Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

GEOTECHNICAL INVESTIGATION
PROPOSED SMVS TEMPLE
6939 KING STREET
CALEDON, ONTARIO

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1 INTRODUCTION

Terraprobe Inc. (Terraprobe) was retained by Swaminarayan Mandir Vasna Sanstha (SMVS) Canada to conduct a geotechnical investigation for the proposed development located at 6939 King Street in the Town of Caledon, Ontario.

This report encompasses the results of the geotechnical investigation conducted for the proposed development to determine the prevailing subsurface soil and ground water conditions, and based on this information, provides geotechnical engineering recommendations for the design of foundations, slab-on-grade, earth pressure and seismic design parameters, pavement design and bedding/embedment and cover. Geotechnical comments are also included on pertinent construction aspects, excavation, bedding/embedment, backfill and ground water control.

2 SITE AND PROJECT DESCRIPTIONS

The site is located in the southwest quadrant of the intersection of King Street and Centreville Creek Road, in the Town of Caledon, Ontario. The general location of the site is presented on Figure 1.

The property currently consists of a parallelogram-shaped shaped parcel of agricultural land and covers an area of approximately 61,000 m^2 (15 acres).

It is proposed to develop the site to include a religious temple with at-grade parking lots. It is understood that the proposed temple will be a one-story slab-on-grade structure with no basement.

3 INVESTIGATION PROCEDURE

The field investigation was conducted on July 14 and September 21, 2020, and consisted of drilling and sampling a total of twelve (12) boreholes, extending to about 1.8 to 8.1 m depth below grade. The approximate locations of the boreholes are shown on the enclosed Borehole Location Plan (Figure 2).

The boreholes were drilled by a specialist drilling contractor using track-mounted drill rig power auger. The borings were advanced using continuous flight solid stem augers, and were sampled at 0.75 m and 1.5 m intervals with a conventional 50 mm diameter split barrel samplers when the Standard Penetration Test (SPT) was carried out (ASTM D1586). The field work (drilling, sampling and testing) was observed and recorded by a member of our field engineering staff, who logged the borings and examined the samples as they were obtained.

All samples obtained during the investigation were sealed into clean plastic jars, and transported to our geotechnical testing laboratory for detailed inspection and testing. All borehole samples were examined (tactile) in detail by a geotechnical engineer, and classified according to visual and index properties. Laboratory tests consisted of water content determination on all samples; and a Sieve and Hydrometer analysis on five (5) selected native soil samples (Borehole 1, Sample 3; Borehole 3, Sample 4;

Borehole 5, Sample 3; Borehole 8, Sample 2 and Borehole 11, Sample 2). The measured natural water contents of individual samples and the results of the Sieve and Hydrometer analysis are plotted on the enclosed Borehole Logs at respective sampling depths. The results of Sieve and Hydrometer analysis are also summarized in Section 4.4 of this report, and appended.

Water levels were measured in open boreholes upon completion of drilling. Monitoring wells comprising 50 mm diameter PVC pipes were installed in selected boreholes (Boreholes 1, 3 and 5) to facilitate ground water monitoring. The PVC tubing was fitted with a bentonite clay seal as shown on the accompanying Borehole Logs. Water levels in the monitoring wells were measured on October 5 and 13, 2020. The results of ground water monitoring are presented in Section 4.5 of this report.

The borehole ground surface elevations were surveyed by Terraprobe using a Trimble R10 GNSS System. The Trimble R10 system uses the Global Navigation Satellite System and the Can-Net reference system to determine target location and elevation. The Trimble R10 system is reported to have an accuracy of up to 10 mm horizontally and up to 30 mm vertically.

It should be noted that the elevations provided on the Borehole Logs are approximate only, for the purpose of relating soil stratigraphy and should not be used or relied on for other purposes.

4 SUBSURFACE CONDITIONS

The specific soil conditions encountered at each borehole location are described in greater detail on the Borehole Logs, with a summary of the general subsurface soil conditions outlined below. This summary is intended to correlate this data to assist in the interpretation of the subsurface conditions encountered at the site.

It should be noted that the subsurface conditions are confirmed at the borehole locations only, and may vary between and beyond the borehole locations. The boundaries between the various strata as shown on the logs are based on non-continuous sampling. These boundaries represent an inferred transition between the various strata, rather than a precise plane of geologic change.

4.1 Topsoil

A topsoil layer was encountered at the ground surface in Boreholes 2 to 10. The thickness ranged from 200 to 300 mm. The topsoil was dark brown in colour and consisted of matrix of silt and sand.

The topsoil surficial layer thicknesses provided in the report were obtained at individual borehole locations, as measured through the collar of the open borehole or as inferred from non-continuous sampling. Thickness may vary between and beyond borehole locations.

4.2 Earth Fill

A earth fill zone, consisting of clayey silt with varying amounts of sand and trace amounts of gravel and organics was encountered at the ground surface in Boreholes 1, 11, and 12 and beneath the topsoil layer in Boreholes 3, 4, 6, 9, and 10 and extends to depths varying from about 0.6 m (Borehole 11) to about 1.2 m (Boreholes 1, and 12) below existing grade.

Standard Penetration Test (SPT) results (N-values) obtained from the earth fill zone ranged from 7 to 21 blows per 300 mm of penetration, indicating a firm to very stiff consistency, typically stiff. The in-situ moisture contents of the earth fill samples ranged from 10 to 19 percent by mass, indicating a moist condition.

4.3 Glacial Till

Silt and clay to clayey silt till deposit, with trace to some sand and trace amounts of gravel was encountered beneath the earth fill zone in Boreholes 1, 3, 4, 6, and 9 to 12 and the topsoil layer in Boreholes 2, 5, 7 and 8 and extended to the full depth of the investigation ranging from 2.0 m (Boreholes 7 to 12) to 8.1 m (Boreholes 1, 3, and 5) below grade. The upper zone of the glacial till deposit extending up to 0.8 m depth blow grade was weathered and disturbed in Boreholes 2, 5, 6, and 7. The composition of the weathered and disturbed soil is generally similar to that of underlying undisturbed soil but included trace amounts of organic matter and topsoil.

The result of Standard Penetration Test (N-values) obtained from the undisturbed silt and clay to clayey silt till deposits ranged from 14 to 51 blows per 300 mm of penetration to 50 blows per 125 mm of penetration, indicating a stiff to hard consistency (typically very stiff to hard). The in-situ moisture contents of the silt and clay glacial till samples ranged from 12 to 17 percent by mass, indicating a moist condition.

It should be noted that the glacial till deposit may contain larger size particles (cobbles and boulders) that are not specifically identified in the boreholes. The size and distribution of such obstructions cannot be predicted with borings, because the borehole sampler size is insufficient to secure representative samples for the particles of this size.

4.4 Geotechnical Laboratory Test Results

The geotechnical laboratory testing consisted of natural water content determination for all samples, while Sieve and Hydrometer analysis were conducted on selected soil samples. The test results are plotted on the enclosed Borehole Logs at respective sampling depths.

The results (graphs) of the Sieve and Hydrometer (grain size) analysis are appended and a summary of these results is presented as follows:

Borehole No. Sample No.	Sampling Depth below Grade (m)	Percentage (by mass)				Descriptions (MIT System)
		Gravel	Sand	Silt	Clay	
Borehole 1, Sample 3	1.8	2	14	48	36	SILT AND CLAY TILL some sand, trace gravel
Borehole 3, Sample 4	2.5	1	16	43	40	SILT AND CLAY TILL some sand, trace gravel
Borehole 5, Sample 3	1.8	0	13	40	47	CLAY AND SILT TILL some sand
Borehole 8, Sample 2	1.0	4	11	42	43	CLAY AND SILT TILL some sand, trace gravel
Borehole 11, Sample 2	1.1	6	13	41	40	SILT AND CLAY TILL some sand, trace gravel

4.5 Ground Water

Observations pertaining to the depth of water level and caving were made in the open boreholes immediately after completion of drilling, and are noted on the enclosed Borehole Logs. Monitoring wells were installed in Boreholes 1, 3, and 5 to facilitate ground water level monitoring and the purpose of hydrogeological study. The ground water level measurements in the monitoring wells were taken on October 5 and 13, 2020 and are noted on the enclosed Borehole Logs. A summary of these observations is provided as follows,

Borehole No.	Depth of Boring below Grade (m)	Depth to Cave below Grade (m)	Water Level Depth/Elevation (m) at the Time of Drilling	Water Level Depth/Elevation (m) in Monitoring Wells on October 5, 2020	Water Level Depth/Elevation (m) in Monitoring Wells on October 13, 2020
Borehole 1	8.1	5.8	Dry	1.0/265.9	5.7/261.1
Borehole 2	6.6	5.5	Dry	Monitoring well not installed	Monitoring well not installed
Borehole 3	8.1	Open	Dry	3.1/263.2	3.7/262.6
Borehole 4	6.6	Open	Dry	Monitoring well not installed	Monitoring well not installed
Borehole 5	8.1	Open	Dry	2.3/264.1	3.7/262.7
Borehole 6	6.6	5.8	Dry	Monitoring well not installed	Monitoring well not installed

The water levels noted above may fluctuate seasonally depending upon the amount of precipitation and surface runoff.

