	40	<2		BH103_1.5-1.8 (PHC/VOC)
			-brown, medium-dense to hard, some gravel		SS3	DP		<1	<2		
			-grey		SS4	DP	100	<1	<2		Recorded water level of 3.99 mbgs on June 8, 2021
			Borehole terminated at 4.6 mbgs upon completion in SANDY SILT								

Logged By: RD
Input By: LW

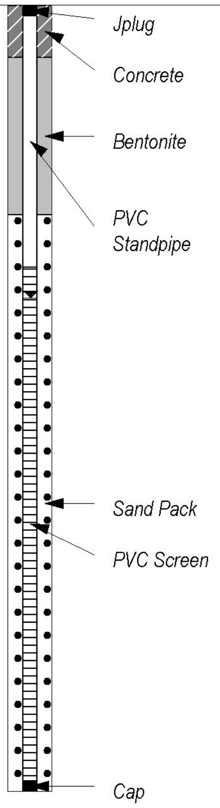
Peterborough
Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

Log of Borehole: BH104

Page 1 of 1

Client: Valiant Rental Properties Ltd.
Project Name: Phase II Environmental Site Assessment
Project No.: 12699-001
Contractor: Strata Drilling Group
Method: DP, solid stem
Date Completed: May 25, 2021
Location: 705 Kingston Rd, Pickering
UTM: 17T 651785 m E, 4853555 m N
Elevation:

SUBSURFACE PROFILE					SAMPLING INFO						
Depth (ft)	Depth (m)	Lithology	Description	Elevation (m)	Number	Type	% Recovery	CSV (ppm)	OV (ppm)	Well Installation	Remarks
0	0		Asphalt	0							
1			Fill: Sand, some gravel, trace silt, dark brown, medium-dense, moist								
2											
3	1			-1	SS1	DP	40	30	<2		
4											
5			-increased silt, increased moisture								Recorded water level of 1.70 mbgs on June 8, 2021
6											
7	2			-2	SS2	DP	50	25	<2		
8			-wet, minor black staining, minor HC odour								
9					SS3	DP		30	<2		
10	3		Concrete: Greenish grey lean mix concrete	-3							BH104_2.7-2.9 (PHC/VOC)
11			Sandy Silt: (native) trace clay, trace gravel, trace organics, dark brown, very stiff, moist								
12					SS4	DP	100	30	<2		
13	4		-dark brownish grey, no organics	-4							
14					SS5	DP		15	<2		
15			Borehole terminated at 4.6 mbgs upon completion in SANDY SILT								
16	5			-5							
17											
18											
19											
20	6			-6							
21											
22											
23	7			-7							
24											



Logged By: DN
Input By: LW

APPENDIX F

CORROSIVITY (ALS)

Results Summary WT2325868

Project	23-197-101
Report To	Deeana Reynolds, Grounded Engineering Inc.
Date Received	16-Oct-2023 18:00
Issue Date	23-Oct-2023 21:45
Amendment	0

Client Sample ID			BH105-SS4	BH105-SS6	BH102-SS2B
Date Sampled			13-Oct-2023	13-Oct-2023	13-Oct-2023
Time Sampled			15:30	16:40	17:25
ALS Sample ID			WT2333389-001	WT2333389-002	WT2333389-003
Analyte	Lowest Detection Limit	Units	Sub-Matrix: Soil/Solid	Sub-Matrix: Soil/Solid	Sub-Matrix: Soil/Solid
Physical Tests (Matrix: Soil/Solid)					
Conductivity (1:2 leachate)	5.00	µS/cm	617	143	507
Moisture	0.25	%	6.55	7.32	6.77
Oxidation-reduction potential [ORP]	0.10	mV	254	190	192
Resistivity	100	ohm cm	1620	6990	1970
pH (1:2 soil:CaCl2-aq)	0.10	pH units	7.76	8.09	7.88
Inorganics (Matrix: Soil/Solid)					
Sulfides, acid volatile	0.20	mg/kg	0.39	0.5	0.54
Leachable Anions & Nutrients (Matrix: Soil/Solid)					
Chloride, soluble ion content	5.0	mg/kg	299	5.1	156
Sulfate, soluble ion content	20	mg/kg	73	48	32

INTERPRETATION

AWWA C-105 Standard	**Points**	**Points**	**Points**
% Moisture	1	1	1
pH			
Is pH bet 6.5-7.5 ?	NO	NO	NO
Is Redox Potential < 100 mv?	NO	NO	NO
Are Sulphides present ?	YES	YES	YES
If above three conditions are met, pH is assigned 3 points			
pH - Score	0	0	0
Redox Potential	0	0	0
Resistivity	1	0	1
Acid Volatile Sulphides	**0**	**0**	**0**
TOTAL SCORE (AWWA C-105)	**2**	**1**	**2**

Sample		**BH105-SS4**	**BH105-SS6**	**BH102-SS2B**
Corrosion Protection Recommended?		**No**	**No**	**No**
Resistivity less than 2000 ohm.cm?		**YES**	**No**	**YES**
Anions and Nutrients (Soil)				
Sulphate	%	0.0073	0.0048	0.0032
CLASS OF EXPOSURE		**Negligible**	**Negligible**	**Negligible**

CERTIFICATE OF ANALYSIS

Work Order	: **WT2333389**	Page	: 1 of 3
Client	: **Grounded Engineering Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Deeana Reynolds	Account Manager	: Amanda Overholster
Address	: 1 Banigan Drive Toronto ON Canada M4H 1G3	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 647 370 3191	Telephone	: 1 416 817 2944
Project	: 23-197-101	Date Samples Received	: 16-Oct-2023 18:00
PO	: ----	Date Analysis Commenced	: 17-Oct-2023
C-O-C number	: 20-1047463	Issue Date	: 23-Oct-2023 21:45
Sampler	: IB/IH		
Site	: 705 KINGSTON RD, PICKERING		
Quote number	: 2023 SOA Pricing		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Jon Fisher	Production Manager, Environmental	Inorganics, Waterloo, Ontario
Niral Patel		Centralized Prep, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key :

CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
µS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Soil/Solid**

