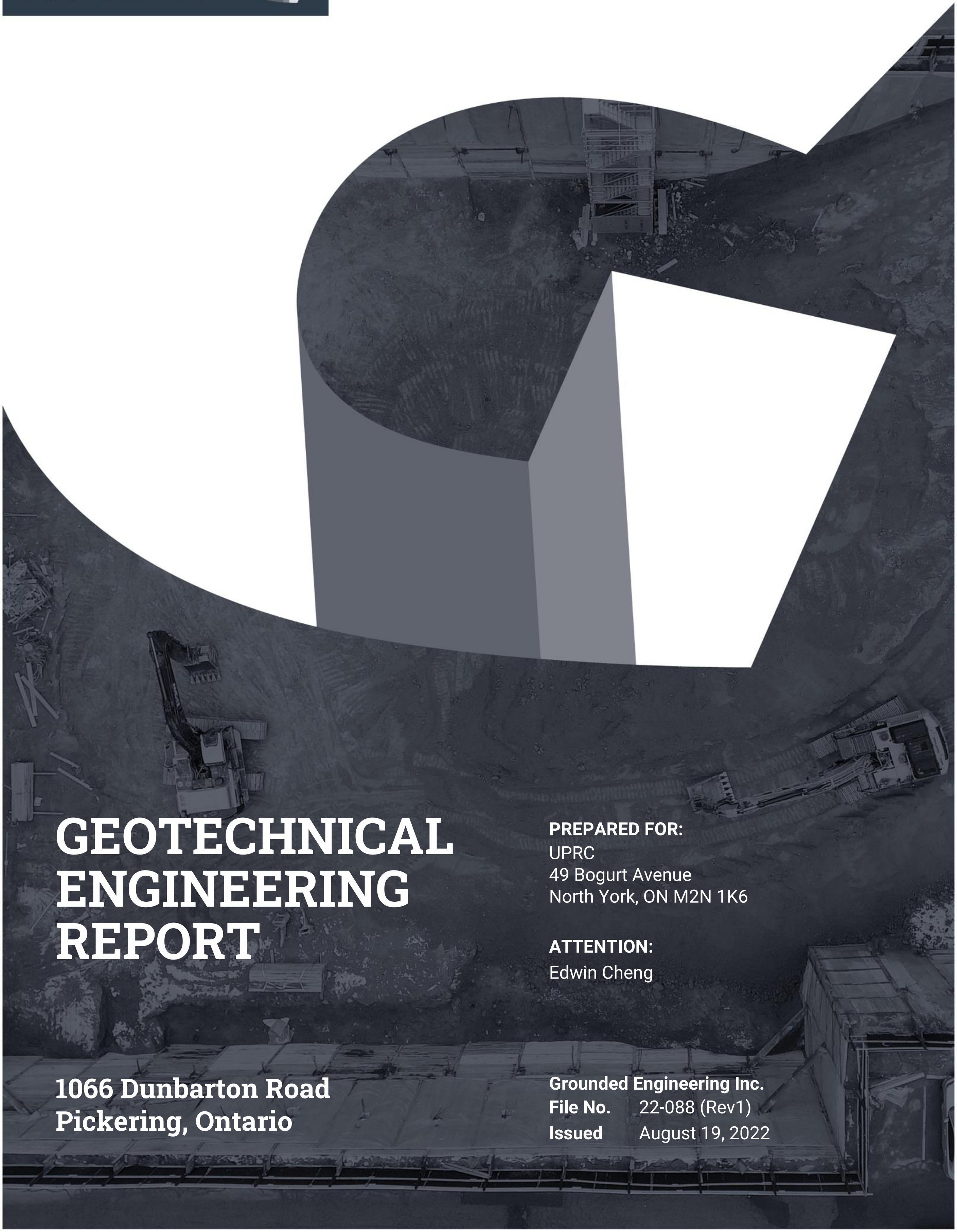

GEOTECHNICAL ENGINEERING REPORT

PREPARED FOR:
UPRC
49 Bogurt Avenue
North York, ON M2N 1K6

ATTENTION:
Edwin Cheng

1066 Dunbarton Road
Pickering, Ontario

Grounded Engineering Inc.
File No. 22-088 (Rev1)
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APPENDICES

1 Introduction

UPRC has retained Grounded Engineering Inc. ("Grounded") to provide preliminary geotechnical engineering design advice for their proposed development at 1066 Dunbarton Road, in Pickering, Ontario.

The proposed project includes demolishing the northeast portion of existing structure and constructing five 3-storey townhome structures, with one unit per structure having a basement level set at a lowest (B1) Finished Floor Elevation (FFE) of 2.8 m below the main floor of the townhomes.

This report has been revised to reflect the new FFEs provided on the latest architectural drawings which were provided to Grounded on August 17, 2022.

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

- Topographic Survey "Part of Lot 25, Concession 1" and "Lots 45, 46, 47, 48, 49, 50, and 51, Registered Plan 40M-1272" in the City of Pickering, prepared by Speight, Van Nostrand & Gibson Limited (Apr. 22, 2022).
- Conceptual Site Plan "Dunbarton-Fairport", prepared by KPMB Architects, dated 05/04/22, received on August 8th, 2022.
- Preliminary Site Grading Plan "1066 Dunbarton Road Preliminary Site Grading Plan", prepared by the WSP, dated August 2022 (Appendix A)

Grounded's preliminary subsurface investigation of the site to date includes three (3) boreholes (Boreholes 1, 2 and 3) which were advanced from May 2nd, 2022.

Based on the borehole findings, preliminary geotechnical engineering advice for the proposed development is provided for foundations, seismic site classification, earth pressure design, slab on grade design, basement drainage, and pavement design. Construction considerations including excavation, groundwater control, and geostructural engineering design advice are also provided.

Grounded Engineering must conduct the on-site evaluation of founding subgrade as foundation and slab construction proceeds. This is a vital and essential part of the geotechnical engineering function and must not be grouped together with other "third-party inspection services". Grounded will not accept responsibility for foundation performance if Grounded is not retained to carry out all the foundation evaluations during construction.

This preliminary geotechnical engineering report is appropriate for due diligence and planning purposes only. Additional boreholes, wells, and a detailed geotechnical engineering report will be required for detailed design.

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 from a benchmark shown on the provided topographic survey of the site. The horizontal coordinates are provided relative to the Universal Transverse Mercator (UTM) geographic coordinate system.

Asphalt and granular thicknesses reported here are observed in individual borehole locations through the top of the open borehole. Thicknesses may vary between and beyond the boreholes.

2.1 Soil Stratigraphy

The following soil stratigraphy summary is based on the borehole results and the geotechnical laboratory testing.

A subsurface profile showing stratigraphy and engineering units is appended.

In general, the boreholes encountered existing pavement structure at the ground surface overlying earth fill, which is underlain by silt and sand, underlain by clayey silt. The deepest borehole investigated to a depth corresponding to Elev. 90.5 m.

2.1.1 Pavements

Boreholes 1 to 3 encountered a pavement structure consisting of 75 mm of asphaltic concrete at the existing ground surface underlain by approximately 75 to 150 mm of aggregate fill.

2.1.2 Earth Fill

Boreholes 1 to 3 encountered earth fill beneath the surficial materials. The earth fill, which extends to depths of about 0.8 m in all three boreholes, varies in composition but generally consists of clayey silt some sand, trace gravel and organics. The earth fill is typically brown to dark brown with black staining, and moist. Due to inconsistent placement and the inherent heterogeneity of earth fill materials, the relative density of the earth fill varies from soft to firm.

2.1.3 Silt and Sand

Boreholes 1 to 3 encountered undisturbed silt and sand, that is clayey to containing trace clay and trace gravel at a depth of 0.8 m below grade (Elev. 99.5 to 97.9 m). The silt and sand is brown and moist. Standard Penetration Test (SPT) results (N-Value) measured in the silt and sand ranged from 18 to 97 blows per 300 mm of penetration ("bpf"), indicating a compact to very dense relative density.

2.1.4 Clayey Silt

Boreholes 1 to 3 encountered undisturbed clayey silt with some to no sand (on average trace sand) at depths of 2.3 to 4.6 m below grade (Elev. 96.9 to 94.1 m). The clayey silt is grey at Borehole 1 and brown at Boreholes 2 and 3, and moist. Standard Penetration Test (SPT) results (N-Value) measured in the clayey silt ranged from 47 to >50 bpf, indicating a hard relative density.

2.2 Groundwater

The depth to groundwater and caved soils was measured in each of the boreholes immediately following the drilling. Monitoring wells were installed in each of the boreholes, and stabilized groundwater levels were measured in each of the monitoring wells one week after the completion of drilling. A monitoring well was installed in Boreholes 1 to 3 upon completion of drilling. Stabilized groundwater levels were measured on two (2) separate occasions after the completion of drilling.

The groundwater observations are shown on the Borehole Logs and are summarized as follows.

Borehole No.	**Borehole depth (m)**	**Upon completion of drilling**		**Strata Screened**	**Water Level in Well, highest (m)**	
		Depth to cave (m)	**Unstabilized water level (m)**		**Date**	**Depth/Elev.**
1	8.2	open	dry	Clayey Silt	2022-05-12	5.6 / 93.1
1	8.2	open	dry	Clayey Silt	2022-05-26	4.8 / 93.9
1	8.2	open	dry	Clayey Silt	2022-06-22	**4.7 / 94.0**
2	7.9	open	dry	Clayey Silt	2022-05-12	1.6/ 98.7
2	7.9	open	dry	Clayey Silt	2022-05-26	**1.6 / 98.7**
2	7.9	open	dry	Clayey Silt	2022-06-22	1.7 / 98.6
3	8.1	open	dry	Clayey Silt	2022-05-12	5.4 / 93.8
3	8.1	open	dry	Clayey Silt	2022-05-26	3.7 / 95.5
3	8.1	open	dry	Clayey Silt	2022-06-22	**3.4 / 95.8**

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.

As reported in Grounded's hydrogeological report for the site, the design groundwater table is at Elev. 98.7± m for Townhouse 1 and 2. The design groundwater table is at Elev. 94.0± m for Townhouse 3 and 4 and Elev. 95.8± m for Townhouse 5. Although not observed in the boreholes and monitoring wells at the site, there is also the possibility of perched water in the earth fill which may accumulate from infiltrated stormwater. Additional groundwater monitoring wells are recommended to better delineate the groundwater table at this site.

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 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*. The results are summarized as follows:

Parameter	**BH 1 SS 4**	**BH 2 SS 3**	**BH 3 SS 2**
Soluble Sulphate (SO_4) in soil sample	<20 μg/g < 0.1 %	<20 μg/g < 0.1 %	58 μg/g < 0.1 %
Class of Exposure	**Negligible**	**Negligible**	**Negligible**

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 standard. The results are summarized as follows:

Parameter	**AWWA C-105 Standard – Assigned Points**					
	BH 1 SS 4		**BH 2 SS 3**		**BH 3 SS 2**	
	Result	**Points**	**Result**	**Points**	**Result**	**Points**
Resistivity (ohm.cm)	2230	0	2990	0	724	8
pH	8.06	0	7.88	0	7.80	0
Redox Potential (mV)	287	0	256	0	270	0
Sulfides (%)	<0.01	2	<0.01	2	<0.01	2
Moisture (%)	6.76	2	7.32	2	11.0	2
Corrosion protection recommended?	No		No		**Yes**	

Parameter	**AWWA C-105 Standard – Assigned Points**					
	BH 1 SS 4		**BH 2 SS 3**		**BH 3 SS 2**	
	Result	**Points**	**Result**	**Points**	**Result**	**Points**
Resistivity less than 2000 ohm.cm?	No		No		**Yes**	

The analytical results only provide an indication of the potential for corrosion. One of the three samples scored more than 10 points and corrosion protective measures are therefore recommended for cast iron alloys. A more recent study by the AWWA has suggested that soil with a resistivity of less than about 2000 ohm.cm should be considered aggressive. One of three samples had resistivity measurements less than 2000 ohm.cm.

2.4 Frost Heave Susceptibility of Soils

A soil's susceptibility to frost heave is related to the percentage of silt and very fine sand in the soil, as frost heave impacts fine-grained soils with low cohesion and high capillarity. The site soils are classified for susceptibility to frost heave according to their grain size distributions on this basis. Geotechnical laboratory results for this site are appended. Per the Second Edition of the Pavement Design and Rehabilitation Manual by the Ministry of Transportation in Ontario, the following table summarizes the relationship between grain size and frost heave susceptibility:

Table 2.1: Relationship Between Grain Size and Frost Susceptibility (MTO)

Grain Size Percentage between 5 and 75 μm	**Susceptibility to Frost Heaving**
0 to 40%	Low
40 to 55%	Moderate
55 to 100%	High

Per the grain size data measured in the site soils, frost heave susceptibility is summarized accordingly:

Table 2.2: Summary of Susceptibility to Frost Heave

Stratum	**Grain Size Percentage between 5 and 75 μm**	**Susceptibility to Frost Heaving**
Earth Fill	Est. 25 to 50%	Low to Moderate
Sand and Silt Till	Est. 40 to 55%	Moderate
Clayey Silt Till	Est. 50%	Moderate
Silt	Est. 65 to 70%	High
Sand	10%	Low

3 Preliminary Geotechnical Engineering Recommendations

Based on the factual data summarized above, we are providing the following geotechnical engineering design recommendations. Contractors must review the factual data while bidding or scoping services for this project and must provide their own opinion as to means, methods, and schedule.

Based on the factual data summarized above, preliminary geotechnical engineering recommendations are provided. These preliminary recommendations are for due diligence purposes only. They 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 Site Grading

Existing grade will be altered across the site per WSP's Preliminary Site Grading Plan (August 2022).

It is understood that site grading will be completed on site prior to foundation and basement excavations. This will involve some cutting and or filling to achieve the desired site grades. The existing grades may be cut up to 2± m below current grade, with the deepest cut being for the most southern townhouse structure (Townhouse 5).

Depending on the application, grade raises may comprise compacted fill or engineered fill.

Compacted fill is generally similar to Engineered Fill, with the following exceptions:

1. Compacted fill does not need full-time inspection and testing, although it does need periodic geotechnical engineering testing and inspections for quality control. The frequency of periodic inspections can vary from once a day to once every 3 days and is to be confirmed after the construction schedule is available for review. Engineered fill requires full-time inspection and testing.
2. Compacted fill can be made on an existing earth fill subgrade if it is proof rolled under our inspection and approved by us prior to fill placement. Engineered fill requires an approved subgrade of native soils.