5 DISCUSSIONS AND RECOMMENDATIONS

The following discussion and recommendations are based on the factual data obtained from this investigation and are intended for the use of the owner and the design engineer. Contractors bidding or providing services on this project should review the factual data and determine their own conclusions regarding construction methods and scheduling.

This report is provided on the basis of these terms of reference and on the assumption 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 Terraprobe should be retained to review the implications of these changes with respect to the contents of this report.

The original Site Plan indicated that the proposed building footprint was located in the eastern portion of the site. Our borehole location and depths were therefore established based on the above original design scheme. Boreholes 1 to 6 located within the original footprint were advanced to about 6.6 to 8.1 m depth below grade. However, the latest Site Plan indicates that the proposed building footprint is moved to the western portion of the site. Boreholes 3, 6 and 9 are located within the latest building footprint. Borehole 9 was advanced to only 2.0 m depth below grade and therefore cannot be used for the foundation design. Only Boreholes 3 and 6 are located in the eastern portion of the building footprint and were advanced to 8.1 m and 6.6 m depth below grade, respectively. Therefore, additional boreholes will be required to provide sufficient subsurface information coverage to meet the latest project design scheme. The geotechnical recommendations provided in this report are preliminary and for the application submission purposes and must be updated once the subsurface conditions obtained from the additional boreholes are available.

5.1 Foundation

Boreholes 3 and 6 located in the eastern portion of the building footprint typically encountered the topsoil at the ground surface underlain by the weathered/disturbed soil zone or the earth fill zone extending to depths ranging from 0.8 m below grade, underlain by undisturbed silt and clay to clayey silt till deposit, extending to the full depth of the investigation in each borehole.

Based on the preliminary design information provided, the proposed building would be a single-storey slab-on-grade structure with no basement.

The undisturbed silt and clay to clayey silt till deposit is considered suitable to support the proposed building foundations. A maximum net geotechnical reaction of 250 kPa (Serviceability Limit States, SLS) and a maximum factored geotechnical resistance of 375 kPa (Ultimate Limit States, ULS) may be used for preliminary design of conventional spread footing foundations (for vertical and concentric loads) supported on the underlying competent undisturbed silt and clay to clayey silt till deposit of very stiff to

hard consistency. Higher bearing pressures are also available and can be analyzed in detail based on the final building design. The final grading plan and design drawings should be reviewed by Terraprobe to better assess the design foundation elevations and to provide updated foundation bearing pressure (geotechnical reaction and resistance) recommendations prior to the development.

The underside of footing elevations must be designed to provide a minimum of 1.2 m of soil cover or equivalent insulation to the foundation subgrade for frost protection considerations in unheated areas. All footings must be designed to bear at least 0.3 m into the undisturbed silt and clay to clayey silt till stratum.

The minimum width of the continuous strip footings must be 500 mm and the minimum footing area for column must be 0.9×0.9 m^2 regardless of loading considerations, in conjunction with the above recommended geotechnical resistance. The geotechnical resistance(s) as recommended allow for up to 25 mm of total settlement. This settlement will occur as load is applied and is linear elastic and non-recoverable. Differential settlement is a function of spacing, loading and foundation size.

5.1.1 Foundation Installation

All exterior foundations and foundations in unheated areas must be provided with a minimum soil cover of 1.2 m or equivalent insulation for frost protection.

It is recommended that all excavated footing base must be evaluated by a qualified geotechnical engineer to ensure that the founding soils exposed at the excavation base are consistent with the design bearing pressure intended by the geotechnical engineer.

Prior to pouring foundation concrete, the foundation subgrade should be cleaned of all deleterious materials such as topsoil, fill, softened, disturbed or caved materials, as well as any standing water. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the foundation subgrade and concrete must be provided.

It is noted that the native soils tend to weather rapidly and deteriorate on exposure to the atmosphere or surface water. Hence, foundation bases which remain open for an extended period of time should be protected by a skim coat of lean concrete.

5.2 Slab-on-Grade

Conventional lightly loaded concrete floor slab should be placed on at least 150 mm of granular base (OPSS.MUNI 1004 19 mm clear stone) compacted to a dense state by vibration. The weathered/disturbed native soil may remain to support the slab-on-grade provided they are approved by the geotechnical engineer at the time of construction. Any subgrade area containing excessive amount of deleterious materials must be sub-excavated. The subgrade must be assessed by a geotechnical engineer or its

representative, prior to placement of the granular base. Any soft or wet subgrade areas identified, should be locally sub-excavated and backfilled with clean earth fill compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD). Based on the borehole information, selection and sorting of the weathered/disturbed native materials will be required.

Suitable geotextile (for instance OPSS.MUNI 1860 Class II non-woven geotextile) needs to be placed to separate granular base course from the subgrade to prevent migration of soil fines where the silt/sand subgrade soils are encountered.

The following subgrade parameters are recommended for the design of slab-on-grade supported on the undisturbed glacial deposit, engineered fill material or compacted earth fill compacted to 98 percent of SPMDD:

K_s = 40,000 kPa/m (undisturbed native glacial till)
K_s = 20,000 kPa/m (engineered fill)
K_s = 18,000 kPa/m (compacted fill)

Provided the finish floor level of the slab-on-grade building is at least 200 mm above the outside design grade, and the site is graded to promote drainage away from the building; subfloor drainage provisions are not required.

Regardless of the approach to slab construction, the floor slabs that are to have bonded floor finish (such as tiles with adhesives) should be provided with a capillary moisture break and a vapour barrier. The floor manufacturers have specific requirements for moisture and vapour barrier, therefore, the floor designer/ architect must ensure that a provision of appropriate moisture and vapour barrier conforming to specific floor finish product requirements is incorporated in the project specifications. Adequate testing must be carried out to ensure acceptable levels of moisture and relative humidity in the concrete slab prior to the installation of floor finish. Studies indicate that a provision of 200 mm thick 19 mm Clear Stone base (OPSS.MUNI 1004) under the slab helps provide a good capillary moisture break provided the granular base is positively drained. However, this provision does not provide protection against moisture vapour migration and/or replace the floor manufacturers' specific requirement(s) for a moisture and vapour barrier.

The under-slab vapour retarder specifications, selection and installation shall conform to ASTM E1745 and ASTM E1643. The moisture vapour measurement tests shall conform to RH: ASTM F2170, RH: ASTM F2420 and Calcium Chloride: ASTM F1869. The Surface Applied Moisture Vapour Barrier system shall meet the guidelines established in ASTM F3010-13.

The soils at this site are susceptible to frost effects which would have the potential to deform hard landscaping material adjacent to the building. It is likely that the buildings may have flush entrances, therefore care must be taken in detailing the exterior slabs/sidewalks by providing insulation/drainage

/non-frost susceptible backfill to maintain the flush threshold during freezing weather conditions. Alternatively, a frost slab construction may be employed at these locations.