(Matrix: **Soil/Solid)**

Client sample ID					**BH105-SS4**	**BH105-SS6**	**BH102-SS2B**	**----**	**----**
Client sampling date / time					13-Oct-2023 15:30	13-Oct-2023 16:40	13-Oct-2023 17:25	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*	**WT2333389-001**	**WT2333389-002**	**WT2333389-003**	**--------**	**--------**
					Result	Result	Result	----	----
Physical Tests									
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm	617	143	507	----	----
Moisture	----	E144/WT	0.25	%	6.55	7.32	6.77	----	----
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV	254	190	192	----	----
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units	7.76	8.09	7.88	----	----
Resistivity	----	EC100R/WT	100	ohm cm	1620	6990	1970	----	----
Inorganics									
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg	0.39	0.50	0.54	----	----
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg	299	5.1	156	----	----
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	73	48	32	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	:**WT2333389**	Page	: 1 of 8
Client	:**Grounded Engineering Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	:Deeana Reynolds	Account Manager	: Amanda Overholster
Address	:1 Banigan Drive Toronto ON Canada M4H 1G3	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:647 370 3191	Telephone	: 1 416 817 2944
Project	:23-197-101	Date Samples Received	: 16-Oct-2023 18:00
PO	: ----	Issue Date	: 23-Oct-2023 21:45
C-O-C number	:20-1047463		
Sampler	:IB/IH		
Site	:705 KINGSTON RD, PICKERING		
Quote number	:2023 SOA Pricing		
No. of samples received	:3		
No. of samples analysed	:3		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH102-SS2B	E396-L	13-Oct-2023	23-Oct-2023	14 days	10 days	✓	23-Oct-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS4	E396-L	13-Oct-2023	23-Oct-2023	14 days	10 days	✓	23-Oct-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS6	E396-L	13-Oct-2023	23-Oct-2023	14 days	10 days	✓	23-Oct-2023	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH102-SS2B	E236.Cl	13-Oct-2023	20-Oct-2023	30 days	7 days	✓	20-Oct-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS4	E236.Cl	13-Oct-2023	20-Oct-2023	30 days	7 days	✓	20-Oct-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS6	E236.Cl	13-Oct-2023	20-Oct-2023	30 days	7 days	✓	20-Oct-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH102-SS2B	E236.SO4	13-Oct-2023	20-Oct-2023	30 days	7 days	✓	20-Oct-2023	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS4	E236.SO4	13-Oct-2023	20-Oct-2023	30 days	7 days	✓	20-Oct-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS6	E236.SO4	13-Oct-2023	20-Oct-2023	30 days	7 days	✓	20-Oct-2023	28 days	0 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH102-SS2B	E100-L	13-Oct-2023	20-Oct-2023	30 days	6 days	✓	20-Oct-2023	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS4	E100-L	13-Oct-2023	20-Oct-2023	30 days	6 days	✓	20-Oct-2023	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS6	E100-L	13-Oct-2023	20-Oct-2023	30 days	6 days	✓	20-Oct-2023	30 days	7 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH102-SS2B	E144	13-Oct-2023	----	----	----		17-Oct-2023	----	4 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS4	E144	13-Oct-2023	----	----	----		17-Oct-2023	----	4 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS6	E144	13-Oct-2023	----	----	----		17-Oct-2023	----	4 days	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH102-SS2B	E125	13-Oct-2023	18-Oct-2023	180 days	4 days	✓	18-Oct-2023	180 days	5 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS4	E125	13-Oct-2023	18-Oct-2023	180 days	4 days	✓	18-Oct-2023	180 days	5 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS6	E125	13-Oct-2023	18-Oct-2023	180 days	4 days	✓	18-Oct-2023	180 days	5 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH102-SS2B	E108A	13-Oct-2023	17-Oct-2023	30 days	4 days	✓	18-Oct-2023	30 days	5 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS4	E108A	13-Oct-2023	17-Oct-2023	30 days	4 days	✓	18-Oct-2023	30 days	5 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH105-SS6	E108A	13-Oct-2023	17-Oct-2023	30 days	4 days	✓	18-Oct-2023	30 days	5 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			*Count*		*Frequency (%)*		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1201093	1	14	7.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1189095	1	16	6.2	5.0	✓
Moisture Content by Gravimetry	E144	1188845	1	17	5.8	5.0	✓
ORP by Electrode	E125	1190690	1	10	10.0	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1188807	1	17	5.8	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1189094	1	5	20.0	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1189093	1	5	20.0	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1201093	1	14	7.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1189095	2	16	12.5	10.0	✓
Moisture Content by Gravimetry	E144	1188845	1	17	5.8	5.0	✓
ORP by Electrode	E125	1190690	1	10	10.0	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1188807	1	17	5.8	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1189094	2	5	40.0	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1189093	2	5	40.0	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1201093	1	14	7.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1189095	1	16	6.2	5.0	✓
Moisture Content by Gravimetry	E144	1188845	1	17	5.8	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1189094	1	5	20.0	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1189093	1	5	20.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A ALS Environmental - Waterloo	Soil/Solid	MECP E3137A	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode.
ORP by Electrode	E125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Oxidation Redution Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO4 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500 S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.
Resistivity Calculation for Soil Using E100-L	EC100R ALS Environmental - Waterloo	Soil/Solid	APHA 2510 B	Soil Resistivity (calculated) is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Preparation Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Waterloo	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A ALS Environmental - Waterloo	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.
Distillation for Acid Volatile Sulfide in Soil	EP396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.

QUALITY CONTROL REPORT

Work Order : **WT2333389**
Client : Grounded Engineering Inc.
Contact : Deeana Reynolds
Address : 1 Banigan Drive
Toronto ON Canada M4H 1G3
Telephone :
Project : 23-197-101
PO : ----
C-O-C number : 20-1047463
Sampler : IB/IH 647 370 3191
Site : 705 KINGSTON RD, PICKERING
Quote number : 2023 SOA Pricing
No. of samples received : 3
No. of samples analysed : 3

Page : 1 of 5
Laboratory : ALS Environmental - Waterloo
Account Manager : Amanda Overholster
Address : 60 Northland Road, Unit 1
Waterloo, Ontario Canada N2V 2B8
Telephone : 1 416 817 2944
Date Samples Received : 16-Oct-2023 18:00
Date Analysis Commenced : 17-Oct-2023
Issue Date : 23-Oct-2023 21:45