Compacted fill shall comprise earth fill that is inorganic, clean, and geotechnically suitable soil sourced from the site or imported.

Across the entire fill area, the topsoil and other deleterious materials must be removed. The proposed subgrade must be cut neat and must be inspected by Grounded to identify any voids, organics, or soft, wet, or weak zones. Any identified areas must be sub-excavated to a competent subgrade. Compacted fill may be made on inspector-approved existing clean non-organic earth fill, or native soil. Engineered fill must be made to bear on inspector-approved undisturbed native soil.

All fill must be placed in loose lifts of 150 mm and compacted to a minimum of 98% SPMDD at a moisture content within 2% of optimum. Engineered fill must be placed under the full-time supervision of a Geotechnical Engineer, who shall perform frequent in situ density measurements to ensure the uniformity and adequacy of the compaction effort.

Soil that is used as engineered or common earth fill must have a moisture content within 2% of optimum and be free of deleterious materials, cobbles/boulders greater than 150 mm in diameter, topsoil, and other organics. Representative soil samples must be collected from the proposed fill material and tested using the Standard Proctor Maximum Dry Density (SPMDD) method to determine the optimum moisture content and maximum dry density prior to placement and compaction as common or engineered fill.

Prior to the arrival of imported soil materials, they must be test per the requirements of O.Reg 406/19 and approved by the Environmental QP for the site.

The existing topsoil is not geotechnically suitable and must be removed from settlement sensitive areas (structures, pavements, etc.). Topsoil may be re-used in landscaped areas that are not sensitive to settlement, or wasted off-site. Moisture content measurements made on earth fill soil samples from the boreholes range from 7 to 25% (on average, 13.5%). They occasionally contain trace organics. We estimate that the existing fill may be suitable for immediate re-use as common earth fill or engineered fill if it is sorted to remove any excess organics, moisture, or other deleterious materials.

Moisture content measurements made on silt and sand soil samples from the boreholes within 2 m of existing grade range from 7 to 14% (on average, 8%). We estimate that most of the undisturbed native soil at the site is likely suitable for immediate re-use on site.

As inferred by the boreholes, embedded cobbles and boulders should be anticipated in all existing fill and native soils.

Common earth fill or engineered fill may not be readily compacted in small volumes, such as trenches or in areas adjacent to foundations or catch basins. For areas of limited extent, compactable aggregate-source backfills like Granular B (OPSS.MUNI 1010) are recommended for post-construction grade integrity. All new placed fill shall be compacted to a minimum of 98% SPMDD.

Frost susceptible soils within 1.2 m of finished grades in unheated areas (e.g. pavements) could potentially cause pavements to heave or crack next to other structures (e.g. curbs, catchbasins, etc.). The degree of heaving is unknown. If frost susceptibility is to be considered in design (to be determined by the Owner based on their own pavement performance criteria), all soil placed within 1.2 m of finished grades must be classified to have a low susceptibility to frost heaving, as defined in Section 2.4 above.

Where engineered fill pads tie into existing grades, the engineered fill should extend for a distance of at least 2 m beyond the proposed structure footprints in every direction as measured at the founding level, and should extend downwards from this point at no steeper than 1 to 1 (horizontal to vertical) slope to the adjacent ground level.

For the expected heights of engineered fill to be placed, post-construction settlements of the engineered fill itself (i.e. due to self-weight) can be expected to be around 1% of the height of soil placed, depending on the composition of the engineered fill. If the engineered fill is composed of sand or aggregate materials, then post-construction settlements of the engineered fill will be around 0.5% or less and will occur within a week or two. If the engineered fill is sourced from the existing earth fill or glacial till from the site or similar fine grained soils, it will take several weeks for the majority of post-construction settlement due to self-weight to occur.

3.2 Foundation Design Parameters

The grade at site in our three boreholes ranged from 100.3 to 98.7± m, however due to site grading the Finished Floor Elevations (FFE) will be lowered into native material. Following the naming convention in Figure 3 and the Preliminary Site Grading Plan provided by WSP appended, the ground surface FFE for Townhouses 1, 2, 3, 4 and 5 are at Elev. 99.85 m, Elev. 99.85 m, Elev. 98.90 m, Elev. 97.85 m and 96.22 m respectively. The majority of the townhomes will have no basements. Only one unit per block will have a basement, which we have been instructed will be 2.8 m below the ground surface FFEs. Existing topsoil and earth fill soils at the site are considered unsuitable for the support of the proposed building foundations.

When exposed to ambient environmental temperatures in the Greater Toronto Area, the design earth cover for frost protection of foundations and grade beams is 1.2 metres.

3.2.1 Spread Footings

Conventional spread footings made to bear on the undisturbed silt and sand or clayey silt may be designed using a maximum factored geotechnical resistances at ULS of 450 kPa, and a maximum net geotechnical reaction at SLS of 300 kPa for an estimated maximum total settlement of 25 mm. Footings bearing on engineered fill (placed and compacted under the full time supervision of a geotechnical engineer) may be designed using a maximum factored geotechnical resistances at ULS of 225 kPa, and a maximum net geotechnical reaction at SLS of 150 kPa for an estimated maximum total settlement of 25 mm.

Spread footing foundations must be at least 800 mm wide and must be embedded a minimum of 600 mm below FFE. These minimum requirements apply in conjunction with the above recommended geotechnical resistance regardless of loading considerations. The geotechnical reaction at SLS refers to a settlement which for practical purposes is linear and non-recoverable. Differential settlement is related to column spacing, column loads, and footing sizes.

Prior to excavation, it will be necessary to positively dewater the sands and silts for any foundation excavations extending below the groundwater table. These excavations must be dewatered to a minimum 1.2 m below the lowest proposed 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 above recommendations for bearing capacity will not be valid. It is not possible to positively dewater the undisturbed clayey silt. Groundwater seepage from the cohesive clayey silt can be managed with localized sumps and pumps as necessary.

Footings stepped from one elevation to another should be offset at a slope not steeper than 7 vertical to 10 horizontal.

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.

3.3 Earthquake Design Parameters

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 top 30 metres of the site stratigraphy, 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 (for spread footings) of about 95± metres, the boreholes observe very dense silty sand or hard clayey silt. 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.

3.4 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	29	0.35	0.52	2.88
Silt and Sand	20	38	0.24	0.38	4.20
Clayey Silt	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 assumed basement wall in solid ports directly to the sumps. This is discussed in Section 3.5.

If a watertight design is preferred, the full height of the assumed basement wall should be watertight and designed to withstand horizontal hydrostatic pressure below Elev. 98.7 m for Townhouse 1 and 2, Elev. 94.0± m for Townhouse 3 and 4 and Elev. 95.8± m for Townhouse 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 rock 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 Canadian Foundation Engineering Manual (CFEM) Ed. 4 (0.8)
N = normal load at base of footing (kN)
φ = internal friction angle (see table above)

3.5 Slab on Grade Design Parameters

All proposed slab-on-grade elevations for townhomes with or without basements will be made on undisturbed native soils according to our Boreholes 1-3 and the FFEs provided in the August 2022 drawings from the client; except for the no-basement areas of Townhome Block 3. The existing topsoil and pavement materials must be removed in all building footprints. In Townhome Block 3 where there is no basement, a conventional slab on grade would be made on loose earth fill. In its present state the earth fill is not competent for the support of a slab on grade. The existing earth fill should be compacted in place, proof-rolled, and inspected under the supervision of Grounded for obvious exposed loose or disturbed areas, or for areas containing excessive deleterious materials or moisture. 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 modulus of subgrade reaction appropriate for design of the slab on grade resting on compacted earth fill soils is 10,000 kPa/m.

In all other areas, 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 30,000 kPa/m.

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 200 mm thick layer of 19 mm clear stone or HL8 coarse aggregate (OPSS.MUNI 1150) or HPB vibrated to a dense state.

If the basements are made as a conventional drained structure, a permanent drainage system including subfloor drains is required (see Section 3.5). In this case, 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 200 mm thick layer of HL8 coarse aggregate (OPSS.MUNI 1150) or HPB vibrated to a dense state. In the areas of Townhouse Blocks 1 and 2 where the groundwater table is above the basement elevation, the drainage layer must be separated from the sands 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.

Subfloor drains are typically installed in trenches below the capillary moisture break drainage layer per the typical detail appended. If trenches are to be avoided for whatever reason, the subfloor drainage system can be incorporated into the capillary moisture break and drainage layer. In this case, the subfloor drains are laid directly on the flat subgrade and backfilled with a minimum 300 mm thick layer of HL8 coarse aggregate (OPSS.MUNI 1150) or HPB, vibrated to a dense state. Any solid collection pipes must be sloped so that they positively discharge to the sumps.

Prior to placement of the capillary moisture break and construction of the slab, the cut subgrade be cut and inspected by Grounded for obvious exposed loose or disturbed areas, or for areas containing excessive deleterious materials or moisture. These areas shall be recompacted in place and retested, or else replaced with Granular B placed as engineered fill (in lifts 150 mm thick or less and compacted to a minimum of 98 percent SPMDD). The slab on grade should not be placed on frozen subgrade, to prevent settlement of the slab as the subgrade thaws. Areas of frozen subgrade should be removed during subgrade preparation.

3.6 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.

Subfloor drainage is required for all townhomes in Blocks 1, 2, and 5 regardless of whether there are basements or not. In Blocks 3 and 4, subfloor drainage is only required where there are basements.

For a conventional drained basement approach, 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. The exterior faces of foundation walls should be provided with a layer of waterproofing to protect interior finishes.

Subfloor drainage pipes are to be spaced at a maximum 3 m (measured on-centres) for Blocks 1 and 2, and 6 m on-centres for all other blocks. If subdrain elevation conflicts with top of footing elevation, footings should be lowered as necessary.

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. A layer of waterproofing placed between the drain core product and the basement wall should be considered to protect interior finishes from moisture.

In an open cut excavation, basement wall drainage is installed directly against the basement wall from the open cut side. Perimeter foundation drains made in this application comprise perforated pipe (minimum 100 mm diameter) surrounded by a granular filter of OPSS.MUNI HL-8 Coarse

Aggregate providing a minimum 300 mm of cover over the drain pipe. 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 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. 22-088).

3.7 Site Servicing

All services must have at least 1.2 metres of earth cover or equivalent insulation for frost protection. Where site services are not installed below the basement levels of the proposed development, the following recommendations apply.

3.7.1 Bedding

The soil subgrade encountered within utility trenches on site may consist of either earth fill or native sands and silts. If earth fill is encountered, the subgrade must be compacted in place to a minimum 98% SPMDD. The trench base must be inspected for obvious loose, wet, or disturbed material. Any unsuitable material must be subexcavated and replaced with imported fill compacted to 98% SPMDD.

If trenches extend below the groundwater table, the groundwater table must be lowered to 1.2 m below the lowest excavation elevation prior to excavation.

Bedding material must consist of well graded granular fill such as Granular A (OPSS.MUNI 1010). Clear stone is specifically prohibited at this site. The bedding material must be compacted to a minimum 95% SPMDD. Clear stone is strictly prohibited at this site as bedding material.

3.7.2 Backfill

Excavated earth fill and native soils on site will constitute adequate backfill material if the soil meets the backfill specifications:

- Any deleterious material in the earth fill is removed prior to reuse as backfill.
- The moisture content is within 2% of optimum, or moisture conditioned to within 2% of optimum.
- The backfill must be compacted to a minimum 98% SPMDD.

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 sands and silts are Type 4 soils, or Type 3 soils if dewatered
- The clayey silt is a Type 2 soil

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:

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 238 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.

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 used for design purposes is at Elev. 98.7 m in Blocks 1 and 2, 95.8 m in Block 5, and 94.0 m in Blocks 3 and 4.

In Blocks 1 and 2, the bulk excavation level for the proposed basement at Elev. 97± m as well as excavations for foundations will all be below the design groundwater table. Positive dewatering to lower the groundwater table will be required to facilitate construction as well as to maintain the integrity of the subgrade for foundation and slab-on-grade support. Dewatering will take some time to accomplish prior to the start of excavation. The water level must be kept at least 1.2 m below the lowest excavation elevation during construction. Failure to dewater prior to excavation will result in unrecoverable disturbance of the subgrade, which will render advice provided for undisturbed subgrade conditions inapplicable.

For all other blocks, seepage into excavations may be allowed to drain into the excavation and then controlled by a conventional sump pump arrangement. Nevertheless, delays in excavation will occur as the seepage is controlled and these delays should be anticipated in the construction schedule. Cohesionless wet zones were encountered in several of the boreholes. If these cohesionless zones are penetrated, some seepage from these wet zones should be anticipated.

It is recommended that a professional dewatering contractor be consulted to review the subsurface conditions and to design a site-specific dewatering system. It is the dewatering contractor’s responsibility to assess the factual data and to provide recommendations on dewatering system requirements.

Should the excavation be open cut or supported using permeable soldier pile and lagging shoring, positive dewatering will be required on a continuous ongoing basis during excavation and throughout construction.

4.3 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 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.

4.4 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 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.

The long-term performance of a slab on grade is highly dependent upon the subgrade support and drainage conditions. 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 and the compaction of all fill should be monitored by Grounded at the time of construction to confirm material quality, thickness, and to ensure adequate compaction.

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 engineering drawings prior to issue or construction to ensure that the recommendations in this report have been appropriately implemented.

This preliminary geotechnical engineering feasibility study 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.

5.1 Investigation Procedures

The geotechnical engineering analysis and advice provided are 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 conventional standard practice by Grounded as well as other 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 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 or rock 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 this potential site alteration.

The geotechnical engineering advice provided in this report is based on the factual observations made from the site investigations as reported. It is intended for use by the owner and their retained design team. If there are changes to the features of the development or to the scope, the interpreted subsurface information, geotechnical engineering design parameters, advice, and discussion on construction considerations may not be relevant or complete for the project. Grounded should be retained to review the implications of such changes with respect to the contents of this report.