5.3 Earth Pressure Design Parameters

Walls or bracings subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following equation:

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

Where:
- **P** = the horizontal pressure (kPa)
- **K** = the earth pressure coefficient
- **h** = the depth below the ground surface (m)
- $\mathbf{h_w}$ = the depth below the ground water level (m)
- $\boldsymbol{\gamma}$ = the bulk unit weight of soil (kN/m^3)
- $\boldsymbol{\gamma_w}$ = the bulk unit weight of water (9.8 kN/m^3)
- $\boldsymbol{\gamma'}$ = the submerged unit weight of the exterior soil, ($\gamma_{sat} - \gamma_w$)
- **q** = the complete surcharge loading (kPa)

Where the wall backfill can be drained effectively to eliminate hydrostatic pressures on the wall, this equation can be simplified to:

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

This equation assumes that free-draining granular backfill is used and positive drainage is provided to ensure that there is no hydrostatic pressure acting in conjunction with the earth pressure.

Resistance to sliding of retaining structures is developed by friction between the base of the footing and the soil. This friction **(R)** depends on the normal load on the soil contact (**N**) and the frictional resistance of the soil (**tan ϕ**) expressed as **R = N tan ϕ**. The factored geotechnical resistance at ULS is **0.8 R**.
Passive earth pressure resistance is generally not considered as a resisting force against sliding for conventional retaining structure design because a structure must deflect significantly to develop the full passive resistance.

The average values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follow:

Parameter	Definition	Units
ϕ	angle of internal friction	degrees
γ	bulk unit weight of soil	kN/ m^3

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

Stratum/Parameter	Φ (degree)	γ (kN/m³)	K_a	K_o	K_p
Weathered/Disturbed Soil/Earth Fill	28	19.0	0.36	0.53	2.77
Undisturbed Silt and Clay to Clayey Silt Till	32	21.0	0.31	0.47	3.25

The above values of the earth pressure coefficients are for the horizontal backfill grade behind the wall. The earth pressure coefficients for inclined grade will vary based on the inclination of the retained ground surface.

5.4 Earthquake Design Parameters

The Ontario Building Code 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 4.1.8.4.A. of the Ontario Building Code. 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 on the basis of rational analysis of undrained shear strength (s_u) or penetration resistance (N-values).

$$\upsilon_{s-avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{\upsilon_{si}}} \qquad S_{u-avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{s_{ui}}} \qquad N_{avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

Shear Wave Velocity **Undrained Shear Strength** **SPT N-values**

Based on the borehole data (advanced to a maximum of 8.1 m depth below grade), it is understood that the proposed buildings will be founded on the glacial till deposit of typically very stiff to hard consistency. It is expected that the deeper stratigraphy in this area is at least as competent as the lowest proven strata in the boreholes. On this basis, preliminary site seismic classification may be taken as Site Class C according to 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 Ontario Building Code (2012) provide the applicable acceleration and velocity based site

coefficients. The applicable acceleration and velocity based site coefficients for Site Class C are provided as follows:

Site Class	Values of F_a (acceleration based coefficients)				
	$S_a(0.2) \leq 0.25$	$S_a(0.2) = 0.50$	$S_a(0.2) = 0.75$	$S_a(0.2) = 1.00$	$S_a(0.2) \geq 1.25$
C	1.0	1.0	1.0	1.0	1.0

Site Class	Values of F_v (velocity based coefficients)				
	$S_a(1.0) \leq 0.1$	$S_a(1.0) = 0.2$	$S_a(1.0) = 0.3$	$S_a(1.0) = 0.4$	$S_a(1.0) \geq 0.5$
C	1.0	1.0	1.0	1.0	1.0

It should be noted that the above site seismic designation is estimated on the basis of rational analysis of the undrained shear strength information obtained from the boreholes advanced at the site only up to a maximum of 8.1 m depth below grade and with assumed undrained shear strength for the soil stratigraphy beneath the investigation depth. A site specific Multichannel Analysis of Surface Waves (MASW) may be conducted to confirm the site seismic classification.

5.5 Pavement

Based on the preliminary design information, a parking lot would be constructed in the western portion of the project site. It is understood that the proposed parking lot will be mainly subjected to passenger car traffic, with occasional commercial vehicle traffic, for instance fire truck, garbage truck, delivery truck, etc.

5.5.1 Pavement Design

The asphalt pavement design for parking lot and fire route/driveway is provided in the following table

Pavement Structural Layers	Parking Lot	Fire Route and Driveway
HMA Surface Course, OPSS 1150 HL 3	40 mm	40 mm
HMA Binder Course, OPSS 1150 HL 8	50 mm	65 mm
Granular Base Course, OPSS MUNI 1010 Granular A	150 mm	150 mm
Granular Subbase Course, OPSS MUNI 1010 Granular B Type I	300 mm	400 mm
Total Thickness	540 mm	655 mm

5.5.2 Drainage

Control of water is an important factor in achieving a good pavement life. Therefore, we recommend that provisions be made to drain the new pavement subgrade and its granular layers. Drainage can be achieved by installing catchbasin(s) and a storm sewer system to collect surface runoff and, this system can also be used for subsurface drainage by installing subdrains that are designed to drain into the catchbasins. The subgrade must be free of depressions and sloped at a grade of 3 percent to provide positive drainages.

Continuous pavement subdrains (designed to drain into catchbasins) should be provided along both sides of the driveway curblines. Two lengths of subdrain (each minimum 3 m long) should also be installed at each catchbasin at the parking lot area. All sub-drain arrangements should comply with *OPSD 216.021 Subdrain Pipe, Connection and Outlet, Urban*.

5.5.3 General Pavement Recommendations

HL 3 and HL 8 hot mix asphalt mixes should be designed, produced and placed in conformance with OPSS 1150 and OPSS 310 requirements and pertinent Town's standards.

Granular base and subbase materials should meet the requirements of OPSS MUNI 1010. Granular materials should be compacted to 100 percent SPMDD at ±2 percent of the OMC.

PG 58-28, conforming to OPSS MUNI 1101 is recommended in the HMA surface and binder courses.

Tack coat SS-1 should be applied between hot mix asphalt binder course and surface course.

5.5.4 Subgrade Preparation

All topsoil, organics, soft/loose soils should be stripped from the subgrade areas. The exposed subgrade is expected to consist of silt and clay to clayey silt glacial till deposit or the earth fill materials and these soils will be weakened by construction traffic when wet; especially if site work is carried out during the periods of wet weather. An adequate granular working surface would be likely required in order to minimize subgrade disturbance and protect its integrity in wet periods.

Immediately prior to placing the granular subbase, the exposed subgrade should be proof rolled with a heavy rubber-tired vehicle (such as a loaded gravel truck). The subgrade should be inspected for signs of rutting, distress and displacement. Areas displaying signs of rutting, distress and displacement should be recompacted and retested or, these materials should be locally excavated and replaced with well-compacted clean approved fill material.

The fill material may consist of either granular material or local inorganic soils provided that its moisture content is within ±2 percent of OMC. Fill material should be placed and compacted in accordance with

OPSS.MUNI 501 and the subgrade should be compacted to 98 percent of SPMDD. The final subgrade surface should be sloped at least 3 percent to provide positive drainage.

5.6 Pipe Bedding and Cover/Embedment

The design details and invert elevations of the underground utilities were not available at the time of preparation of this report. The following sections provide preliminary geotechnical engineering information for the design of underground services with relatively shallow inverts. Trench excavation should be carried out in accordance with the *Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects* (O.Reg. 213/91 with recent amendments) (refer to Section 5.7 for details), while trench bedding, backfilling and compaction should be carried out in accordance with OPSD 802 series/or OPSS.MUNI 401 and the Town's standards as appropriate.

The undisturbed silt and clay to clayey till deposit will be suitable for support of buried services that are properly bedded. Where disturbance of the trench base has occurred, due to ground water seepage, or construction traffic, the disturbed soils should be sub-excavated and replaced with suitably compacted granular material. Any accumulation of water at the base of the excavation and any soft/loose soils should be removed prior to placement of the pipe bedding/embankment. Placement of the pipe bedding/embedment must be done in dry condition.

Rigid pipes should be installed in conformance with the OPSD 802.030 or OPSD 802.031 requirements, while flexible pipes should be installed in conformance with the OPSD 802.010 requirements. The recommended bedding and embedment materials should be OPSS.MUNI 1010 Granular A or 19 mm crusher run limestone. The cover materials for rigid pipes should be OPSS.MUNI 1010 Granular B with 100 percent passing 26.5 mm sieve.

Further detail information on bedding/embedment and cover materials can be provided following availability of detailed design drawings.

The bedding, embedment and cover materials should be placed in layers not exceeding 200 mm in thickness and compacted to a minimum of 95 percent SPMDD or vibrated into a dense state in the case of clear stone type bedding.