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Jon Fisher	Production Manager, Environmental	Waterloo Inorganics, Waterloo, Ontario
Niral Patel		Waterloo Centralized Prep, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 1188807)											
WT2333342-003	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	4.61	4.84	4.87%	5%	----
Physical Tests (QC Lot: 1188845)											
WT2333389-001	BH105-SS4	Moisture	----	E144	0.25	%	6.55	6.72	2.54%	20%	----
Physical Tests (QC Lot: 1189095)											
WT2333397-001	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	2.82 mS/cm	2850	1.06%	20%	----
Physical Tests (QC Lot: 1190690)											
WT2333389-001	BH105-SS4	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	254	239	6.08%	25%	----
Inorganics (QC Lot: 1201093)											
WT2332604-001	Anonymous	Sulfides, acid volatile	----	E396-L	0.21	mg/kg	0.34	0.50	0.16	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1189093)											
WT2333389-001	BH105-SS4	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	73	71	2	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1189094)											
WT2333389-001	BH105-SS4	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	299	287	3.96%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Physical Tests (QCLot: 1188845)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1189095)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Inorganics (QCLot: 1201093)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 1189093)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 1189094)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Concentration*	*LCS*	*Low*	*High*	*Qualifier*
Physical Tests (QCLot: 1188807)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	99.8	98.0	102	----
Physical Tests (QCLot: 1188845)									
Moisture	----	E144	0.25	%	50 %	99.4	90.0	110	----
Physical Tests (QCLot: 1189095)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1409 µS/cm	96.7	90.0	110	----
Inorganics (QCLot: 1201093)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	2.54 mg/kg	94.5	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1189093)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	5000 mg/kg	100	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1189094)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	5000 mg/kg	101	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Reference Material ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*RM*	*Low*	*High*	*Qualifier*
Physical Tests (QCLot: 1189095)									
	RM	Conductivity (1:2 leachate)	----	E100-L	1970.3 µS/cm	104	70.0	130	----
Physical Tests (QCLot: 1190690)									
	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	101	90.0	110	----
Leachable Anions & Nutrients (QCLot: 1189093)									
	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	1070 mg/kg	103	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1189094)									
	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	432 mg/kg	103	70.0	130	----

SLR-216

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 - 1047463

ALS www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Page

Environmental Division
Waterloo
Work Order Reference
WT2333389

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report	
Company:	Grounded Engineering	
Contact:	Deana Reynolds	
Phone:	647-370-3191	
Company address below will appear on the final report		
Street:	1 Banigan Dr.	
City/Province:	Toronto, ON	
Postal Code:	M4H 1G3	
Invoice To	Same as Report To	☒ YES ☐ NO
	Copy of Invoice with Report	☒ YES ☐ NO
Company:		
Contact:		

Reports / Recipients

Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A
☒ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax dreynolds@groundedeng.ca
Email 2 mgarcia@groundedeng.ca
Email 3

Invoice Recipients

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax accounting@groundedeng.ca
Email 2 stavares@groundedeng.ca

Turnaround Time (TAT) Requested

☒ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Addi may apply to rush requests on weekends, statutory holidays and non-r

Date and Time Required for all E&P TATs:

For all tests with rush TATs requested, please

Project Information

ALS Account # / Quote #:
Job #: 23-197-101
PO / AFE:
LSD: 705 Kingston Rd, Pickering.
ALS Lab Work Order # (ALS use only):

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler: IB/TH

Analysis Re

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Corrosivity	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
				Soil					
	BH105-SS4	13-Oct-23	3:30Pm		1	X			
	BH105-SS6		4:40Pm		1	X			
	BH102-SS2B		17:25		1	X			

Drinking Water (DW) Samples¹ (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO
Are samples for human consumption/ use?
☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Corrosivity Suite

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED
Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO
Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				5.4	3.4		

SHIPMENT RELEASE (client use)

Released by: Lawrence Boand Date: 10/13/23 Time: 6:00

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by: Date: Time:

FINAL SHIPMENT RECEPTION (ALS use only)

Received by: TH Date: 2023-10-16 Time: 18:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

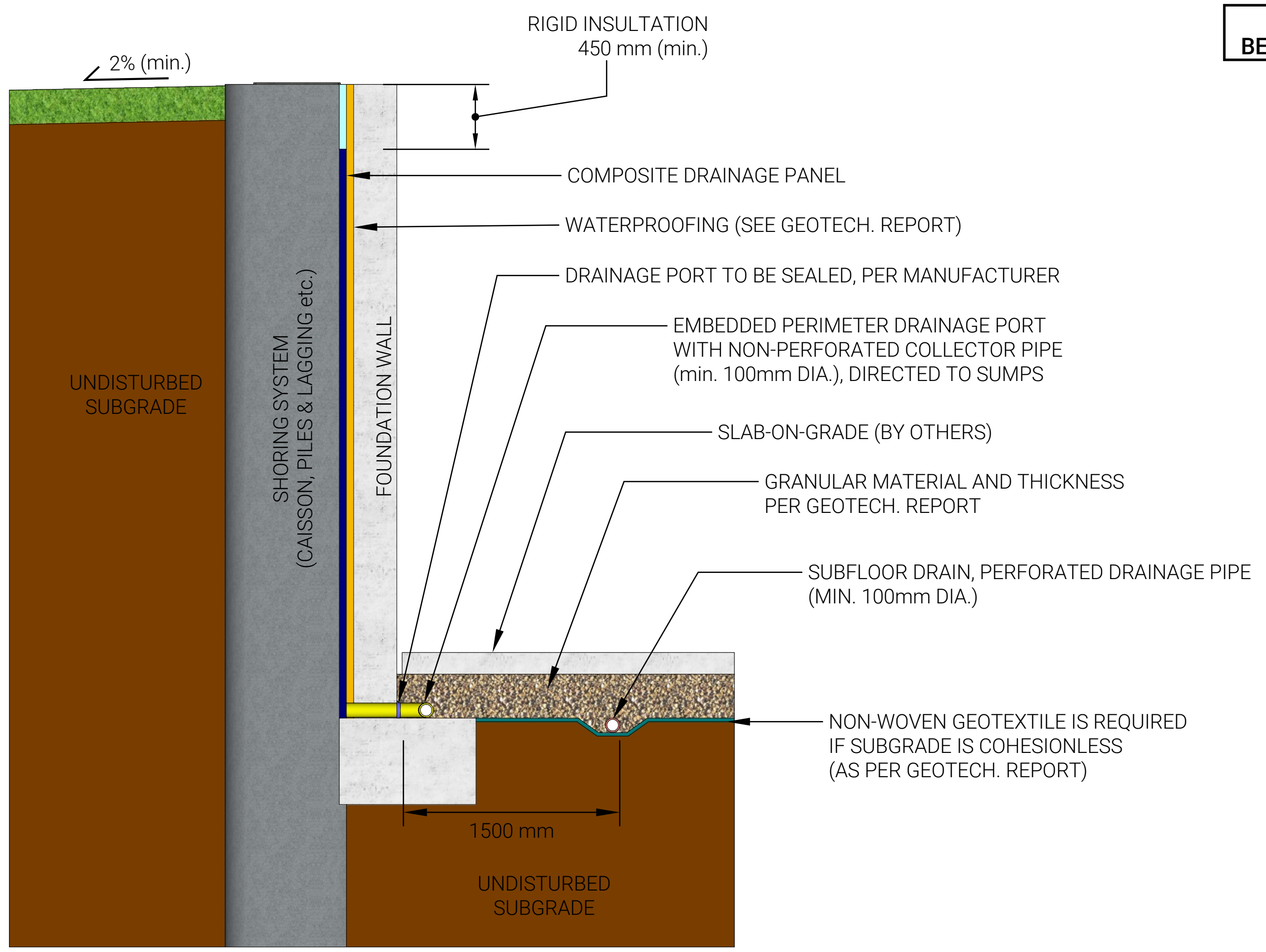
AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