This report provides preliminary geotechnical engineering advice intended for use by the owner and their retained design team for due diligence only. 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 UPRC 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

Saeed B

LICENSED PROFESSIONAL ENGINEER
SB
S. BASTAN
100532430
2022-08-19
PROVINCE OF ONTARIO

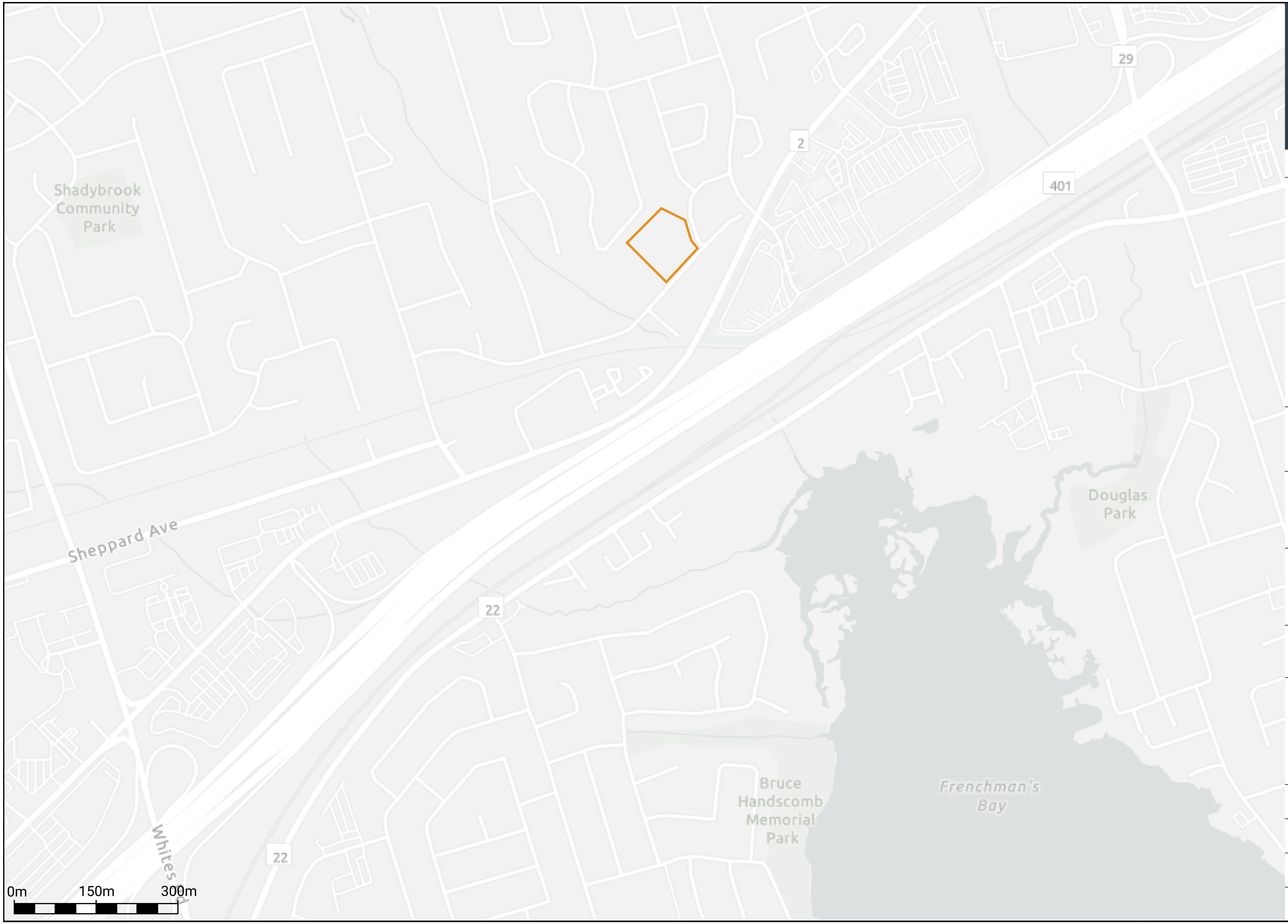
LICENSED PROFESSIONAL ENGINEER
KB
K. J. BYCKALO
100199873
2022-08-19
PROVINCE OF ONTARIO

Sam Bastan, P.Eng.
Project Engineer

Kyle Byckalo, P. Eng.,
Senior Geotechnical Engineer

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

FIGURES



GROUNDED
ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

— APPROXIMATE PROPERTY BOUNDARY

Note

Reference

ArcGIS MyMaps 2022.

Project

1066 DUNBARTON ROAD, PICKERING, ONTARIO

Figure Title

SITE LOCATION PLAN

North

TRUE
PROJECT

Date

JUNE 2022

Scale

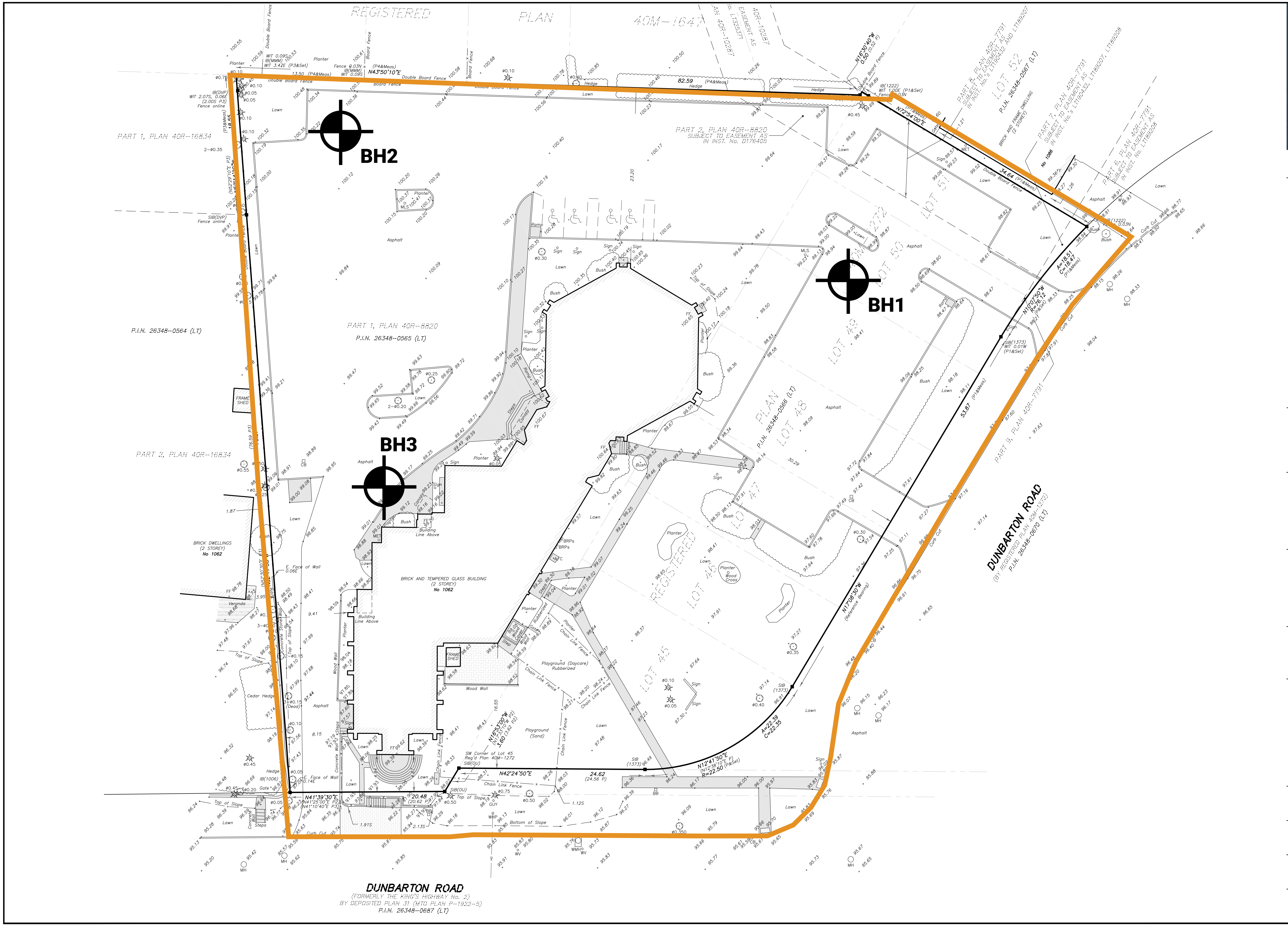
AS INDICATED

Job No

22-088

Figure No

FIGURE 1



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LEGEND

🟧	APPROXIMATE PROPERTY BOUNDARY
⌖	BOREHOLE WITH MONITORING WELL

Note

Reference

Survey Drawing Job No.: 220-0021
Dated: Apr. 22, 2022
Prepared by: Speight, Van Nostrand & Gibson Limited.

Project

1066 DUNBARTON ROAD, PICKERING, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN - EXISTING

North

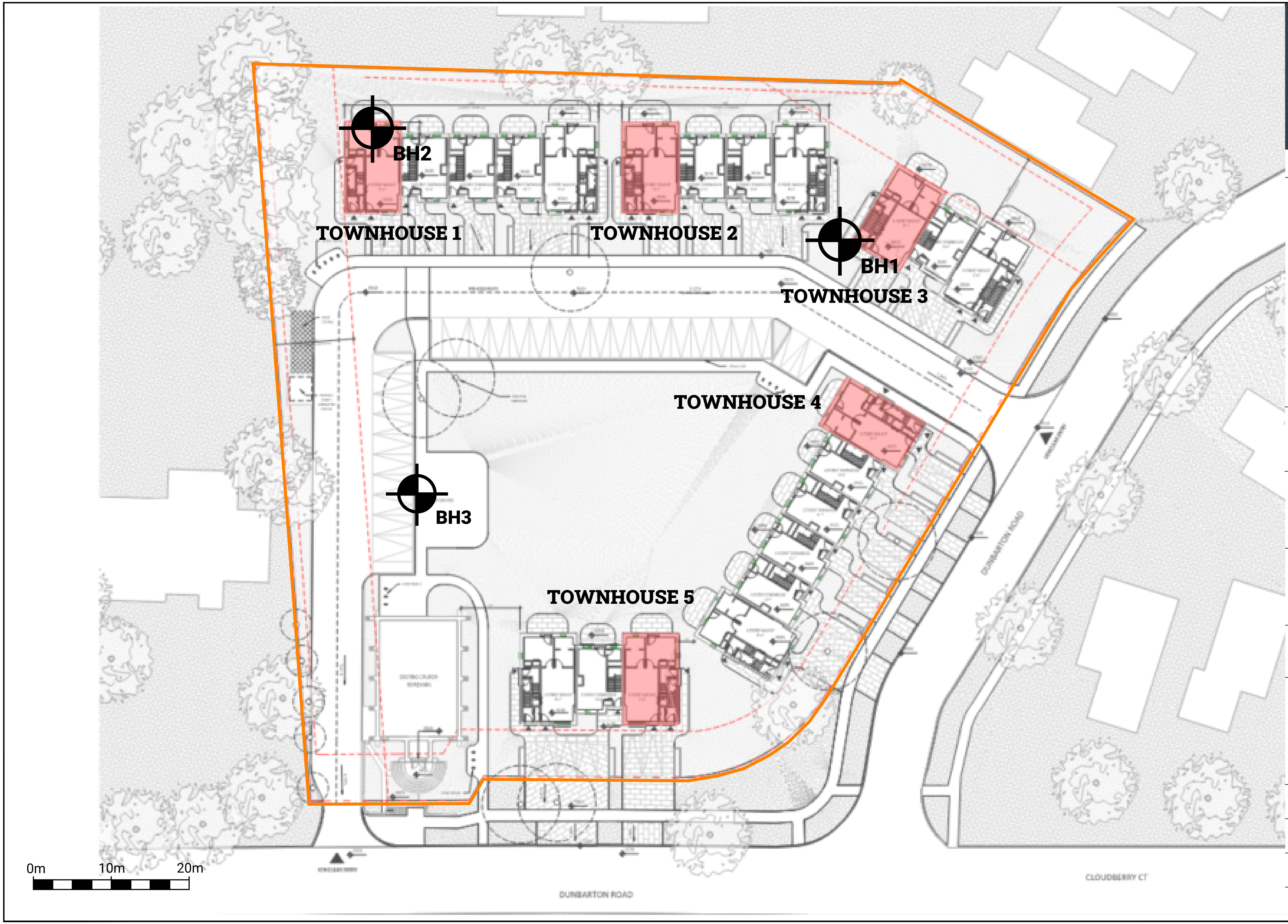
TRUE
PROJECT

Date
JUNE 2022

Scale
AS INDICATED

Job No
22-088

Figure No
FIGURE 2



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LEGEND

🟧 APPROXIMATE PROPERTY BOUNDARY

⊕ MONITORING WELL LOCATION

Note

Reference

Conceptual Site Plan A1-03
Prepared by KBMB Architects
Dated 05/04/22
Received 06/30/22