5.7 Excavations and Ground Water Control

The boreholes data indicate that the weathered/disturbed materials and undisturbed native soils would be encountered in the excavations. Excavations must be carried out in accordance with the *Occupational Health and Safety Act and Regulations for Construction Projects*. These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety.

TYPE 1 SOIL

a. is hard, very dense and only able to be penetrated with difficulty by a small sharp object;

b. has a low natural moisture content and a high degree of internal strength;
c. has no signs of water seepage; and
d. can be excavated only by mechanical equipment.

TYPE 2 SOIL

a. is very stiff, dense and can be penetrated with moderate difficulty by a small sharp object;
b. has a low to medium natural moisture content and a medium degree of internal strength; and
c. has a damp appearance after it is excavated.

TYPE 3 SOIL

a. is stiff to firm and compact to loose in consistency or is previously-excavated soil;
b. exhibits signs of surface cracking;
c. exhibits signs of water seepage;
d. if it is dry, may run easily into a well-defined conical pile; and
e. has a low degree of internal strength

TYPE 4 SOIL

a. is soft to very soft and very loose in consistency, very sensitive and upon disturbance is significantly reduced in natural strength;
b. runs easily or flows, unless it is completely supported before excavating procedures;
c. has almost no internal strength;
d. is wet or muddy; and
e. exerts substantial fluid pressure on its supporting system.

The earth fill and weathered/disturbed soil would be classified as Type 3 Soil while the native glacial till deposits would be classified as Types 2 Soil above and Type 3 Soil below prevailing ground water level under these regulations.

Where workmen must enter excavations advanced deeper than 1.2 m, the trench walls should be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. The regulation stipulates the steepest slopes of excavation by soil type 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 the Occupational Health and Safety Act and Regulations for Construction Projects, and include provisions for timbering, shoring and moveable trench boxes.

It should be noted that the glacial till deposit may contain larger particles (cobbles and boulders) that are not specifically identified in the Borehole Logs. The size and distribution of such obstructions cannot be predicted with borings, because the borehole sampler size is insufficient to secure representative samples

of the particles of this size. Provision should be made in excavation contracts to allocate risks associated with time spent and equipment utilized to remove or penetrate such obstructions when encountered.

All boreholes remained dry upon completion of the drilling. The ground water levels measured on October 5 and 13, 2020 in the monitoring wells (installed in Boreholes 1, 3 and 5) indicated that the water levels ranged from 1.0 to 5.7 m depth below grade.

The site is underlain by relatively low permeability glacial till deposits that should preclude significant amounts of free-flowing ground water seepage into the excavation in the short-term. Therefore, significant ground water seepage is not expected for the relatively shallow excavation, and active dewatering (by well points etc.) would not be required. However, perched ground water seepage may be encountered during the excavations primarily emanating from the fill materials and silt/sand lenses typically found in the glacial till deposit due to its mode of deposition. The perched ground water seepage should diminish slowly and can be controlled by continuous pumping from a conventional sump and pump arrangement at the base of the excavation. For excavations extending to depths greater than 0.3 m below the prevailing water table, it will be necessary to lower the ground water level below the excavation base, prior to, and maintain during the subsurface construction.

5.7.1 Regulatory Requirements

The volume of water entering the excavation will be based on both ground water infiltration and precipitation events. Based on recent regulation changes within O.Reg. 63/16, the following dewatering limits and requirements are as follows:

- Construction Dewatering less than 50,000 L/day: The takings of both ground water and storm water **does not require** a Construction Dewatering Assessment Report (CDAR) and **does not require** a Permit to Take Water (PTTW) from the Ministry of the Environment and Climate Change (MOECC).
- Construction Dewatering greater than 50,000 L/day and less than 400,000 L/day: The taking of ground water and/or storm water **requires** a Construction Dewatering Assessment Report (CDAR) and **does not** require a Permit to Take Water (PTTW) from the Ministry of the Environment and Climate Change (MOECC).
- Construction Dewatering greater than 400,000 L/day: The taking of ground water and/or storm water **requires** a Construction Dewatering Assessment Report (CDAR) and **requires** a Permit to Take Water (PTTW) from the Ministry of the Environment and Climate Change (MOECC).

If it is expected that greater than 50,000 L/day of water will be pumped, a CDAR and/or a PTTW should be obtained as soon as possible in advance of construction to avoid possible delays. Depending on the construction methodology for the site servicing (trench boxes or open cut, and length of trench) and the time of year (high versus low ground water levels), there is the possibility that water taking of greater than 50,000 L/day may occur at this site.

A CDAR takes up to 1 month to complete if monitoring wells are already installed on site. Once the CDAR is completed, it is uploaded to the Environmental Activity and Sector Registry (EASR), which registers the construction dewatering with the MOECC without the need for a permit. If the results of the CDAR indicate that greater than 400,000 L/day will be pumped, a PTTW application must be submitted to the MOECC. A PTTW application can take up to an additional 3 months for the MOECC to process upon completion of the CDAR. Note that Environmental Compliance Assessments, Impact Study Reports and applicable municipal, provincial and conservation authority approvals (completed by others) will be required as part of the CDAR.

5.8 Backfill

The native soils are considered suitable for backfill provided the moisture content of these soils is within 3% of the Optimum Moisture Content (OMC). It should be noted that there may be wet zones within the subsurface soils (particularly soils excavated from below the prevailing water level) which could be too wet to compact. Any soil material with 3% or higher in-situ moisture content than its OMC, could be put aside to dry or be tilled to reduce the moisture content so that it can be effectively compacted. Alternatively, materials of higher moisture content could be wasted and replaced with imported material which can be readily compacted.

In settlement sensitive areas, the backfill should consist of clean earth and should be placed in lifts of 150 mm thickness or less, and heavily compacted to a minimum of 95% SPMDD at a water content close to optimum (within 2%). The upper 1.2 m of the pavement subgrade must be compacted to a minimum of 98% SPMDD.

It should be noted that the soils encountered on the site are generally not free draining, and will be difficult to handle and compact should they become wetter as a result of inclement weather or seepage. Hence, it can be expected that the earthworks will be difficult and may incur additional costs if carried out during wet periods (i.e. spring and fall) of the year.

5.9 Quality Control

Excavations on this site must be shored to preserve the integrity of the surrounding properties and structures. The Ontario Building Code 2012 stipulates that engineering review of the subsurface conditions is required on a continuous basis during the installation of earth retaining structures. Terraprobe should be retained to provide this review, which is an integral part of the geotechnical design function as it relates to the shoring design considerations. Terraprobe can provide detailed shoring design services for the project, if requested. All foundations must be monitored by the geotechnical engineer on a continuous basis as they are constructed. The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code 2012. If Terraprobe is not retained to carry out foundation evaluations during construction, then Terraprobe accepts no responsibility for the performance or non-

performance of the foundations, even if they are ostensibly constructed in accordance with the conceptual design advice provided in this report.

Concrete for this structure will be specified in accordance with the requirements of CAN3 - CSA A23.1. Terraprobe maintains a CSA certified concrete laboratory and can provide concrete sampling and testing services for the project as necessary.

The requirements for fill placement on this project should be stipulated relative to SPMDD, as determined by ASTM D698. In-situ determinations of density during fill placement by Procedure Method B of ASTM D2922 are recommended to demonstrate that the contractor is achieving the specified soil density. Terraprobe is a CNSC licensed operator of appropriate nuclear density gauges for this work and can provide sampling and testing services for the project as necessary.

Terraprobe can provide thorough in house resources, quality control services for Building Envelope, Roofing and Structural Steel in accordance with CSA W178, as necessary, for the Structural and Architectural quality control requirements of the project. Terraprobe is certified by the Canadian Welding Bureau under W178.1-1996.

6 LIMITATIONS AND RISK

6.1 Procedures

This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Terraprobe and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained by Terraprobe.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with the most stringent level of care may fail to detect certain conditions. Terraprobe has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations. The conditions that Terraprobe has interpreted to exist between sampling points can differ from those that actually exist.