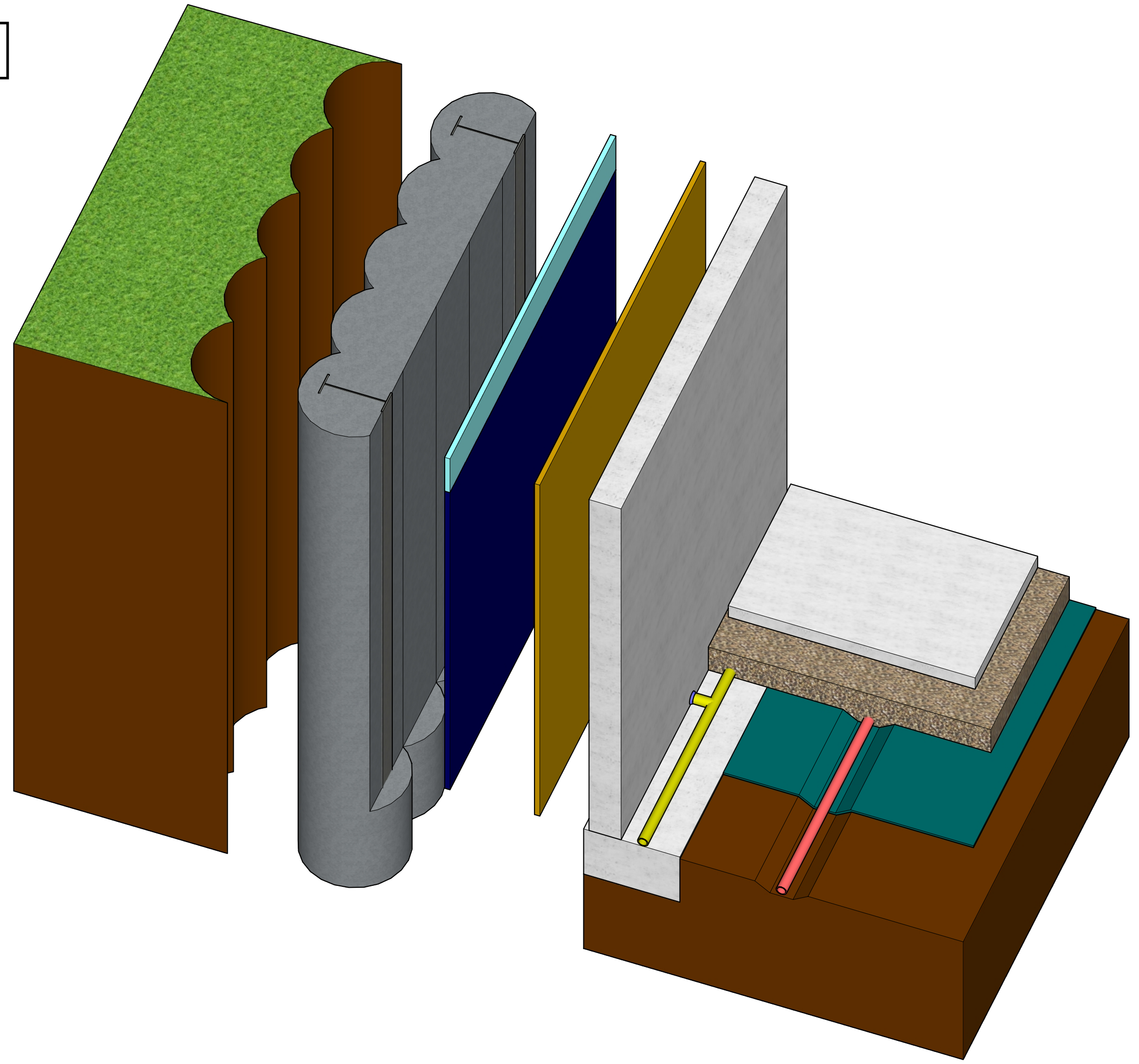
1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX G

OBJECTS ARE COLOR-CODED BETWEEN TWO VIEWS FOR CLARITY



SECTIONAL VIEW



ISOMETRIC VIEW

SUBFLOOR DRAINAGE SYSTEM

1. THE SUBFLOOR DRAINS SHOULD BE SET IN PARALLEL ROWS, IN ONE DIRECTION, AND SPACED AS PER THE GEOTECHNICAL REPORT.
2. THE INVERT OF THE PIPES SHOULD BE A MINIMUM OF 300mm BELOW THE UNDERSIDE OF THE SLAB-ON-GRADE.
3. A CAPILLARY MOISTURE BARRIER (I.E. DRAINAGE LAYER) CONSISTING OF A MINIMUM 200 mm LAYER OF CLEAR STONE (OPSS MUNI 1004) COMPACTED TO A DENSE STATE (OR AS PER THE GEOTECHNICAL REPORT). WHERE VEHICULAR TRAFFIC IS REQUIRED, THE UPPER 50 mm OF THE CAPILLARY MOISTURE BARRIER MAY BE REPLACED WITH GRANULAR A (OPSS MUNI 1010) COMPACTED TO A MINIMUM 98% SPMDD.
4. A NON-WOVEN GEOTEXTILE MUST SEPARATE THE SUBGRADE FROM THE SUBFLOOR DRAINAGE LAYER IF THE SUBGRADE IS COHESIONLESS. THE NON-WOVEN GEOTEXTILE MAY CONSIST OF TERRAFIX 360R OR AN APPROVED EQUIVALENT.