Project

1066 DUNBARTON ROAD, PICKERING, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN - PROPOSED

North

TRUE
PROJECT

Date

AUGUST 2022

Scale

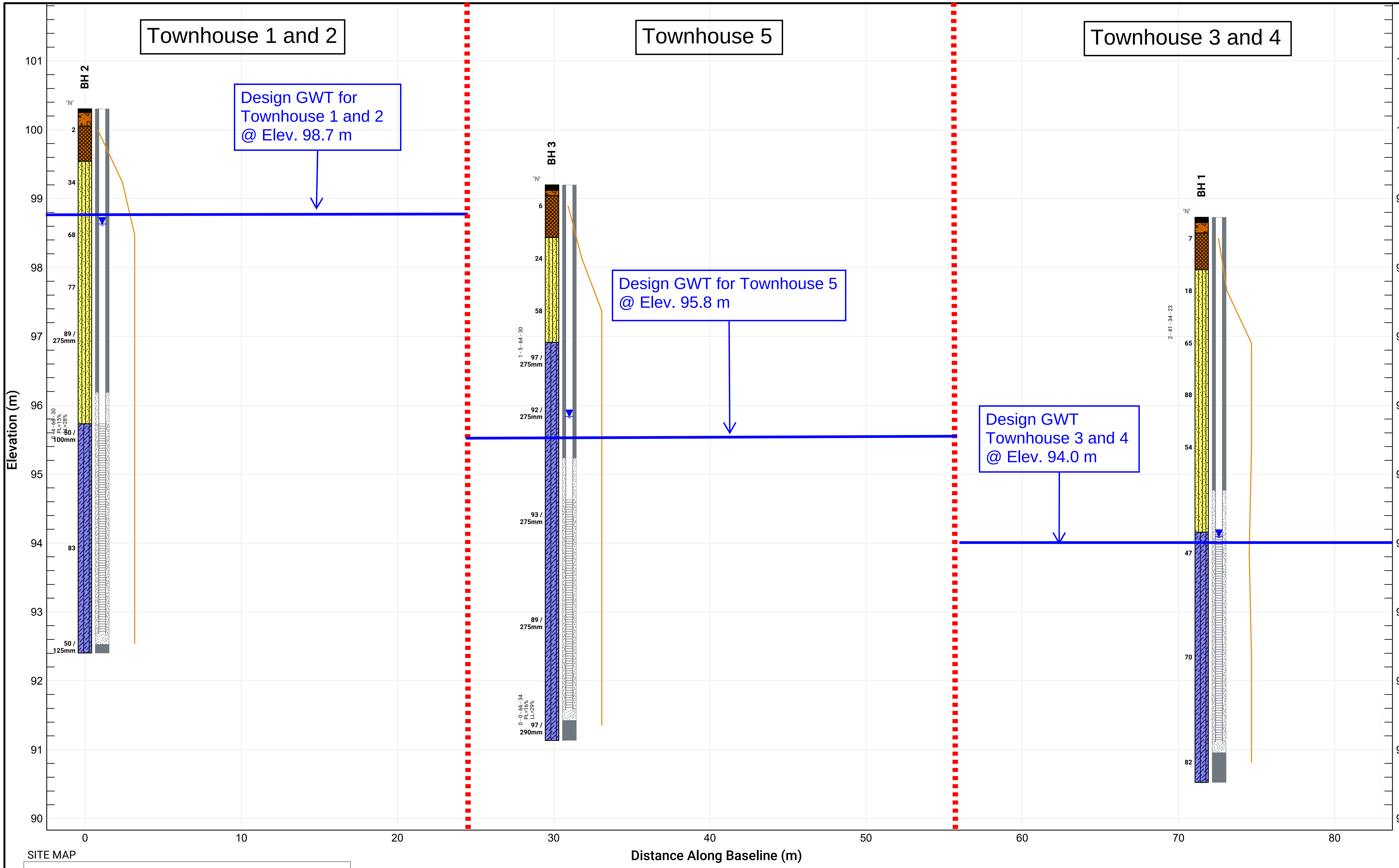
AS INDICATED

Job No

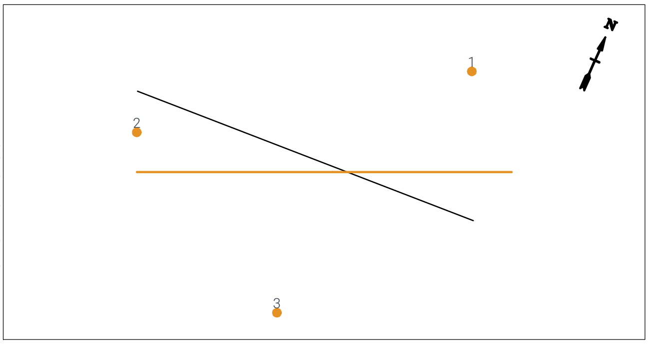
22-088

Figure No

FIGURE 3



SITE MAP



BOREHOLE STRATIGRAPHY LEGEND

■ Asphalt
▨ Clayey Silt
Aggregate
▦ Fill
Silt and Sand

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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

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

Project
**1066 DUNBARTON RD.
PICKERING, ON**

Figure Title
SUBSURFACE PROFILE

Date
AUGUST 2022

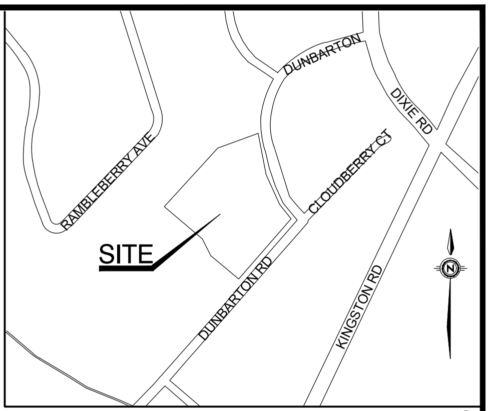
Scale
AS INDICATED

Job No
22-088

Figure No
FIGURE 4

file: 22-088 gint-ge-lt-djx8wg3.gpj

APPENDIX A



KEY PLAN NTS

Preliminary

2022-08-05 2:01:17 PM

LEGEND

▬ ▬	SITE BOUNDARY
- · - · -	SWALE
+ 170.72	PROPOSED ELEVATION
HP	HIGH POINT
LP	LOW POINT
+EX.167.16	EXISTING ELEVATION
+SW.167.16	SWALE ELEVATION
➞	DIRECTION OF OVERLAND FLOW
☐	STORMWATER CATCHBASIN

CLIENT
UNITED PROPERTY
RESOURCE
CORPORATION

TITLE
1066 DUNBARTON ROAD
PRELIMINARY SITE
GRADING PLAN

wsp

100 Scotia Court
Whitby, ON L1N 8Y6
t. 905.668.3022
f. 905.668.9443
www.wsp.com

Checked	M.I.	Drawn	N.M.M
Date	AUGUST 2022	Proj. No.	221-05497
Scale	1:500	Figure No.	4

Aug 05, 2022 - 2:00pm, CANM076622
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APPENDIX B

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

PI: plasticity index

γ: soil unit weight (bulk)

G_s: specific gravity

S_u: undrained shear strength

▽ unstabilized water level

▼ 1st water level measurement

▼ 2nd water level measurement most recent

▼ 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.

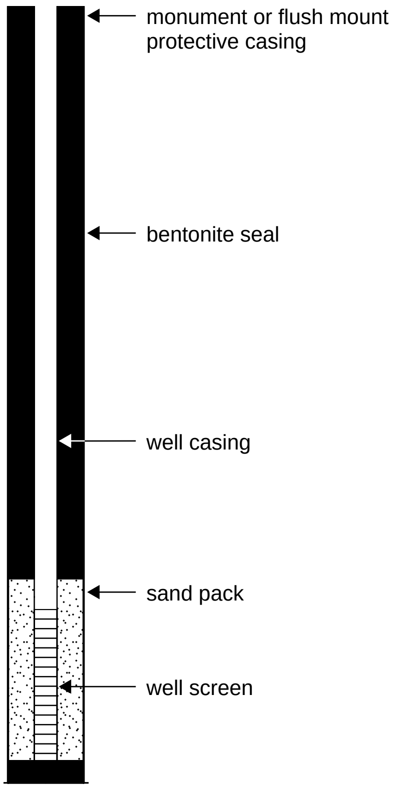
ASTM D3441 Cone Penetration Test (CPT)
Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.

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



ROCK CORE TERMINOLOGY (MTO SHALE)

TCR	**Total Core Recovery** the total length of recovery (soil or rock) per run, as a percentage of the drilled length
SCR	**Solid Core Recovery** the total length of sound full-diameter rock core pieces per run, as a percentage of the drilled length
RQD	**Rock Quality Designation** the sum of all pieces of sound rock core in a run which are 10 cm or greater in length, as a percentage of the drilled length

Natural Fracture Frequency (typically per 0.3 m) The number of natural discontinuities (joints, faults, etc.) which are present per 0.3m. Ignores mechanical or drill-induced breaks, and closed discontinuities (e.g. bedding planes).

LOGGING DISCONTINUITIES

Discontinuity Type

BP	bedding parting
CL	cleavage
CS	crushed seam
FZ	fracture zone
MB	mechanical break
IS	infilled seam
JT	Joint
SS	shear surface
SZ	shear zone
VN	vein
VO	void

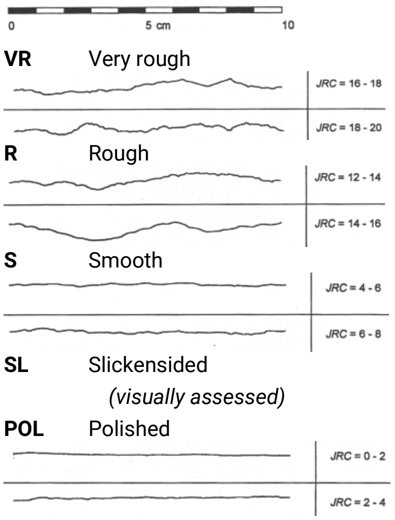
Coating

CN	Clean
SN	Stained
OX	Oxidized
VN	Veneer
CT	Coating (>1 mm)

Dip Inclination

H	horizontal/flat	0 - 20°
D	dipping	20 - 50°
SV	sub-vertical	50 - 90°
V	vertical	90±°

Roughness (Barton et al.)



Spacing in Discontinuity Sets
(*ISRM 1981*)

VC	very close	< 60 mm
C	close	60 – 200 mm
M	mod. close	0.2 to 0.6 m
W	wide	0.6 to 2 m
VW	very wide	> 2 m

Aperture Size

T	closed / tight	< 0.5 mm
GA	gapped	0.5 to 10 mm
OP	open	> 10 mm

Planarity

PR	Planar
UN	Undulating
ST	Stepped
IR	Irregular
DIS	Discontinuous
CU	Curved

GENERAL

Degree of Weathering (*after MTO, RR229 Evaluation of Shales for Construction Projects*)

Zone	Degree	Description
Z1	unweathered	shale, regular jointing
Z2	partially weathered	angular blocks of unweathered shale, no matrix, with chemically weathered but intact shale
Z3		soil-like matrix with frequent angular shale fragments < 25mm diameter
Z4a		soil-like matrix with occasional shale fragments < 3mm diameter
Z4b	fully weathered	soil-like matrix only

Strength classification (*after Marinos and Hoek, 2001; ISRM 1981b*)

Grade		UCS (MPa)	Field Estimate (Description)
R6	extremely strong	> 250	can only be chipped by geological hammer
R5	very strong	100 - 250	requires many blows from geological hammer
R4	strong	50 - 100	requires more than one blow from geological hammer
R3	medium strong	25 - 50	can't be scraped, breaks under one blow from geological hammer
R2	weak	5 - 25	can be peeled / scraped with knife with difficulty
R1	very weak	1 - 5	easily scraped / peeled, crumbles under firm blow of geo. hammer
R0	extremely weak	< 1	indented by thumbnail

Bedding Thickness (*Q. J. Eng. Geology, Vol 3, 1970*)

Very thickly bedded	> 2 m
Thickly bedded	0.6 – 2m
Medium bedded	200 – 600mm
Thinly bedded	60 – 200mm
Very thinly bedded	20 – 60mm
Laminated	6 – 20mm
Thinly Laminated	< 6mm

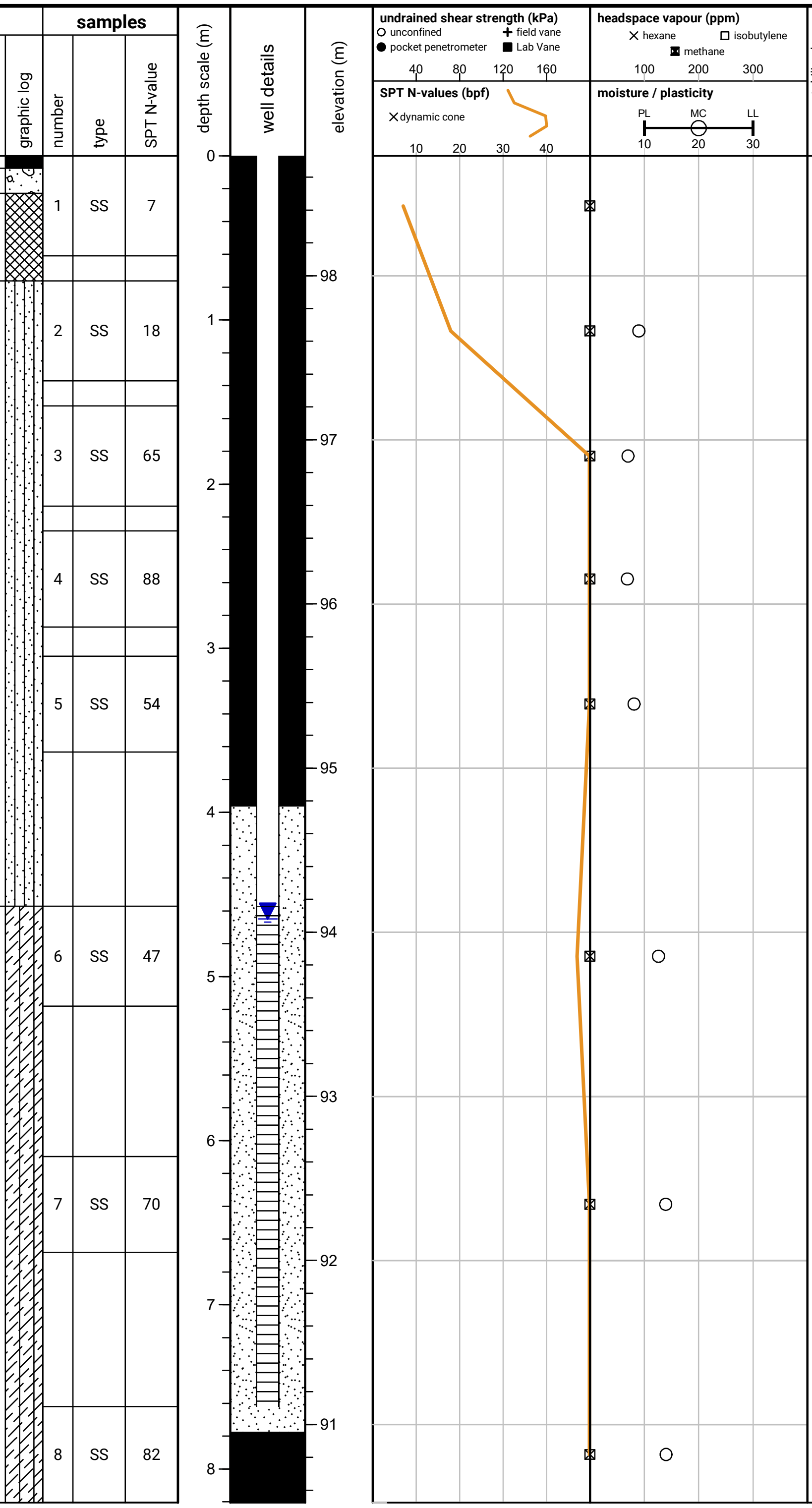
Date Started : May 2, 2022
Position : E: 652696, N: 4854591 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 1

File No. : 22-088
Project : 1066 Dunbarton Rd., Pickering, ON
Client : UPRC

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

elev depth (m)	description	number	type	SPT N-value	lab data and comments
98.7	**GROUND SURFACE**				
	75mm **ASPHALT**				
98.5 0.2	125mm **AGGREGATE**				
	FILL, clayey silt, some sand, trace gravel, firm, brown, moist	1	SS	7	
97.9 0.8	**SILT AND SAND**, clayey, trace gravel, orange staining, very stiff to hard, greyish brown, moist	2	SS	18	SS2: BTEX, Metals, PAHs, PCBs, PHCs, VOCs
	...at 1.5 m, silty sand, very dense	3	SS	65	grain size distribution (%) (MIT): GR 2, SA 41, SI 34, CL 23
	...at 2.3 m, sandy silt some clay	4	SS	88	
		5	SS	54	
94.1 4.6	**CLAYEY SILT**, some sand, hard, grey, moist	6	SS	47	
		7	SS	70	
90.5 8.2		8	SS	82	SS8: BTEX, Metals, PAHs, PCBs, PHCs, VOCs, DUP



END OF BOREHOLE

Dry and open upon completion of drilling.