It may not be possible to drill a sufficient number of boreholes or sample and report them in a way that would provide all the subsurface information that could affect construction costs, techniques, equipment and scheduling. Contractors bidding on or undertaking work on the project should be directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their own investigations and their own interpretations of the factual investigation results, cognizant of the risks implicit in the subsurface investigation activities so that they may draw their own conclusions as to how the subsurface conditions may affect them.

6.2 Changes in Site and Scope

It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions. Groundwater levels are particularly susceptible to seasonal fluctuations.

The discussion and recommendations are based on the factual data obtained from this investigation made at the site by Terraprobe and are intended for use by the owner and its retained designers in the design phase of the project. If there are changes to the project scope and development features, the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant or complete for the revised project. Terraprobe should be retained to review the implications of such changes with respect to the contents of this report.

This report was prepared for the express use of SMVS Canada and their retained design consultants and is not for use by others. This report is copyright of Terraprobe Inc. and no part of this report may be reproduced by any means, in any form, without the prior written permission of Terraprobe Inc. and SMVS Canada who are the authorized users.

It is recognized that the regulatory agencies in their capacities as the planning and building authorities under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both expressed and implied.

We trust the foregoing information is sufficient for your present requirements. If you have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Yours truly,

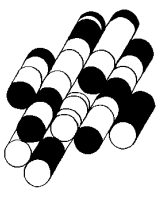
Terraprobe Inc.

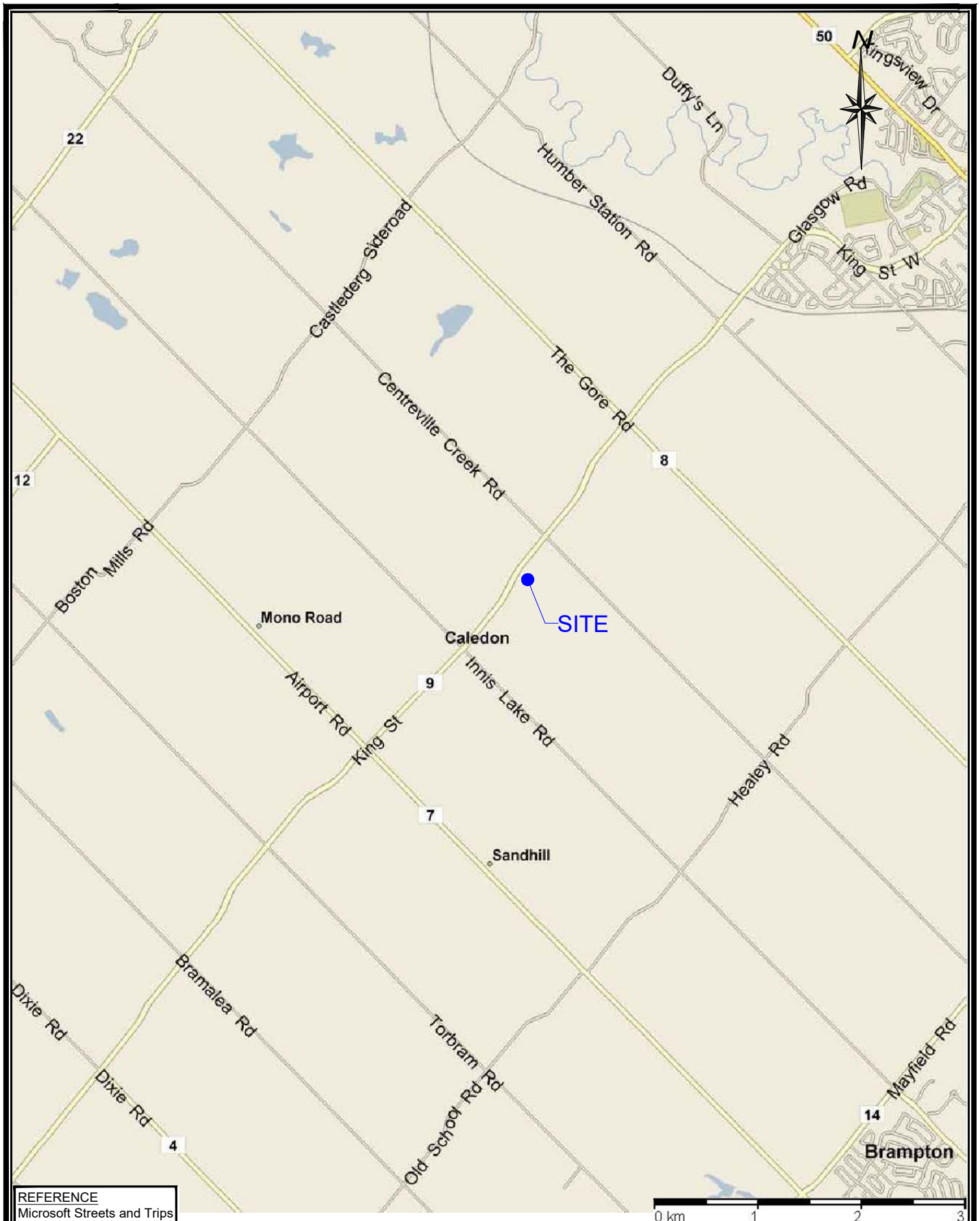
Connor McCormick, B.A.Sc
EIT

Seth Zhang, P. Eng., M.Eng., M.Sc.
Associate

FIGURES

TERRAPROBE INC.





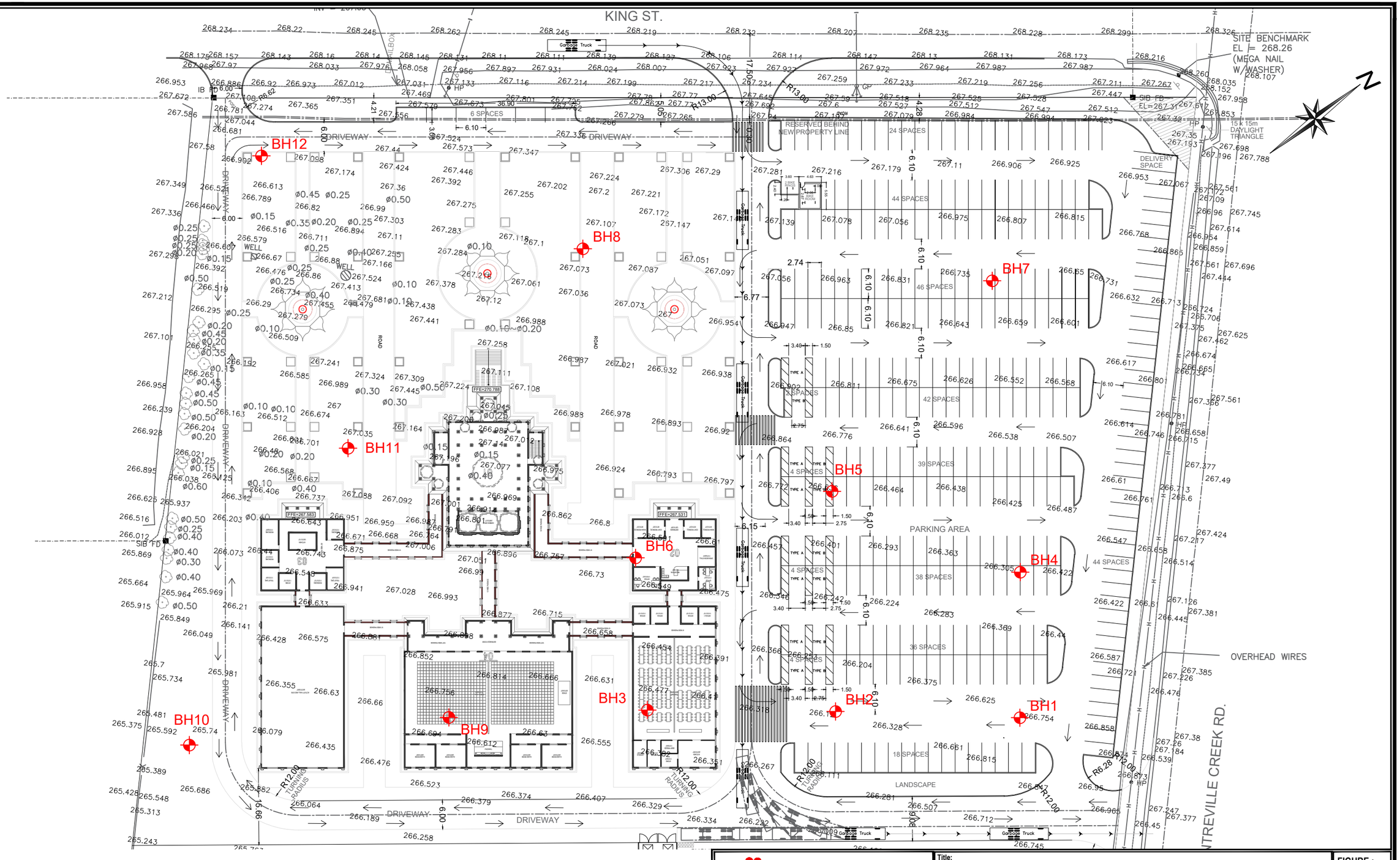
Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Title:

SITE LOCATION PLAN

File. No.: 1-20-0222-01

FIGURE : 1



REFERENCE
Drawing: 6939 KING STREET CALEDON SITE PLAN(REVISED)11 (1) received via email November 5, 2020.