PERIMETER DRAINAGE SYSTEM

1. FOR A DISTANCE OF 1.2m FROM THE BUILDING, THE GROUND SURFACE SHOULD HAVE A MINIMUM 2% GRADE.
2. PREFABRICATED COMPOSITE DRAINAGE PANEL (CONTINUOUS COVER, AS PER MANUFACTURER'S REQUIREMENTS) IS RECOMMENDED BETWEEN THE BASEMENT WALL AND RIGID SHORING WALL. THE DRAINAGE PANEL MAY CONSIST OF MIRADRAIN 6000 OR AN APPROVED EQUIVALENT.
3. PERIMETER DRAINAGE IS TO BE COLLECTED IN NON-PERFORATED PIPES AND CONVEYED DIRECTLY TO THE BUILDING SUMPS.
4. PERIMETER DRAINAGE PORTS SHOULD BE SPACED A MAXIMUM 3m ON-CENTRE. EACH PORT SHOULD HAVE A MINIMUM CROSS-SECTIONAL AREA OF 1500 mm2.

GENERAL NOTES

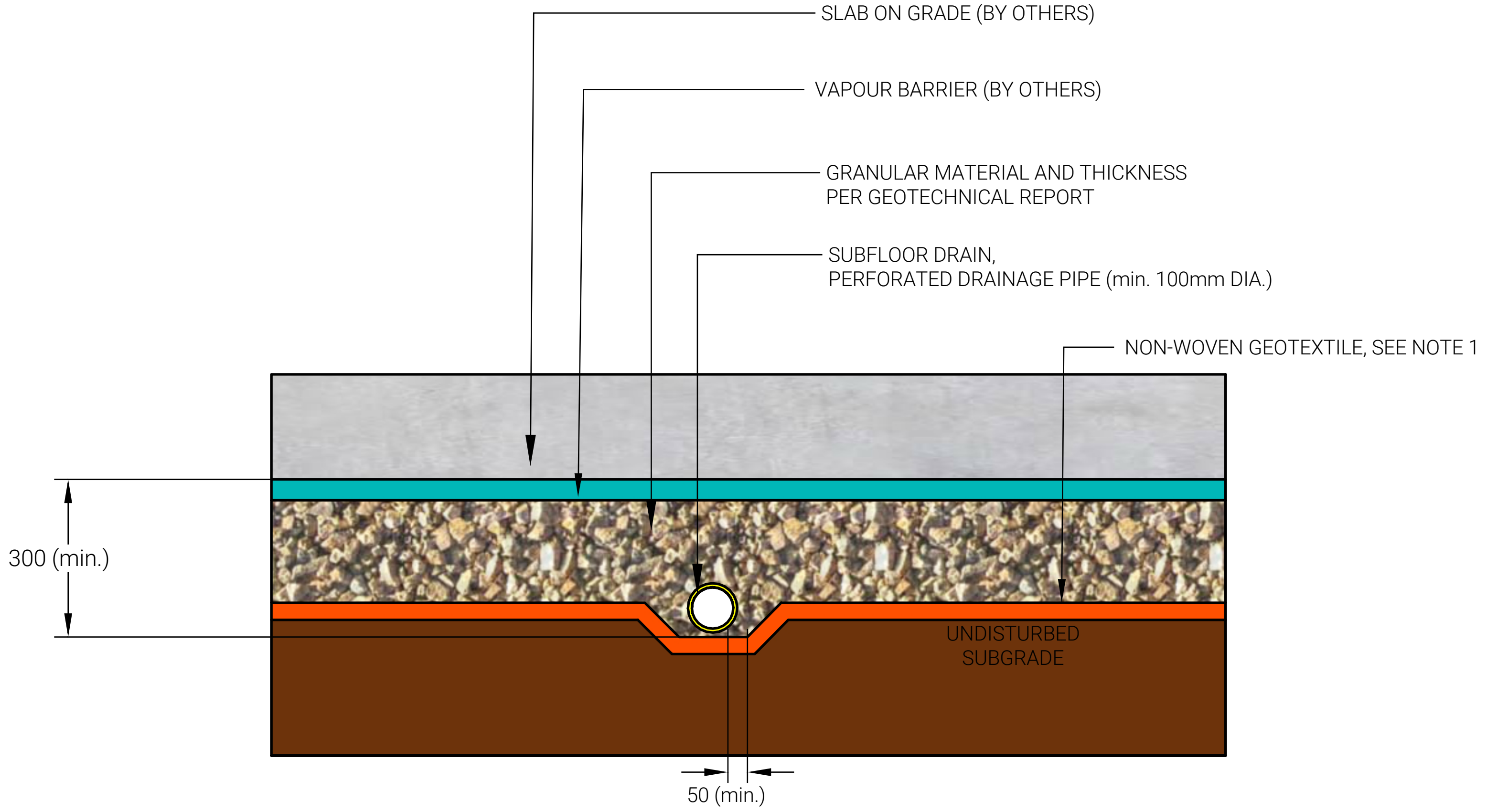
1. THERE SHOULD BE NO STRUCTURAL CONNECTION BETWEEN THE SLAB-ON-GRADE AND THE FOUNDATION WALL OR FOOTING.
2. THERE SHOULD BE NO CONNECTION BETWEEN THE SUBFLOOR AND PERIMETER DRAINAGE SYSTEMS.
3. THIS IS ONLY A TYPICAL BASEMENT DRAINAGE DETAIL. THE GEOTECHNICAL REPORT SHOULD BE CONSULTED FOR SITE SPECIFIC RECOMMENDATIONS.
4. THE FINAL BASEMENT DRAINAGE DESIGN SHOULD BE REVIEWED BY THE GEOTECHNICAL ENGINEER TO CONFIRM THE DESIGN IS ACCEPTABLE.