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

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 12, 2022	5.6	93.1
May 26, 2022	4.8	93.9
Jun 22, 2022	4.7	94.0

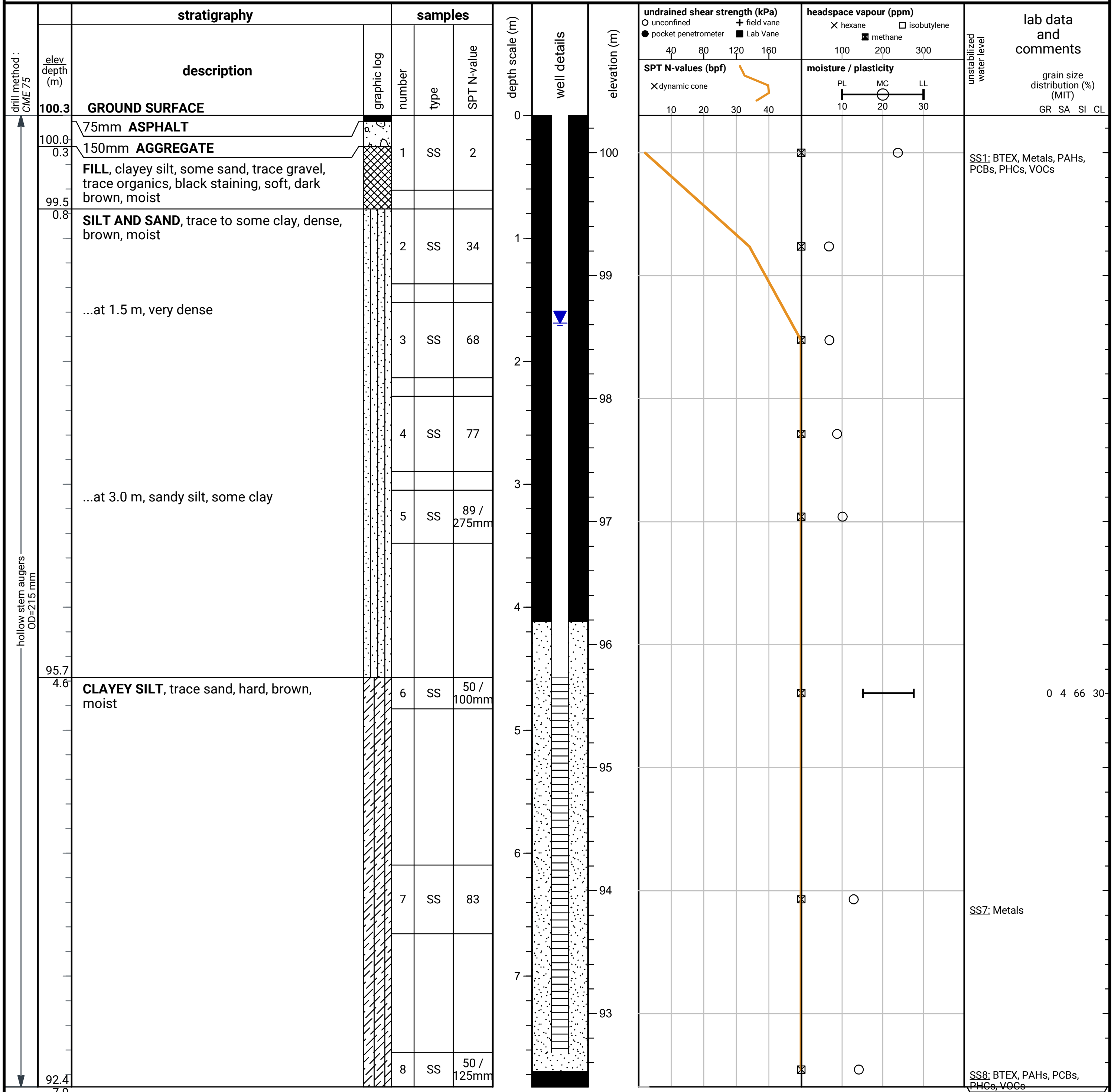
file: 22-088 gint-ge-lt-djx8wg3.gpj

Tech : LJ | **PM** : SB | **Rev** : NN

Date Started : May 2, 2022
Position : E: 652636, N: 4854550 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 2

File No. : 22-088 **Project** : 1066 Dunbarton Rd., Pickering, ON **Client** : UPRC



elev depth (m)	description	number	type	SPT N-value	lab data and comments
100.3	**GROUND SURFACE**				
	75mm **ASPHALT**				
100.0 0.3	150mm **AGGREGATE**				
	FILL, clayey silt, some sand, trace gravel, trace organics, black staining, soft, dark brown, moist	1	SS	2	SS1: BTEX, Metals, PAHs, PCBs, PHCs, VOCs
99.5 0.8	**SILT AND SAND**, trace to some clay, dense, brown, moist	2	SS	34	
	...at 1.5 m, very dense	3	SS	68	
		4	SS	77	
	...at 3.0 m, sandy silt, some clay	5	SS	89 / 275mm	
95.7 4.6	**CLAYEY SILT**, trace sand, hard, brown, moist	6	SS	50 / 100mm	0 4 66 30
		7	SS	83	SS7: Metals
92.4 7.9		8	SS	50 / 125mm	SS8: BTEX, PAHs, PCBs, PHCs, VOCs

END OF BOREHOLE

Dry and open upon completion of drilling.

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

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 12, 2022	1.6	98.7
May 27, 2022	1.6	98.7
Jun 22, 2022	1.7	98.6

GROUNDED ENGINEERING

Date Started : May 2, 2022
Position : E: 652679, N: 4854527 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 3

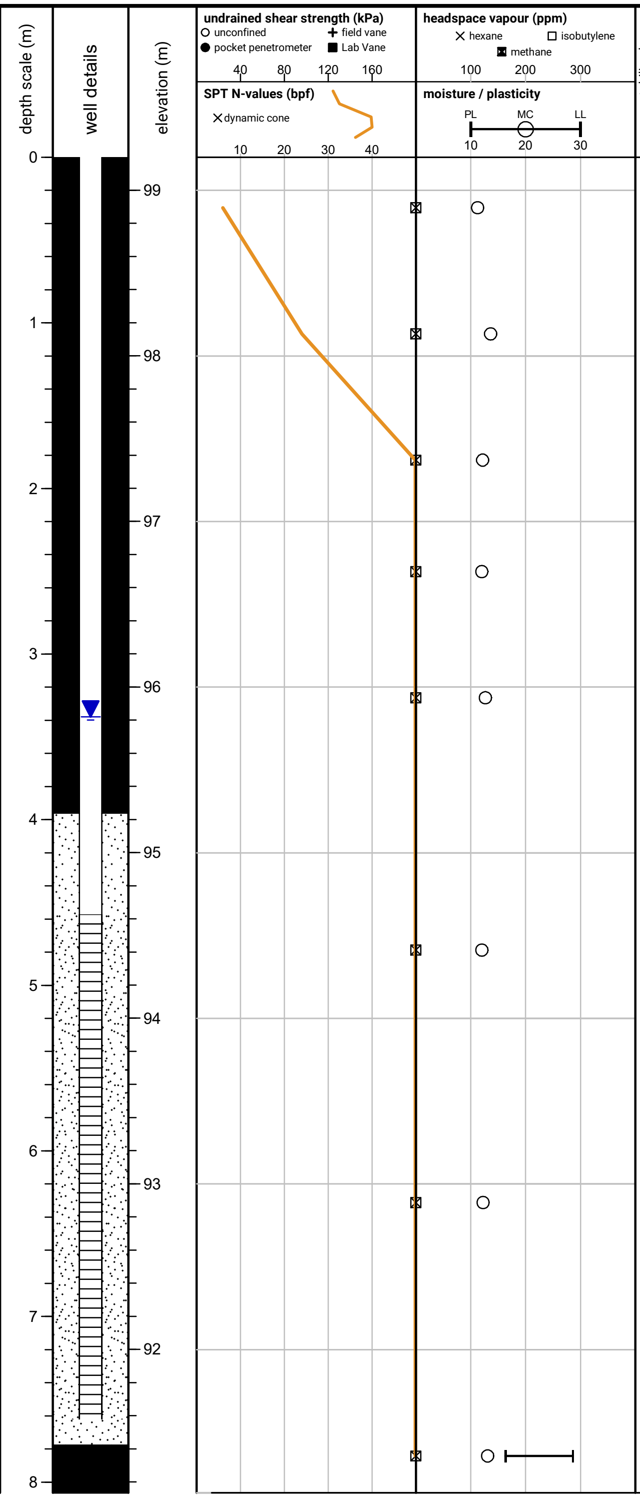
File No. : 22-088 **Project** : 1066 Dunbarton Rd., Pickering, ON **Client** : UPRC

drill method : CME 75

hollow stem augers OD=215 mm

elev depth (m)	description
99.2	**GROUND SURFACE**
99.0	75mm **ASPHALT**
0.2	75mm **AGGREGATE**
	FILL, clayey silt, some sand, trace gravel, firm, brown, moist
98.4 0.8	**SILT AND SAND**, trace clay, compact, brown, moist ...at 1.5 m, very dense
96.9 2.3	**CLAYEY SILT**, trace sand, trace gravel, hard, brown, moist ...at 3.0 m, sandy silt, some clay, some sand, grey, moist, hard ...at 4.6 m, clayey silt
91.1 8.1	**END OF BOREHOLE**

number	type	SPT N-value	lab data and comments	grain size distribution (%) (MIT) GR SA SI CL
1	SS	6	SS1: BTEX, Metals, PAHs, PCBs, PHCs, VOCs	
2	SS	24		
3	SS	58		
4	SS	97 / 275mm		1 5 64 30
5	SS	92 / 275mm		
6	SS	93 / 275mm		
7	SS	89 / 275mm		
8	SS	97 / 290mm	SS8: BTEX, Metals, PAHs, PCBs, PHCs, VOCs	0 0 66 34



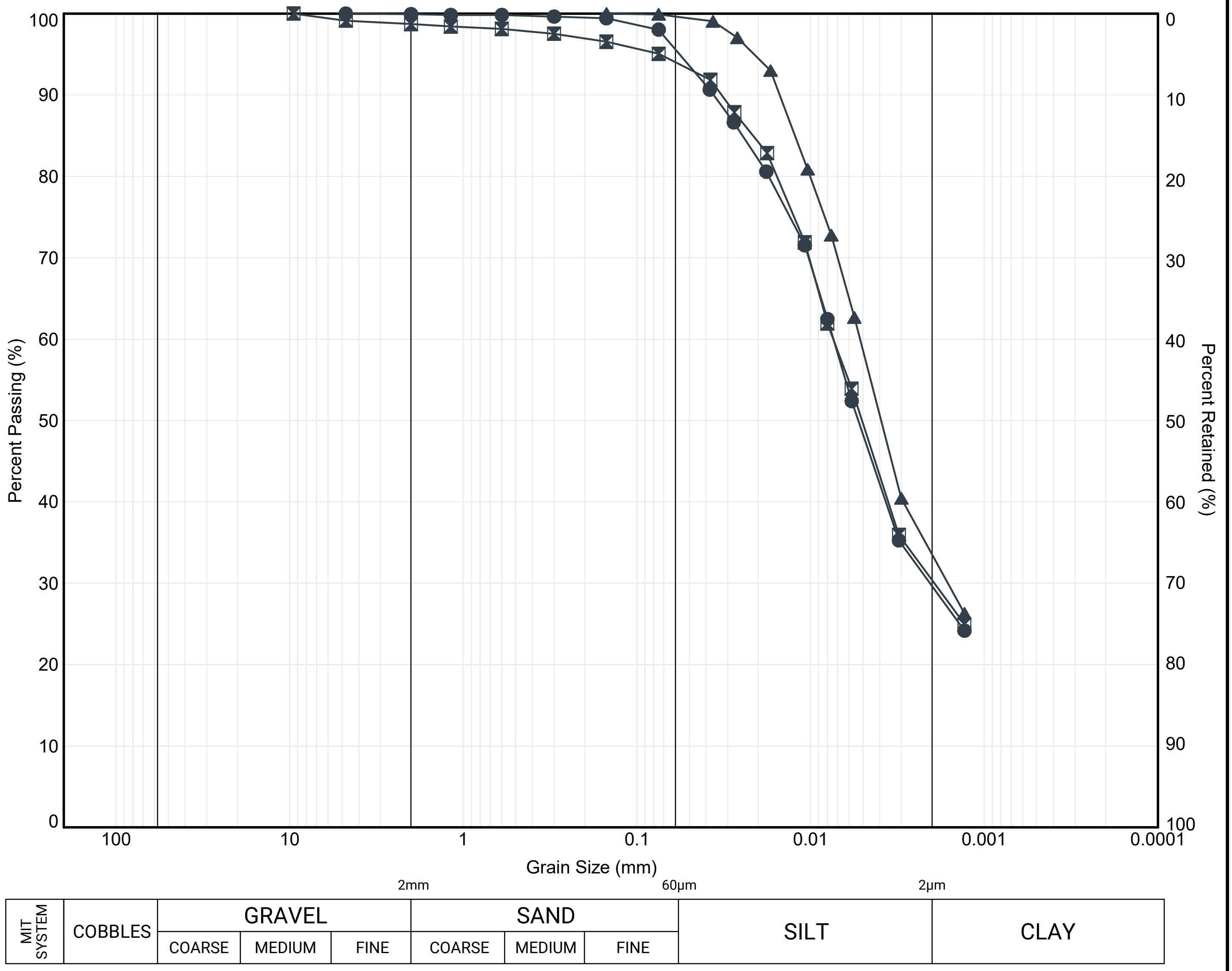
Dry and open upon completion of drilling.