LEGEND
Approximate Borehole Location

0 10 20 30 Metres
SCALE

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Title: **BOREHOLE LOCATION PLAN**

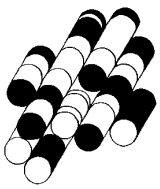
File No. 1-20-0222-01

FIGURE : 2

Z:\1-Project Files\2020\1-20-0222 - 6939 King Street, Caledon\01-Geotechnical Investigation\A. Dwgs. Logs\AutoCAD\6939 KING STREET CALEDON SITE PLAN(REVISED)11 (1) 2020 11 10.dwg, Sandy

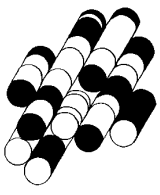
APPENDICES

TERRAPROBE INC.



APPENDIX A

TERRAPROBE INC.



Terraprobe

ABBREVIATIONS AND TERMINOLOGY

SAMPLING METHODS

AS	auger sample
CORE	cored sample
DP	direct push
FV	field vane
GS	grab sample
SS	split spoon
ST	shelby tube
WS	wash sample

PENETRATION RESISTANCE

Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

Dynamic Cone Test (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.)."

COHESIONLESS SOILS

Compactness	'N' value
very loose	< 4
loose	4 – 10
compact	10 – 30
dense	30 – 50
very dense	> 50

COHESIVE SOILS

Consistency	'N' value	Undrained Shear Strength (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 (e.g)	% by weight
trace silt	< 10
some silt	10 – 20
silty	20 – 35
sand *and* silt	> 35

TESTS AND SYMBOLS

MH	mechanical sieve and hydrometer analysis
w, w_c	water content
w_L, LL	liquid limit
w_P, PL	plastic limit
I_P, PI	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
G_s	specific gravity
φ'	internal friction angle
c'	effective cohesion
c_u	undrained shear strength

▽	Unstabilized water level
▼	1st water level measurement
▼	2nd water level measurement
▼	Most recent water level measurement
3.0 +	Undrained shear strength from field vane (with sensitivity)
C_c	compression index
c_v	coefficient of consolidation
m_v	coefficient of compressibility
e	void ratio

FIELD MOISTURE DESCRIPTIONS

Damp	refers to a soil sample that does not exhibit any observable pore water from field/hand inspection.
Moist	refers to a soil sample that exhibits evidence of existing pore water (e.g. sample feels cool, cohesive soil is at plastic limit) but does not have visible pore water
Wet	refers to a soil sample that has visible pore water

LOG OF BOREHOLE 1

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : Saif
Date started : July 14, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597212, N: 4855726 (UTM 17T) Elevation Datum : Geodetic

Rig type : Deidric 60, track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	266.8	**GROUND SURFACE**				
		FILL, clayey silt, trace sand, trace gravel, trace wood chips, very stiff, brown, moist		1	SS	17
1				2	SS	21
	265.6					
	1.2	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, stiff to very stiff, brown, moist (GLACIAL TILL)		3	SS	17
2				4	SS	23
3				5	SS	23
4		...grey below		6	SS	14
5						
6				7	SS	21
7		...rock fragments		8	SS	24
8	258.7					
	8.1	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Elevation Scale (m): 266, 265, 264, 263, 262, 261, 260, 259

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

2 14 48 36

Borehole was dry and caved to 5.8 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2020	1.0	265.9
Oct 13, 2020	5.7	261.1

file: 1-20-0222-01 bh logs.gpj

LOG OF BOREHOLE 2

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597188, N: 4855697 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	266.2 **GROUND SURFACE**					
	265.9 / 0.3	300mm **TOPSOIL**		1	SS	10
		(WEATHERED/DISTURBED)				
	265.4 / 0.8	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	40
1				3	SS	28
2				4	SS	51
3				5	SS	31
4		...grey below		6	SS	30
5						
6				7	SS	30
	259.6 / 6.6	**END OF BOREHOLE**				

Elevation Scale (m): 266, 265, 264, 263, 262, 261, 260

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) — Natural Water Content (MC) — Liquid Limit (LL); 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and caved to 5.5 m below ground surface upon completion of drilling.

file: 1-20-0222-01 bh logs.gpj

LOG OF BOREHOLE 3

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597164, N: 4855667 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	266.3	**GROUND SURFACE**					
0	266.0	300mm **TOPSOIL**					266
	0.3	**FILL**, clayey silt, trace sand, trace gravel, trace organics, stiff, brown, moist		1	SS	13	
	265.5						
1	0.8	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	42	265
				3	SS	32	
2							264
				4	SS	46	
3				5	SS	38	263
4		...at 4.6 m, grey below					262
				6	SS	31	
5							261
6				7	SS	25	260
7							259
8	258.2			8	SS	34	
	8.1	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

1 16 43 40

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2020	3.1	263.2
Oct 13, 2020	3.7	262.6

file: 1-20-0222-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 4

Project No. : 1-20-0222-01 | Client : Swaminarayan Mandir Vasna Sansthan Canada | Originated by : SM

Date started : September 21, 2020 | Project : 6939 King Street | Compiled by : CM

Sheet No. : 1 of 1 | Location : Caledon, Ontario | Checked by : SZ

Position : E: 597189, N: 4855745 (UTM 17T) | Elevation Datum : Geodetic

Rig type : Track-mounted | Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	266.3	**GROUND SURFACE**				
	266.0	250mm **TOPSOIL**				
	0.3	**FILL**, clayey silt, trace to some sand, trace organics, stiff, brown, moist		1	SS	9
	265.5					
	0.8	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	24
1				3	SS	30
2				4	SS	57
3				5	SS	52
4		...grey below		6	SS	34
5				7	SS	33
6	259.7					
	6.6	**END OF BOREHOLE**				

Elevation Scale (m): 266, 265, 264, 263, 262, 261, 260

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-20-0222-01 bh logs.gpj

LOG OF BOREHOLE 5

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597152, N: 4855725 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
266.4	**GROUND SURFACE**				
266.1 / 0.3	300mm **TOPSOIL**				
265.8 / 0.6	(WEATHERED/DISTURBED)		1	SS	11
	SILT AND CLAY to CLAYEY SILT, trace to some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	32
			3	SS	40
			4	SS	30
			5	SS	34
	...grey below		6	SS	26
			7	SS	33
			8	SS	32
258.3 / 8.1	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m): Dynamic Cone; Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane

Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL)

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL — 0 13 40 47

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 5, 2020	2.3	264.1
Oct 13, 2020	3.7	262.7

file: 1-20-0222-01 bh logs.gpj

LOG OF BOREHOLE 6

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597138, N: 4855685 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	266.5	**GROUND SURFACE**					
0	266.3	200mm **TOPSOIL**					
	0.2	**FILL**, clayey silt, trace sand, trace gravel, trace organics, stiff, brown, moist		1	SS	14	266
	265.7						
	0.8	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	36	
1							265
				3	SS	37	
2							
				4	SS	36	264
3							
				5	SS	42	263
4		...grey below					
				6	SS	26	262
5							
							261
6				7	SS	33	
	259.9						260
	6.6	**END OF BOREHOLE**					

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

spoon wet

Borehole was dry and caved to 5.8 m below ground surface upon completion of drilling.