GROUNDED ENGINEERING

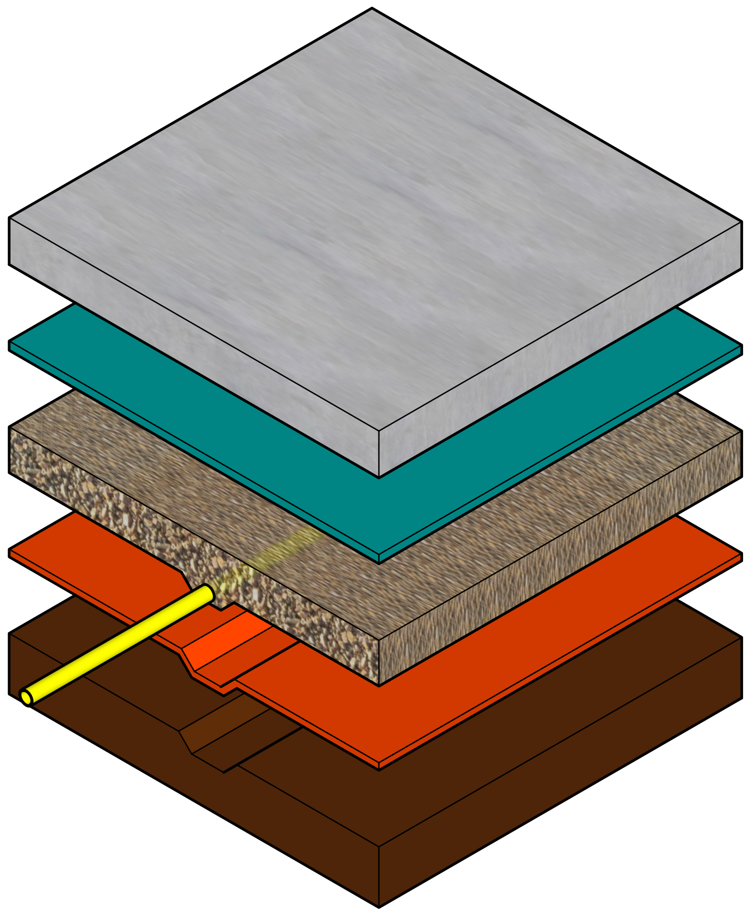
Title

BASEMENT DRAINAGE SHORING SYSTEM TYPICAL DETAILS

OBJECTS ARE COLOR-CODED
BETWEEN TWO VIEWS FOR CLARITY



SECTIONAL VIEW



ISOMETRIC VIEW

NOTES

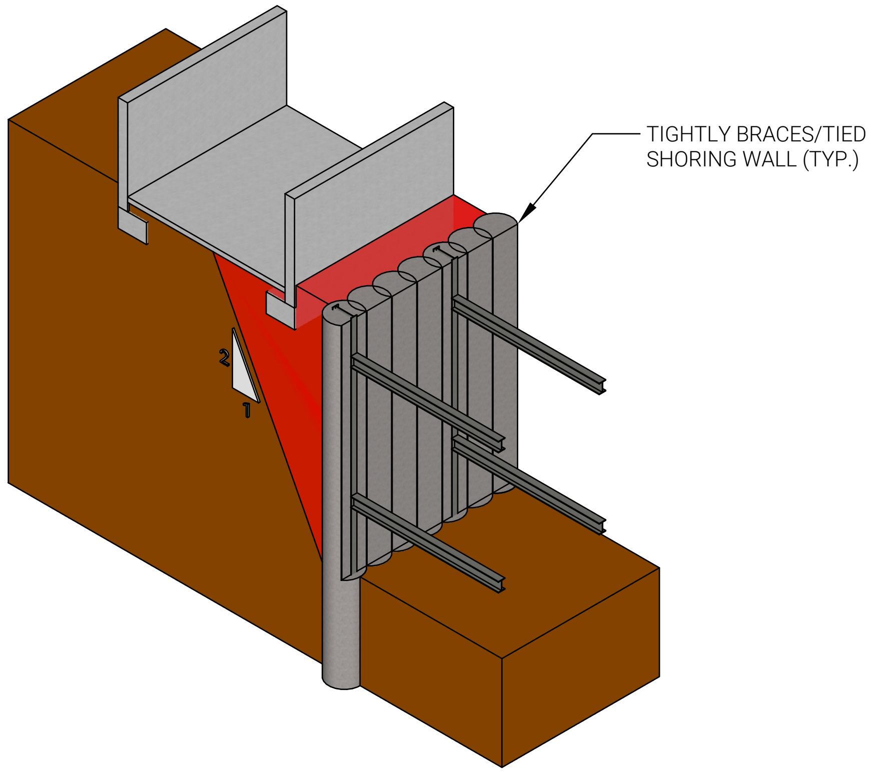
1. WHEN THE SUBGRADE CONSISTS OF COHESIONLESS SOIL, IT MUST BE SEPARATED FROM THE SUBFLOOR DRAINAGE LAYER USING A NON-WOVEN GEOTEXTILE (WITH AN APPARENT OPENING SIZE OF < 0.250mm AND A TEAR RESISTANCE OF > 200 N).

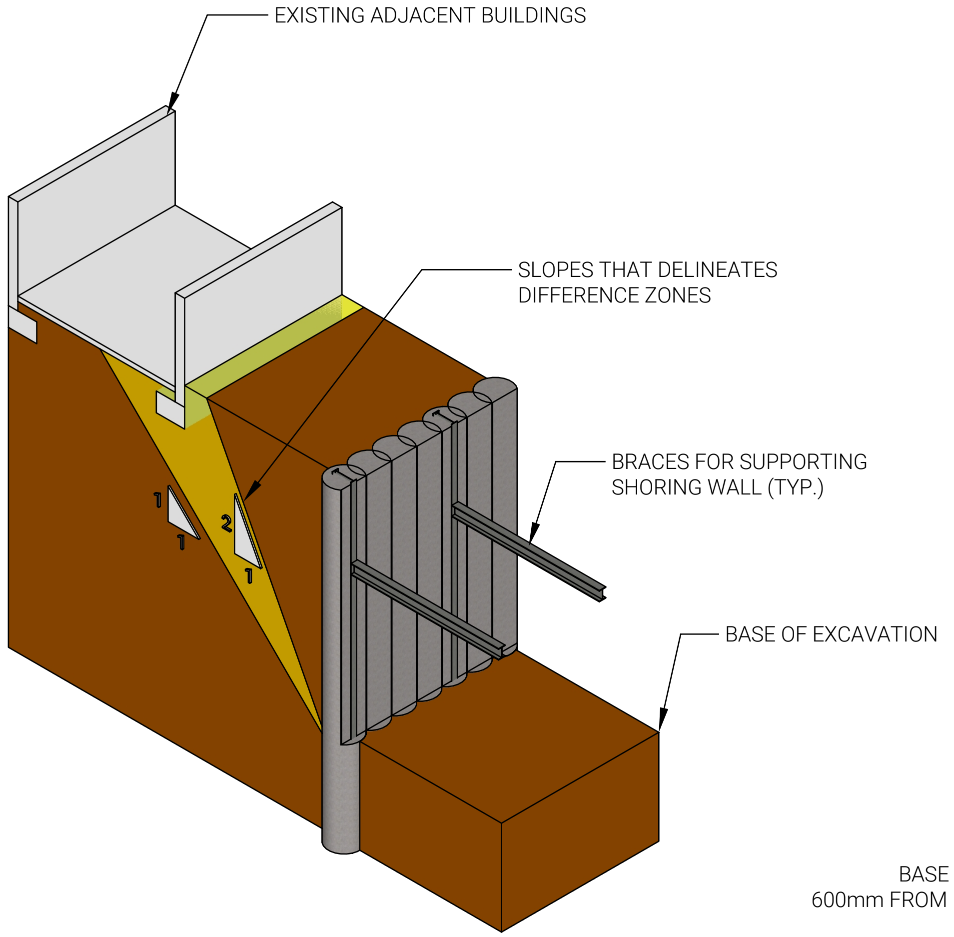
2. TYPICAL SCHEMATIC ONLY. MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT.