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

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 12, 2022	5.4	93.8
May 26, 2022	3.7	95.5
Jun 22, 2022	3.4	95.8

APPENDIX C



MIT SYSTEM

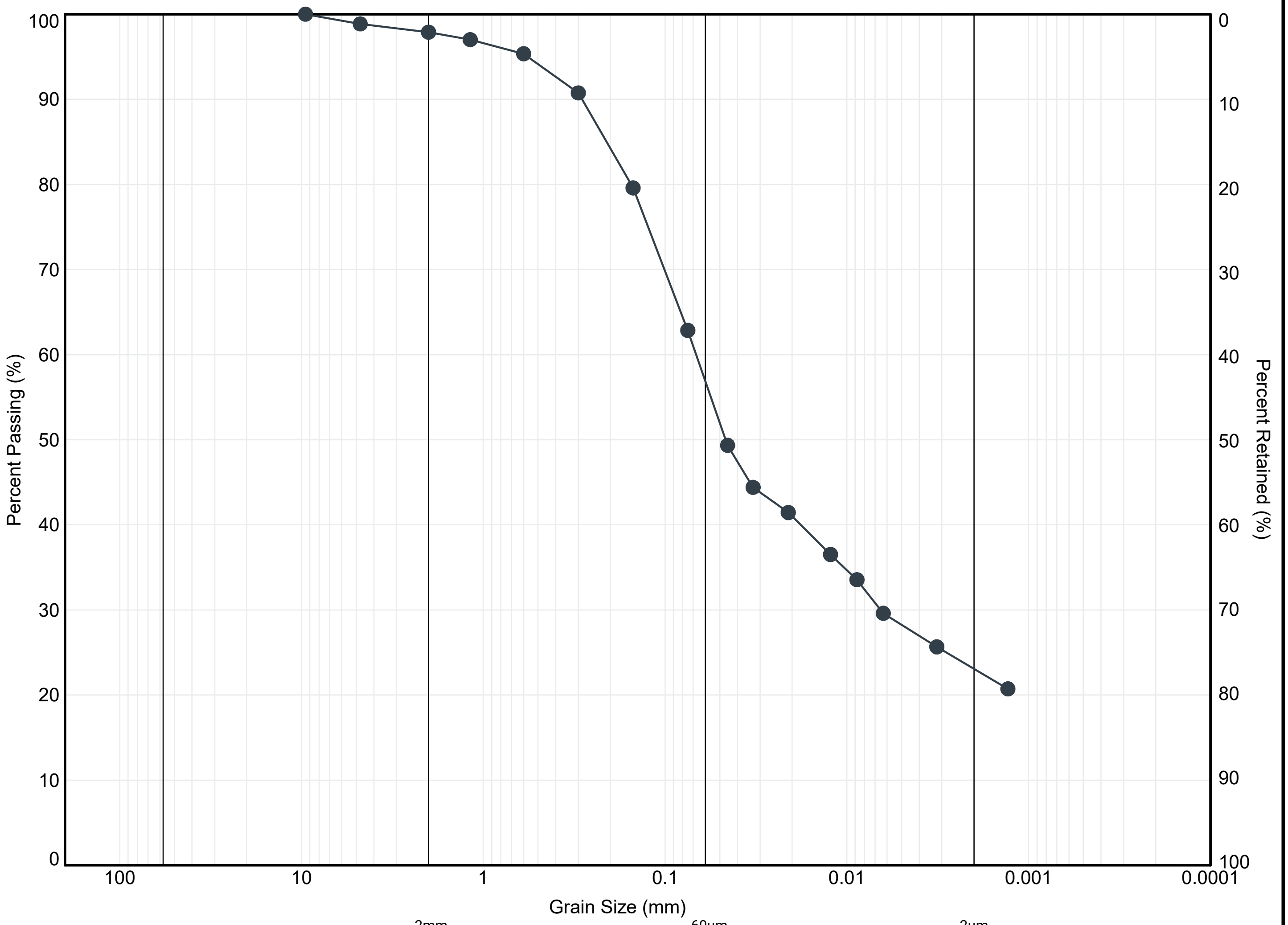
	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**2**	SS6	4.7	95.6	0	4	66	30
☒	**3**	SS4	2.5	96.7	1	5	64	30
▲	**3**	SS8	7.8	91.4	0	0	66	34

GROUNDED
ENGINEERING

Title:

GRAIN SIZE DISTRIBUTION

File No.: **22-088**



		2mm				60µm		2µm	
MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**1**	SS3	1.8	96.9	2	41	34	23

GROUNDED
ENGINEERING

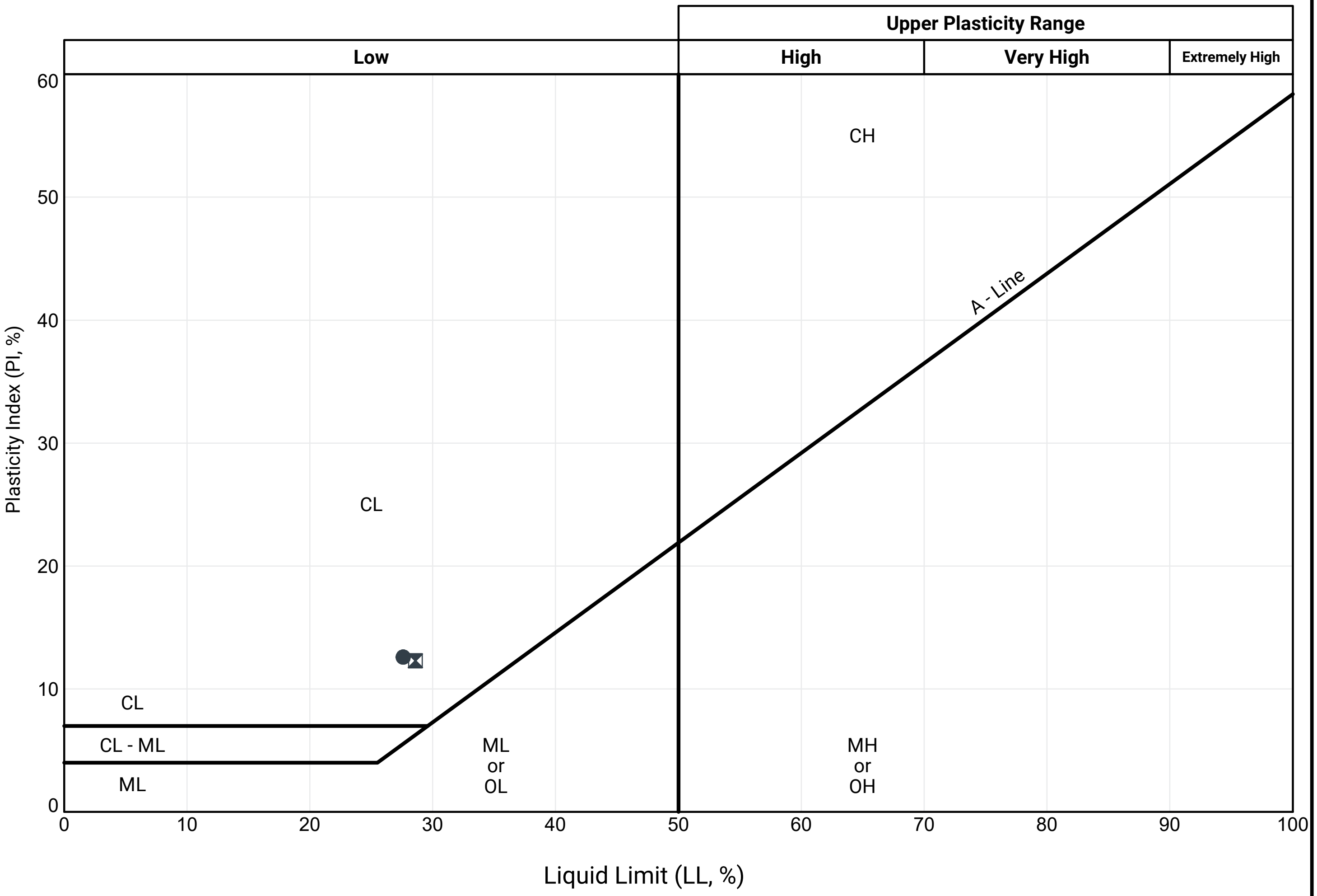
Title:

GRAIN SIZE DISTRIBUTION

File No.:

22-088

file: 22-088 gint.gpj



	Borehole	Sample	Depth (m)	Elev. (m)	LL (%)	PL (%)	PI (%)
●	**2**	SS6	4.7	95.6	28	15	13
☒	**3**	SS8	7.8	91.4	29	16	13

GROUNDED ENGINEERING

Title:

ATTERBERG LIMITS CHART

File No.: **22-088**

APPENDIX D

Grounded Engineering Inc
ATTN: SAM BASTAN
1 Banigan Drive
TORONTO ON M4H 1G3

Date Received: 04-MAY-22
Report Date: 11-MAY-22 15:01 (MT)
Version: FINAL

Client Phone: 647-264-7928

Certificate of Analysis

Lab Work Order #: L2703328

Project P.O. #: NOT SUBMITTED
Job Reference: 22-088
C of C Numbers: 20-951302
Legal Site Desc: 1066 DUNBURTON RD, PICKERING

Amanda Overholster

Amanda Overholster
Account Manager

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2703328-1 BH1 SS4 7.6-9.6 Sampled By: L. JOHNSTON on 02-MAY-22 @ 17:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.449		0.0040	mS/cm		09-MAY-22	R5774934
% Moisture	6.76		0.25	%	05-MAY-22	06-MAY-22	R5772236
pH	8.06		0.10	pH units		06-MAY-22	R5773423
Redox Potential	287		-1000	mV		05-MAY-22	R5772485
Resistivity	2230		1.0	ohm*cm		09-MAY-22	
Leachable Anions & Nutrients							
Chloride	228		5.0	ug/g	06-MAY-22	09-MAY-22	R5774921
Anions and Nutrients							
Sulphate	<20		20	ug/g	06-MAY-22	09-MAY-22	R5774921
Inorganic Parameters							
Acid Volatile Sulphides	0.40		0.20	mg/kg	05-MAY-22	05-MAY-22	R5772491
L2703328-2 BH2 SS3 5-7 Sampled By: L. JOHNSTON on 02-MAY-22 @ 17:00 Matrix: SOIL							
Physical Tests							
Conductivity	0.335		0.0040	mS/cm		09-MAY-22	R5774934
% Moisture	7.32		0.25	%	05-MAY-22	06-MAY-22	R5772236
pH	7.88		0.10	pH units		06-MAY-22	R5773423
Redox Potential	256		-1000	mV		05-MAY-22	R5772485
Resistivity	2990		1.0	ohm*cm		09-MAY-22	
Leachable Anions & Nutrients							
Chloride	102		5.0	ug/g	06-MAY-22	09-MAY-22	R5774921
Anions and Nutrients							
Sulphate	<20		20	ug/g	06-MAY-22	09-MAY-22	R5774921
Inorganic Parameters							
Acid Volatile Sulphides	1.17		0.20	mg/kg	05-MAY-22	05-MAY-22	R5772491
L2703328-3 BH3 SS2 2.6-4.6 Sampled By: L. JOHNSTON on 02-MAY-22 @ 17:00 Matrix: SOIL							
Physical Tests							
Conductivity	1.38		0.0040	mS/cm		11-MAY-22	R5777496
% Moisture	11.0		0.25	%	05-MAY-22	06-MAY-22	R5772236
pH	7.80		0.10	pH units		06-MAY-22	R5773423
Redox Potential	270		-1000	mV		05-MAY-22	R5772485
Resistivity	724		1.0	ohm*cm		11-MAY-22	
Leachable Anions & Nutrients							
Chloride	722		5.0	ug/g	06-MAY-22	09-MAY-22	R5774921
Anions and Nutrients							
Sulphate	58		20	ug/g	06-MAY-22	09-MAY-22	R5774921
Inorganic Parameters							
Acid Volatile Sulphides	2.86	DLHC	0.40	mg/kg	05-MAY-22	05-MAY-22	R5772491

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-R511-WT	Soil	Chloride-O.Reg 153/04 (July 2011)	EPA 300.0

5 grams of dried soil is mixed with 10 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

ALS Test Code	Matrix	Test Description	Method Reference**
EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample 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 and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

ALS Test Code	Matrix	Test Description	Method Reference**
REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580

This analysis is carried out in accordance with the procedure described in the "APHA" method 2580 "Oxidation-Reduction Potential" 2012. Samples are extracted at a fixed ratio with DI water. Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

ALS Test Code	Matrix	Test Description	Method Reference**
RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	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.