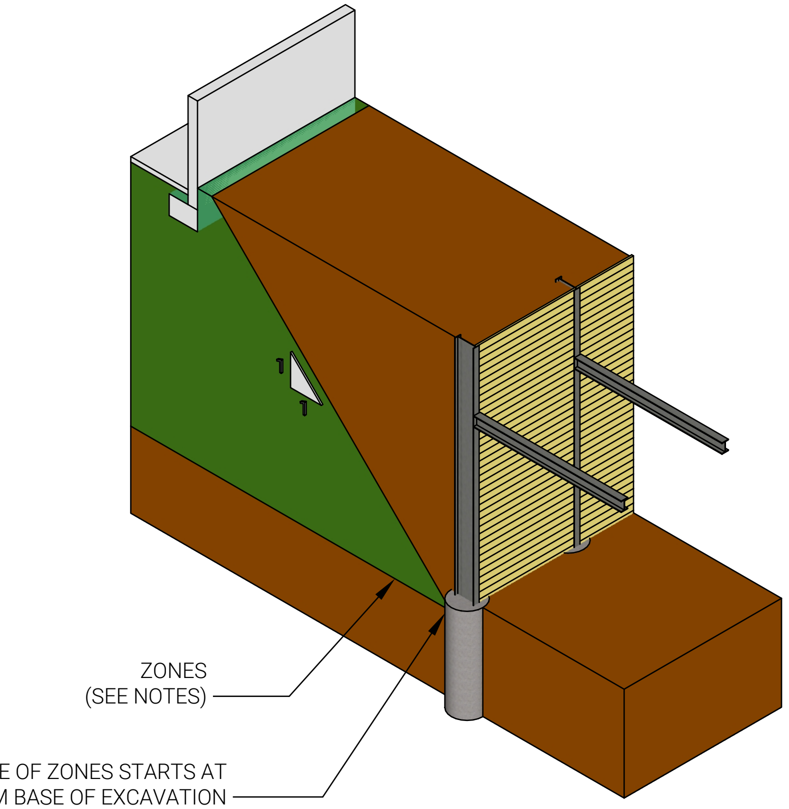
GROUNDED
ENGINEERING

Title

BASEMENT SUBDRAIN TYPICAL DETAIL







ZONE A (RED)

FOUNDATIONS WITHIN THIS ZONE OFTEN REQUIRE UNDERPINNING OR SHORING SYSTEM. HORIZONTAL AND VERTICAL PRESSURES ON EXCAVATION WALL OF NON-UNDERPINNED FOUNDATION MUST BE CONSIDERED

ZONE B (YELLOW)

FOUNDATIONS WITHIN THIS ZONE OFTEN DO NOT REQUIRE UNDERPINNING BUT MAY REQUIRE SHORING SYSTEM. HORIZONTAL AND VERTICAL PRESSURES ON EXCAVATION WALL OF NON-UNDERPINNED FOUNDATION MUST BE CONSIDERED

ZONE C (GREEN)

FOUNDATIONS WITHIN THIS ZONE USUALLY DO NOT REQUIRE UNDERPINNING OR SHORING SYSTEM

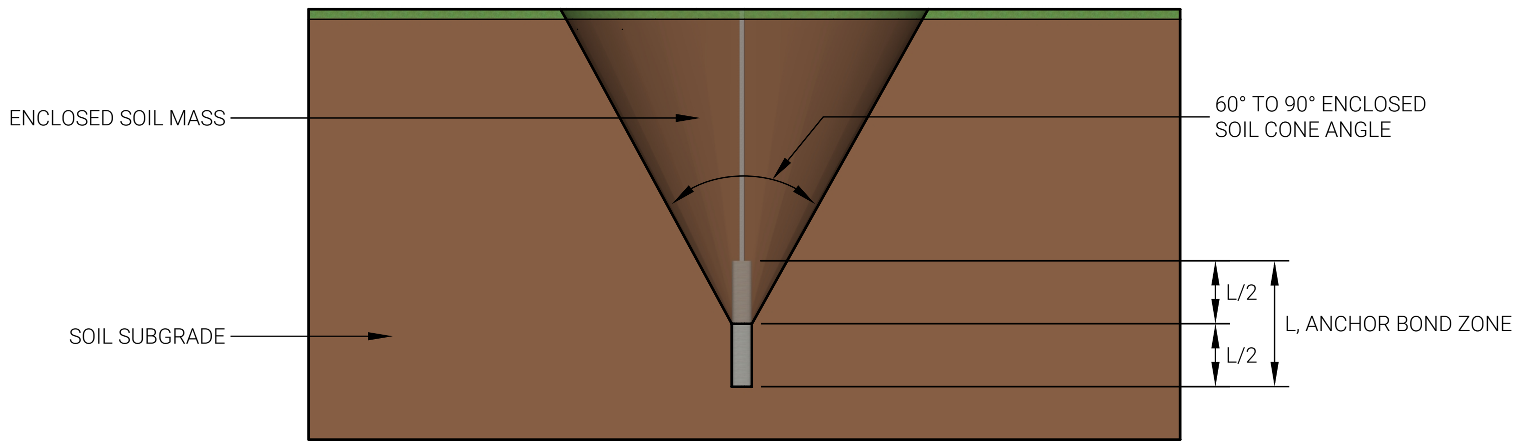
NOTES:
1. USER'S GUIDE - NBC 2005 STRUCTURAL COMMENTARIES (PART 4 OF DIVISION B) - COMMENTARY K.

GROUNDED
ENGINEERING

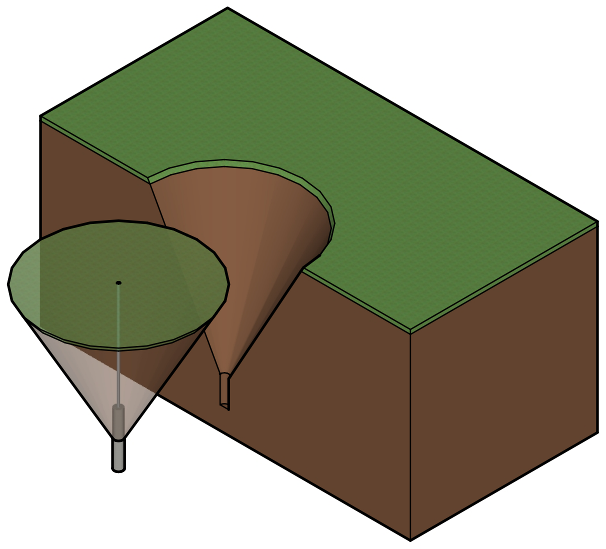
Title

EXCAVATION ZONE OF INFLUENCE GUIDELINES

INDIVIDUAL SOIL TIEDOWN ANCHOR

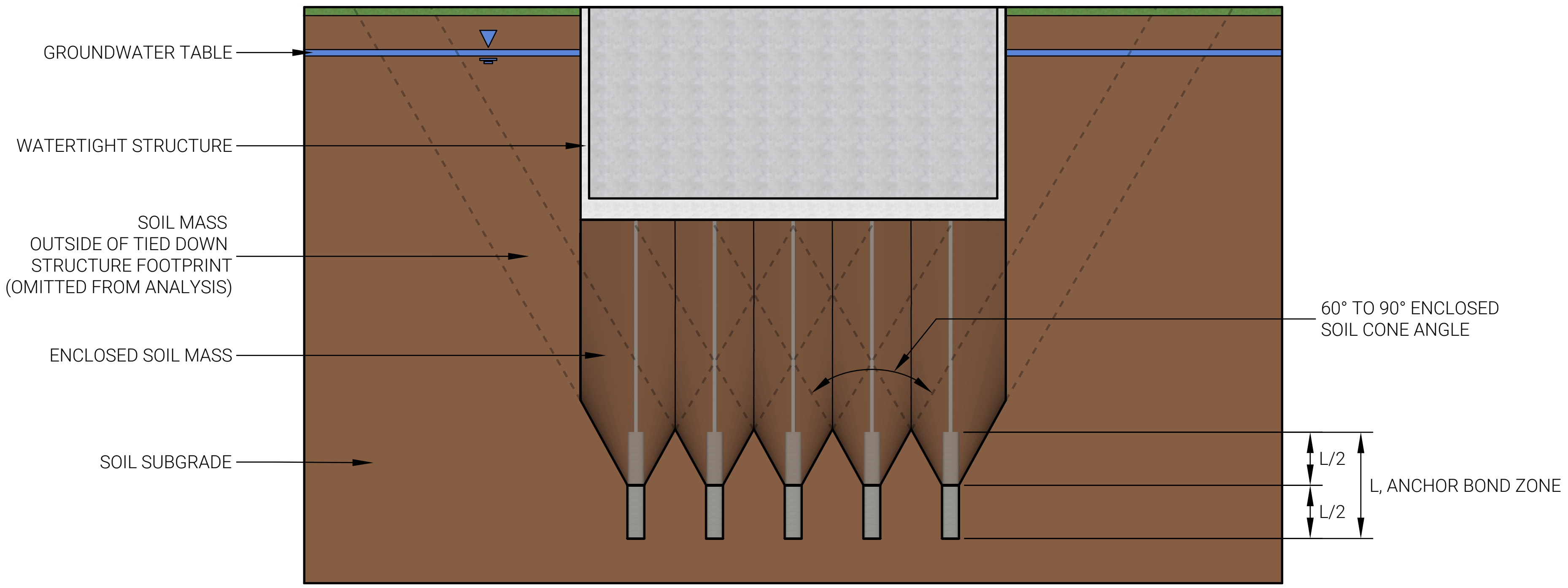


SECTIONAL VIEW

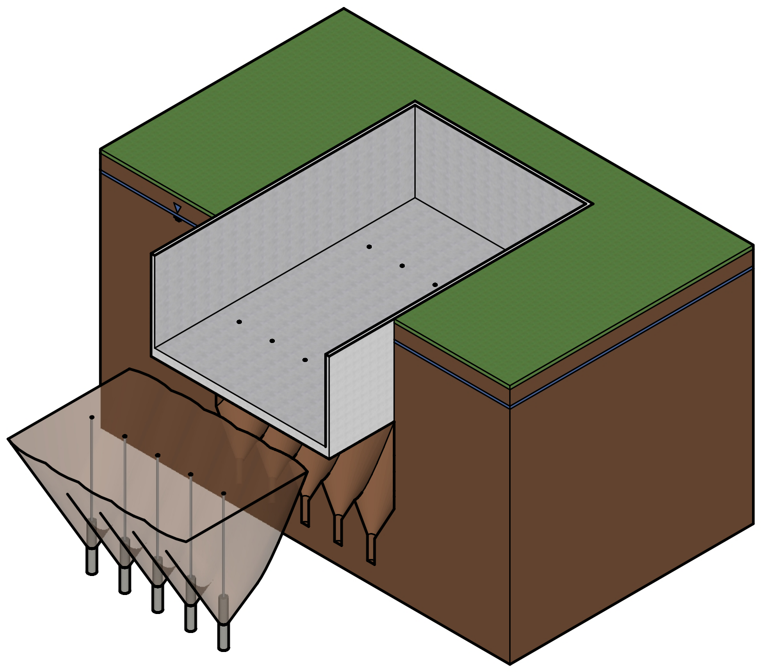


ISOMETRIC VIEW

GRID OF SOIL TIEDOWN ANCHORS WITH STRUCTURE



SECTIONAL VIEW



ISOMETRIC VIEW

NOTES:

1. UNFACTORED EQUILIBRIUM BETWEEN A STRUCTURE AND UPLIFT IS ESTABLISHED WHEN THE TOTAL WEIGHT OF THE STRUCTURE AND THE EFFECTIVE WEIGHT (CALCULATED USING γ') OF THE ENCLOSED SOIL MASS BELOW THE STRUCTURE IS EQUAL TO THE TOTAL UPLIFT PRESSURE (FHWA GEOTECHNICAL ENGINEERING CIRCULAR NO. 4 - GROUND ANCHORS AND ANCHORED SYSTEMS, 1999).
2. THE WEIGHT OF OVERLAPPING ENCLOSED SOIL MASSES MUST ONLY BE ACCOUNTED FOR ONCE.
3. THE WEIGHT OF SOIL OUTSIDE OF THE FOOTPRINT OF THE TIED DOWN STRUCTURE SHOULD BE NEGLECTED.

NOT TO SCALE. FEATURES ARE EXAGGERATED
FOR DEMOSTRATION PURPOSES.

GROUNDED
ENGINEERING

Title

SOIL TIEDOWN ANCHOR GLOBAL STABILITY