ALS Test Code	Matrix	Test Description	Method Reference**
SO4-WT	Soil	Sulphate	EPA 300.0

5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

ALS Test Code	Matrix	Test Description	Method Reference**
SULPHIDE-WT	Soil	Sulphide, Acid Volatile	APHA 4500S2J

This analysis is carried out in accordance with the method described in APHA 4500 S2-J. Hydrochloric acid is added to sediment samples within a purge and trap system. The evolved hydrogen sulphide (H2S) is carried into a basic solution by inert gas. The acid volatile sulfide is then determined colourimetrically.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

20-951302

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Quality Control Report

Workorder: L2703328 Report Date: 11-MAY-22

Client: Grounded Engineering Inc
1 Banigan Drive
TORONTO ON M4H 1G3
Contact: SAM BASTAN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-R511-WT	**Soil**							
Batch R5774921								
WG3724652-7 CRM		**AN-CRM-WT**						
Chloride			100.6		%		70-130	09-MAY-22
WG3724652-8 DUP		**WG3724652-9**						
Chloride		<5.0	<5.0	RPD-NA	ug/g	N/A	30	09-MAY-22
WG3724652-6 LCS								
Chloride			103.4		%		80-120	09-MAY-22
WG3724652-5 MB								
Chloride			<5.0		ug/g		5	09-MAY-22
EC-WT	**Soil**							
Batch R5774934								
WG3724668-4 DUP		**WG3724668-3**						
Conductivity		0.132	0.131		mS/cm	0.9	20	09-MAY-22
WG3724668-2 IRM		**WT SAR4**						
Conductivity			111.2		%		70-130	09-MAY-22
WG3725074-1 LCS								
Conductivity			95.0		%		90-110	09-MAY-22
WG3724668-1 MB								
Conductivity			<0.0040		mS/cm		0.004	09-MAY-22
Batch R5777496								
WG3725180-4 DUP		**WG3725180-3**						
Conductivity		0.0668	0.0683		mS/cm	2.2	20	11-MAY-22
WG3725180-2 IRM		**WT SAR4**						
Conductivity			113.8		%		70-130	11-MAY-22
WG3726124-1 LCS								
Conductivity			94.4		%		90-110	11-MAY-22
WG3725180-1 MB								
Conductivity			<0.0040		mS/cm		0.004	11-MAY-22
MOISTURE-WT	**Soil**							
Batch R5772236								
WG3723890-3 DUP		**L2702991-5**						
% Moisture		31.8	31.5		%	0.9	20	06-MAY-22
WG3723890-2 LCS								
% Moisture			100.5		%		90-110	06-MAY-22
WG3723890-1 MB								
% Moisture			<0.25		%		0.25	06-MAY-22
PH-WT	**Soil**							

Quality Control Report

Workorder: L2703328 Report Date: 11-MAY-22

Client: Grounded Engineering Inc
1 Banigan Drive
TORONTO ON M4H 1G3
Contact: SAM BASTAN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-WT	**Soil**							
Batch R5773423								
WG3724243-1 DUP		**L2703794-1**						
pH		7.56	7.60	J	pH units	0.04	0.3	06-MAY-22
WG3724537-1 LCS								
pH			7.00		pH units		6.9-7.1	06-MAY-22
REDOX-POTENTIAL-WT	**Soil**							
Batch R5772485								
WG3723940-1 CRM		**WT-REDOX**						
Redox Potential			104.2		%		90-110	05-MAY-22
WG3723842-1 DUP		**L2703328-1**						
Redox Potential		287	289		mV	0.7	25	05-MAY-22
SO4-WT	**Soil**							
Batch R5774921								
WG3724652-7 CRM		**AN-CRM-WT**						
Sulphate			102.5		%		60-140	09-MAY-22
WG3724652-8 DUP		**WG3724652-9**						
Sulphate		<20	<20	RPD-NA	ug/g	N/A	25	09-MAY-22
WG3724652-6 LCS								
Sulphate			103.1		%		70-130	09-MAY-22
WG3724652-5 MB								
Sulphate			<20		ug/g		20	09-MAY-22
SULPHIDE-WT	**Soil**							
Batch R5772491								
WG3724060-3 DUP		**L2703328-2**						
Acid Volatile Sulphides		1.17	1.01		mg/kg	15	45	05-MAY-22
WG3724060-2 LCS								
Acid Volatile Sulphides			71.4		%		70-130	05-MAY-22
WG3724060-1 MB								
Acid Volatile Sulphides			<0.20		mg/kg		0.2	05-MAY-22

Quality Control Report

Workorder: L2703328 Report Date: 11-MAY-22

Client: Grounded Engineering Inc
1 Banigan Drive
TORONTO ON M4H 1G3
Contact: SAM BASTAN

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

www.alsglobal.com

Chain of Custody (COC) / Anal

Canada Toll Free: 1 800

L2703328-COFC

mber: 20 - 951302

Page 1 of 1

Report To Contact and company name below will appear on the final report

Company: Grounded Engineering
Contact: ~~Lindsy Levesque~~ SAM BASTAN
Phone:

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 ~~llevesque@groundedeng.ca~~
Email 2 sbastan@groundedeng.ca
Email 3

Invoice Recipients

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

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. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Date and Time Required for all E&P TATs:

For all tests with rush TATs requested, please contact your AM to confirm availability.

Project Information

ALS Account # / Quote #:
Job #: 22-088
PO / AFE:
LSD: 1066 Dunbarton Rd, Pickering

ALS Lab Work Order # (ALS use only): L2703328

Oil and Gas Required Fields (client use)

AFE/Cost Center:
PO#
Major/Minor Code:
Routing Code:
Requisitioner:
Location:

ALS Contact:
Sampler: Leland Johnston

Analysis Request

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)
	Separate Report ↓								
	BH1 SS4 7'6"-9'6"	02-May-22	17:00	Soil		✓			
	BH2 SS3 5'-7'	↓	↓	"		✓			
	BH3 SS2 2'6"-4'6"			"		✓			

Drinking Water (DW) Samples[1] **(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

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			
				7.9			

SHIPMENT RELEASE (client use)

Released by: Leland Johnston Date: 02/05/22 Time: 6pm

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by: Date: Time:

FINAL SHIPMENT RECEPTION (ALS use only)

Received by: AP Date: 4-MAY-22 Time: 18:45

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

AUG 2020 FRONT

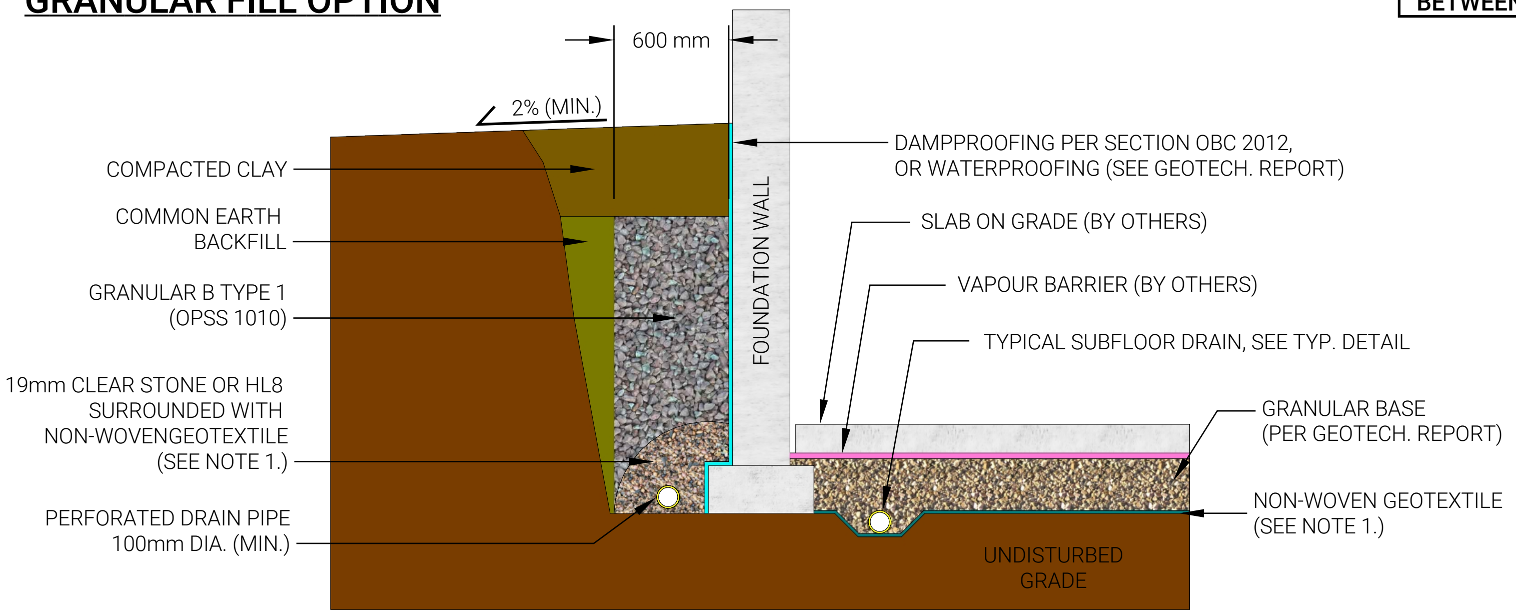
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

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

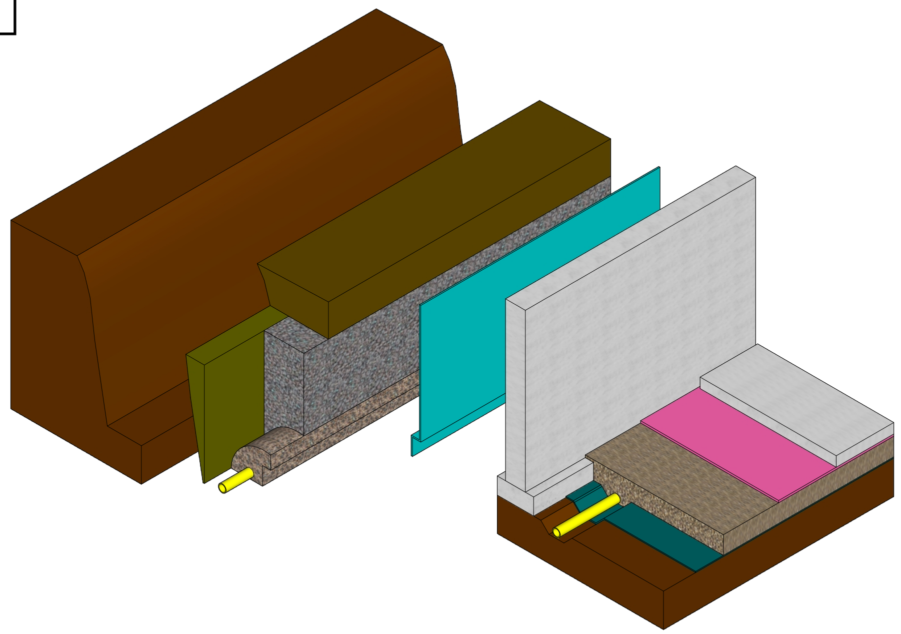
APPENDIX E

OBJECTS ARE COLOR-CODED
BETWEEN TWO VIEWS FOR CLARITY

GRANULAR FILL OPTION

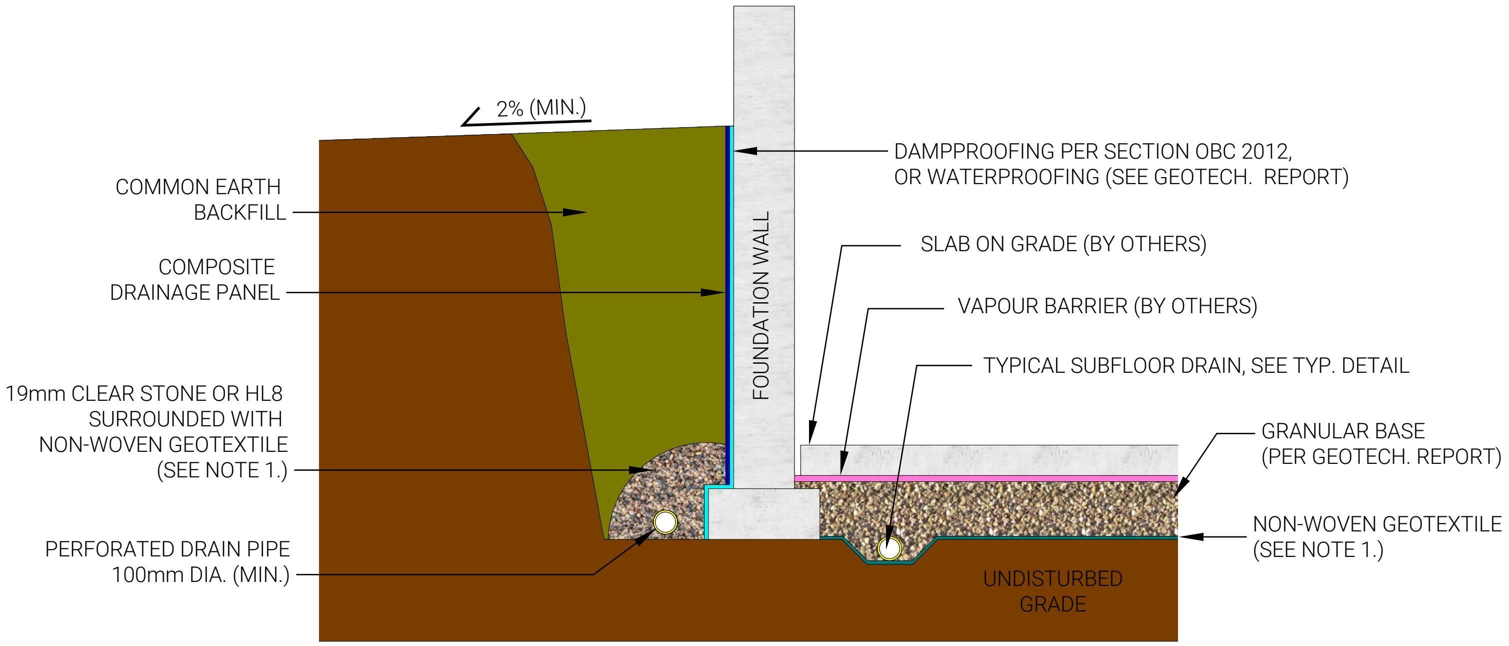


SECTIONAL VIEW

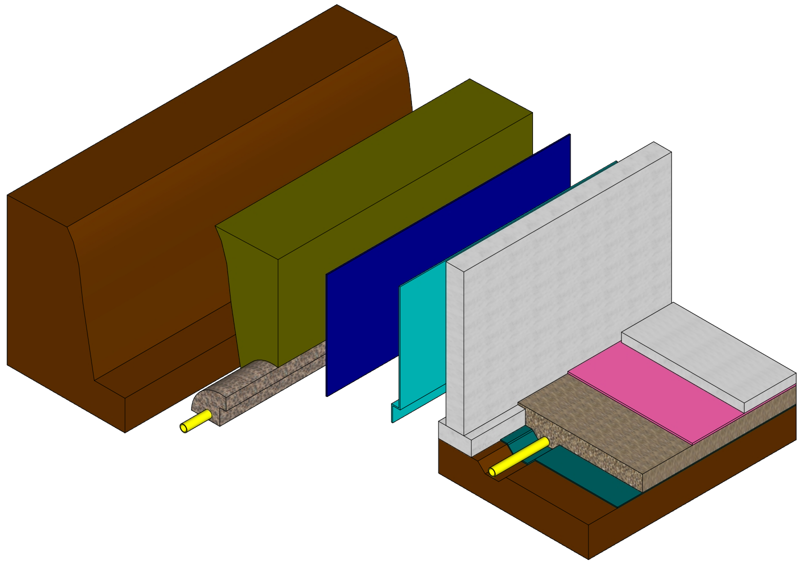


ISOMETRIC VIEW

GEO-COMPOSITE DRAINAGE PANEL OPTION



SECTIONAL VIEW



ISOMETRIC VIEW

NOTES

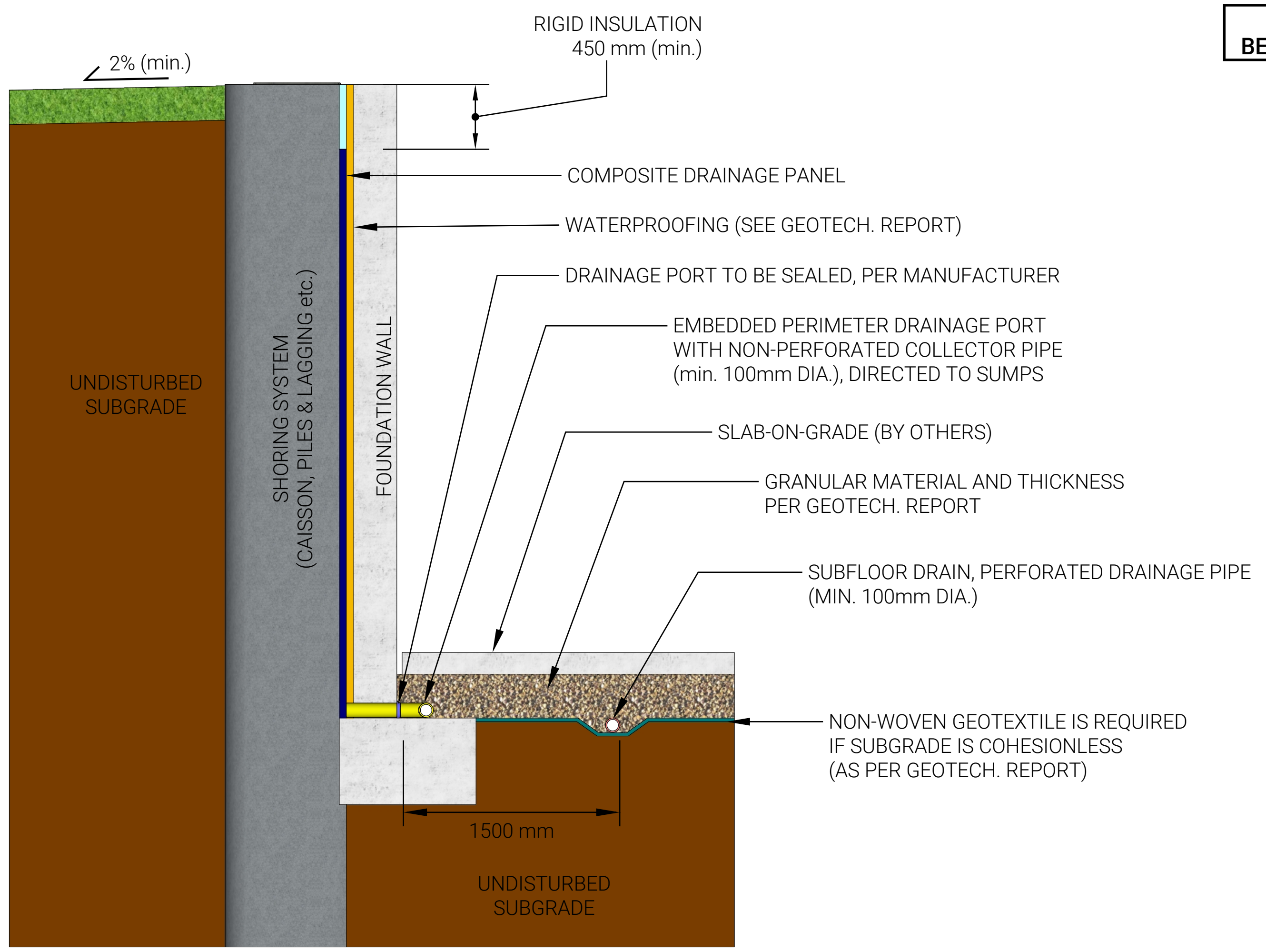
1. A NON-WOVEN GEOTEXTILE WITH AN APPARENT OPENING SIZE OF < 0.250mm AND A TEAR RESISTANCE OF > 200 N.

GROUNDED
ENGINEERING

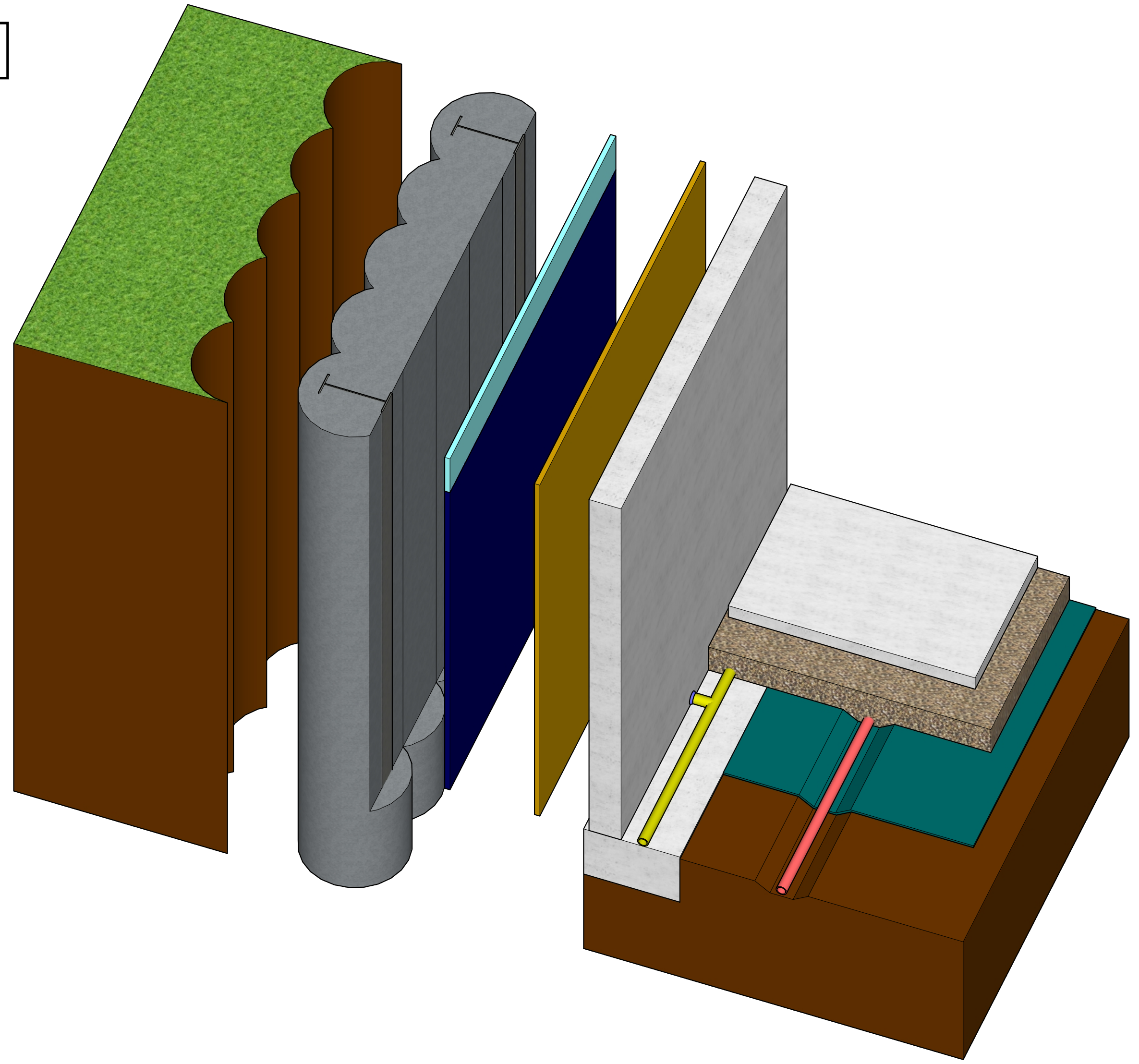
Title

BASEMENT DRAINAGE TYPICAL DETAIL

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

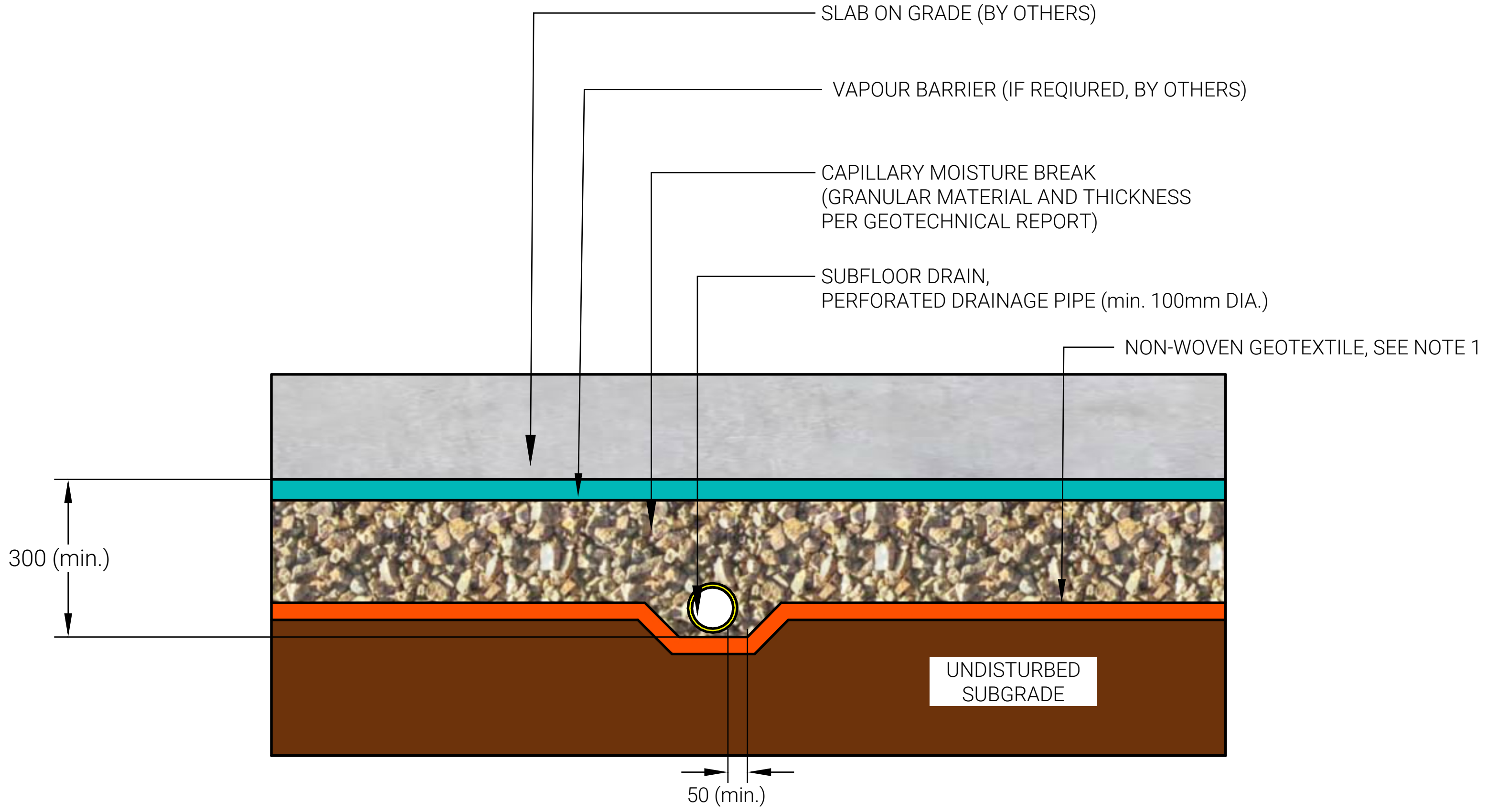
1. THERE SHOULD BE NO STRUCTURAL CONNECTION BETWEEN THE SLAB-ON-GRADE AND THE FOUNDATION WALL OR FOOTING.
2. THERE SHOULD BE NO CONNECTION BETWEEN THE SUBFLOOR AND PERIMETER DRAINAGE SYSTEMS.
3. THIS IS ONLY A TYPICAL BASEMENT DRAINAGE DETAIL. THE GEOTECHNICAL REPORT SHOULD BE CONSULTED FOR SITE SPECIFIC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

GROUNDED ENGINEERING

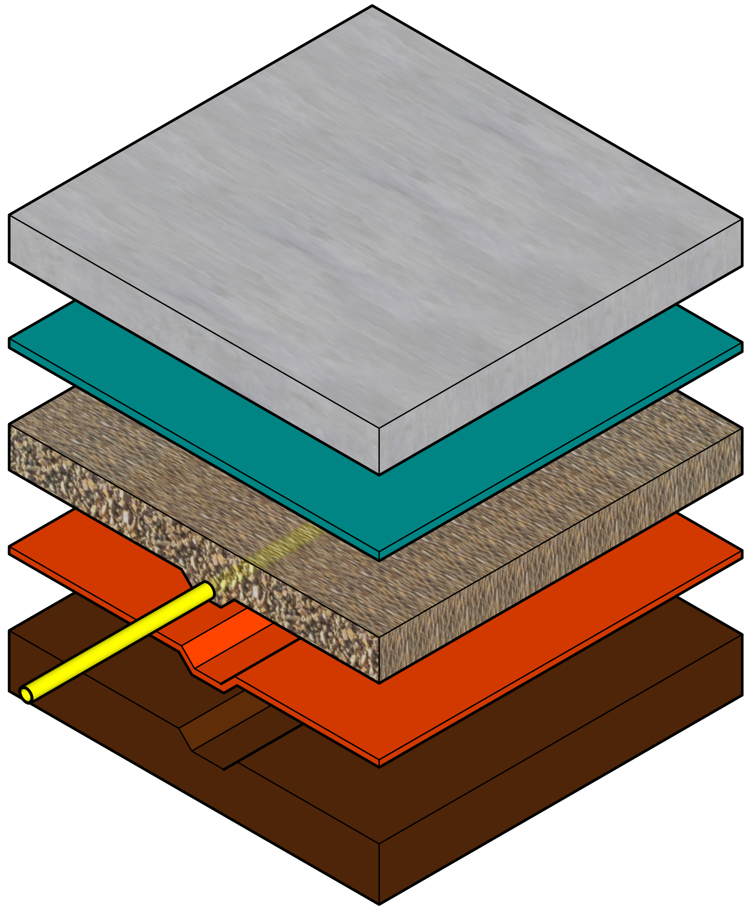
Title

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

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BASEMENT SUBDRAIN TYPICAL DETAIL