file: 1-20-0222-01 bh logs.gpj

LOG OF BOREHOLE 7

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597139, N: 4855778 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
0	**266.6**	**GROUND SURFACE**										
	266.3	300mm **TOPSOIL**										
	0.3	(WEATHERED/DISTURBED)		1	SS	12						
	266.0						266					
	0.6	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	33						
1												
				3	SS	33	265					
	264.6											
	2.0	**END OF BOREHOLE**										

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL MC LL — 10 20 30

Unstabilized Water Level

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE 8

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597081, N: 4855716 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments
0	**267.0**	**GROUND SURFACE**					267	Dynamic Cone 10 20 30 40; Unconfined / Pocket Penetrometer / Field Vane / Lab Vane 40 80 120 160	Plastic Limit / Natural Water Content / Liquid Limit PL MC LL 10 20 30				GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
	266.7	300mm **TOPSOIL**											
	0.3	(WEATHERED/DISTURBED)		1	SS	14							
	266.4												
	0.6	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	38	266						4 11 42 43
				3	SS	28							
	265.0												
	2.0	**END OF BOREHOLE**											

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE 9

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597140, N: 4855634 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments
0	**266.6**	**GROUND SURFACE**											
	266.3	300mm **TOPSOIL**											
	0.3	**FILL**, clayey silt, trace sand, trace gravel, trace organics, stiff, brown, moist		1	SS	11							
	265.8						266						
1	0.8	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	42							
		...rock fragments		3	SS	33	265						
	264.6												
	2.0	**END OF BOREHOLE**											

Penetration Test Values (Blows / 0.3m): Dynamic Cone — 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit — PL, MC, LL — 10 20 30

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-20-0222-01 bh logs.gpj

LOG OF BOREHOLE 10

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : SM
Date started : September 21, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597111, N: 4855589 (UTM 17T) Elevation Datum : Geodetic

Rig type : Track-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments
0	**265.8**	**GROUND SURFACE**						Dynamic Cone 10 20 30 40; Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160	Plastic Limit, Natural Water Content, Liquid Limit PL MC LL 10 20 30				GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
	265.5	250mm **TOPSOIL**											
	0.3	**FILL**, clayey silt, trace sand, trace gravel, stiff, brown, moist		1	SS	11							
	265.0												
1	0.8	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, hard, brown, moist (GLACIAL TILL)		2	SS	32	265						
				3	SS	32	264						
	263.8												
	2.0	**END OF BOREHOLE**											

Borehole was dry and open upon completion of drilling.

file: 1-20-0222-01 bh logs.gpj

LOG OF BOREHOLE 11

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : Saif
Date started : July 14, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597083, N: 4855653 (UTM 17T) Elevation Datum : Geodetic

Rig type : Deidric 60, track-mounted Drilling Method : Continuous sampling

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments
0	**267.1**	**GROUND SURFACE**					267	Dynamic Cone 10 20 30 40; Unconfined / Pocket Penetrometer / Field Vane / Lab Vane 40 80 120 160	Plastic Limit / Natural Water Content / Liquid Limit PL MC LL 10 20 30				
	266.5	**FILL**, clayey silt, sandy, trace gravel, firm, brown, moist		1	SS	7							
1	0.6	**SILT AND CLAY to CLAYEY SILT**, trace to some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		2	SS	24	266						GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL: 6 13 41 40
				3	SS	35							
	265.3												
	1.8	**END OF BOREHOLE**											

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE 12

Terraprobe

Project No. : 1-20-0222-01	Client : Swaminarayan Mandir Vasna Sansthan Canada	Originated by : Saif
Date started : July 14, 2020	Project : 6939 King Street	Compiled by : CM
Sheet No. : 1 of 1	Location : Caledon, Ontario	Checked by : SZ

Position : E: 597025, N: 4855676 (UTM 17T) Elevation Datum : Geodetic

Rig type : Deidric 60, track-mounted Drilling Method : Continuous sampling

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	267.1	**GROUND SURFACE**				
		FILL, clayey silt, trace sand, trace gravel, trace organics, trace top soil inclusions, stiff, brown, moist		1	SS	11
1				2	SS	10
	265.9 1.2	**SILT AND CLAY**, trace sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		3	SS	18
	265.3 1.8	**END OF BOREHOLE**				

Borehole was dry and open upon completion of drilling.

Elevation Scale (m): 267, 266

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

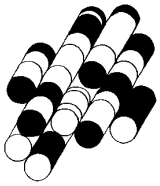
Lab Data and Comments

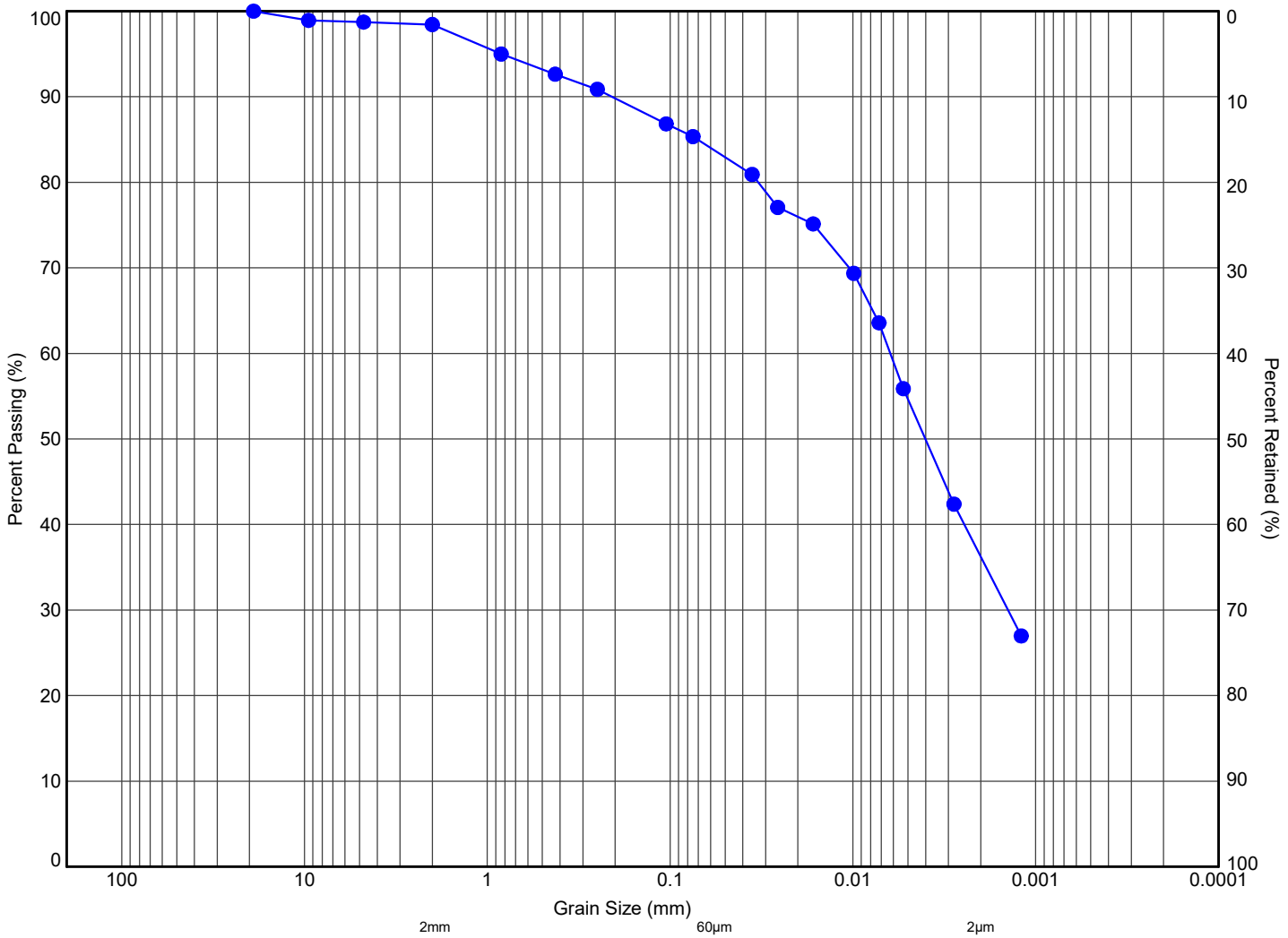
GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

file: 1-20-0222-01 bh logs.gpj

APPENDIX B

TERRAPROBE INC.





MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

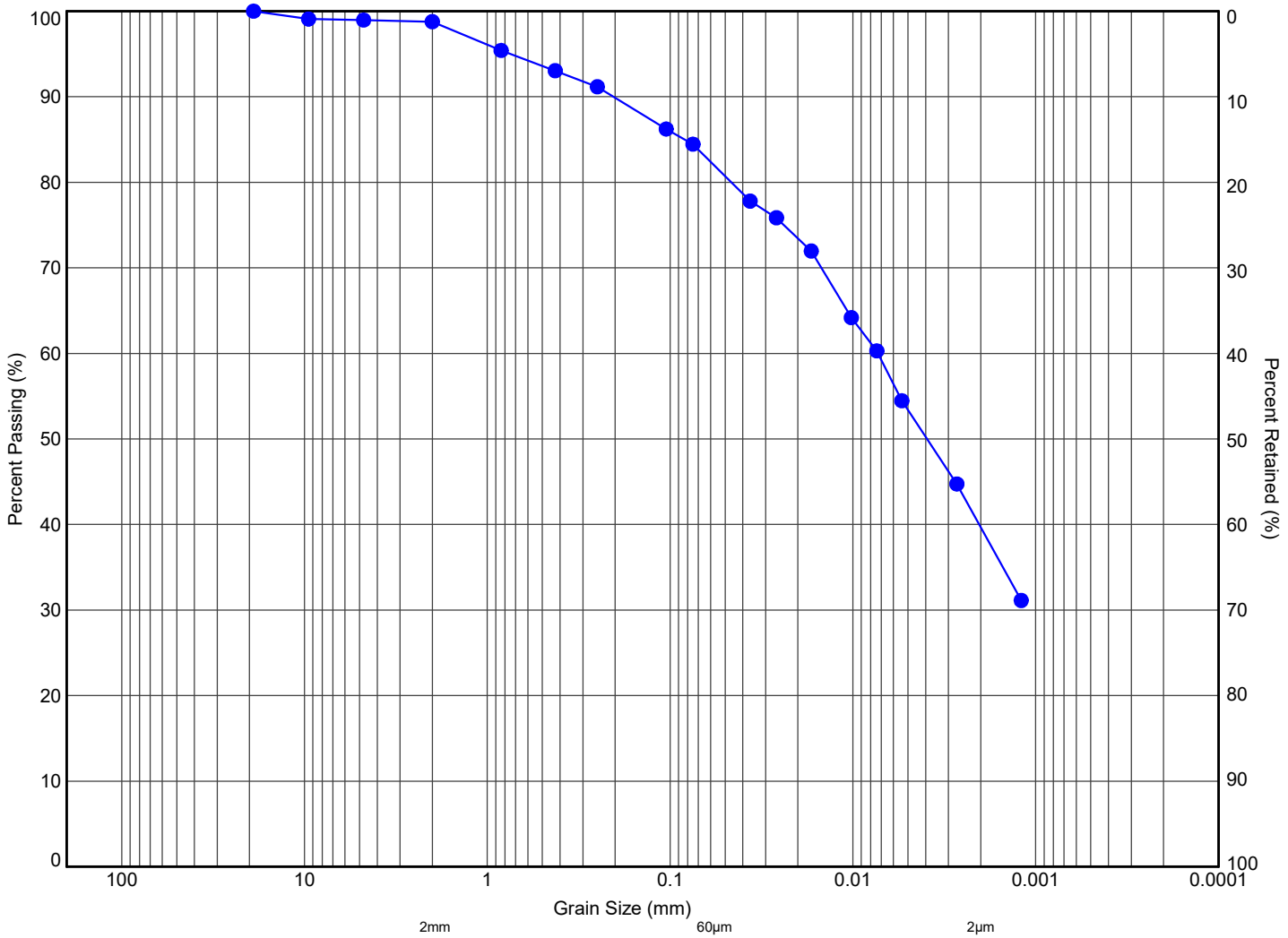
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**1**	SS3	1.8	265.0	2	14	48	36	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SILT AND CLAY, SOME SAND, TRACE GRAVEL

File No.: **1-20-0222-01**



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

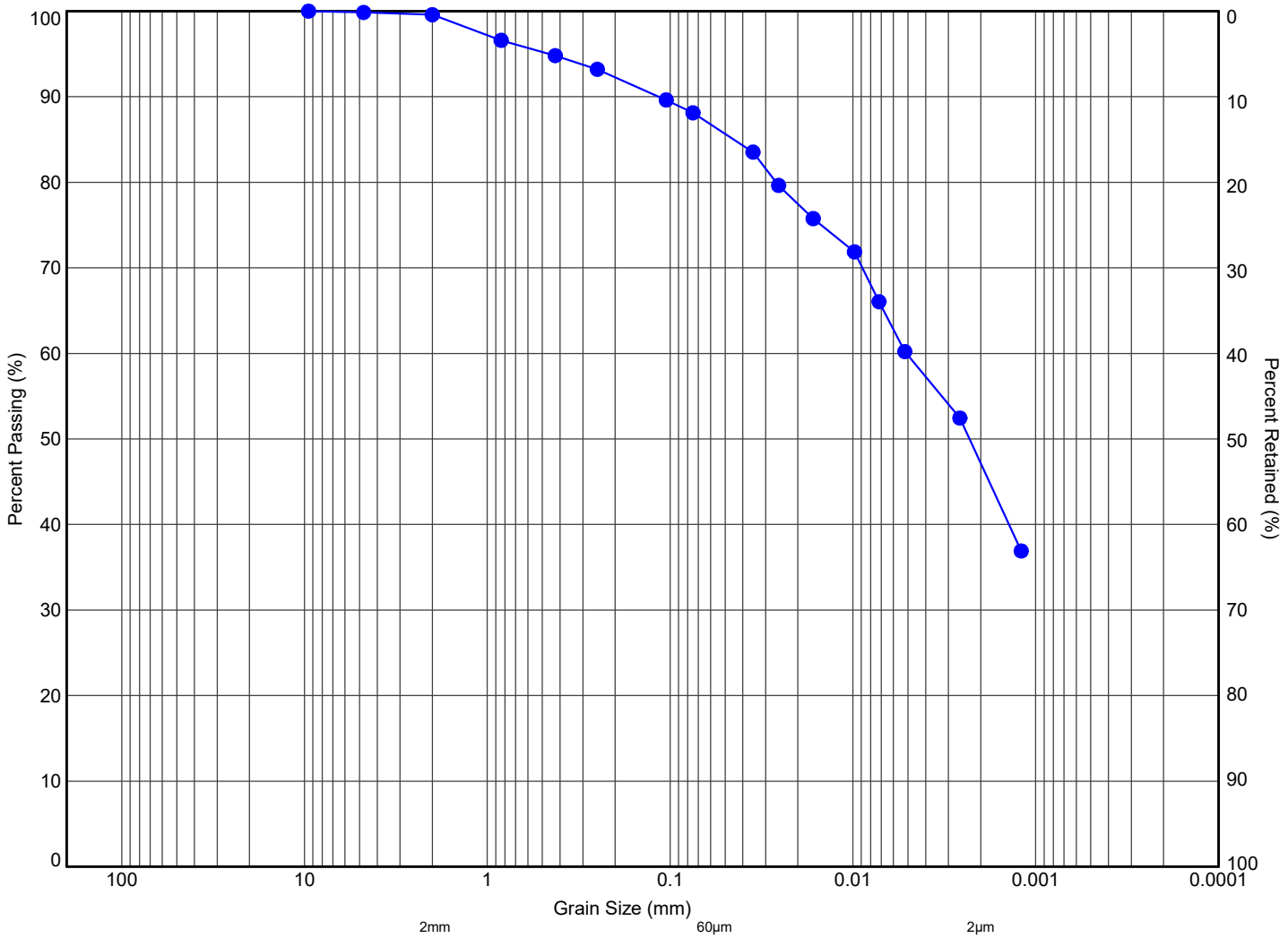
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**3**	SS4	2.5	263.8	1	16	43	40	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SILT AND CLAY, SOME SAND, TRACE GRAVEL

File No.: **1-20-0222-01**



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

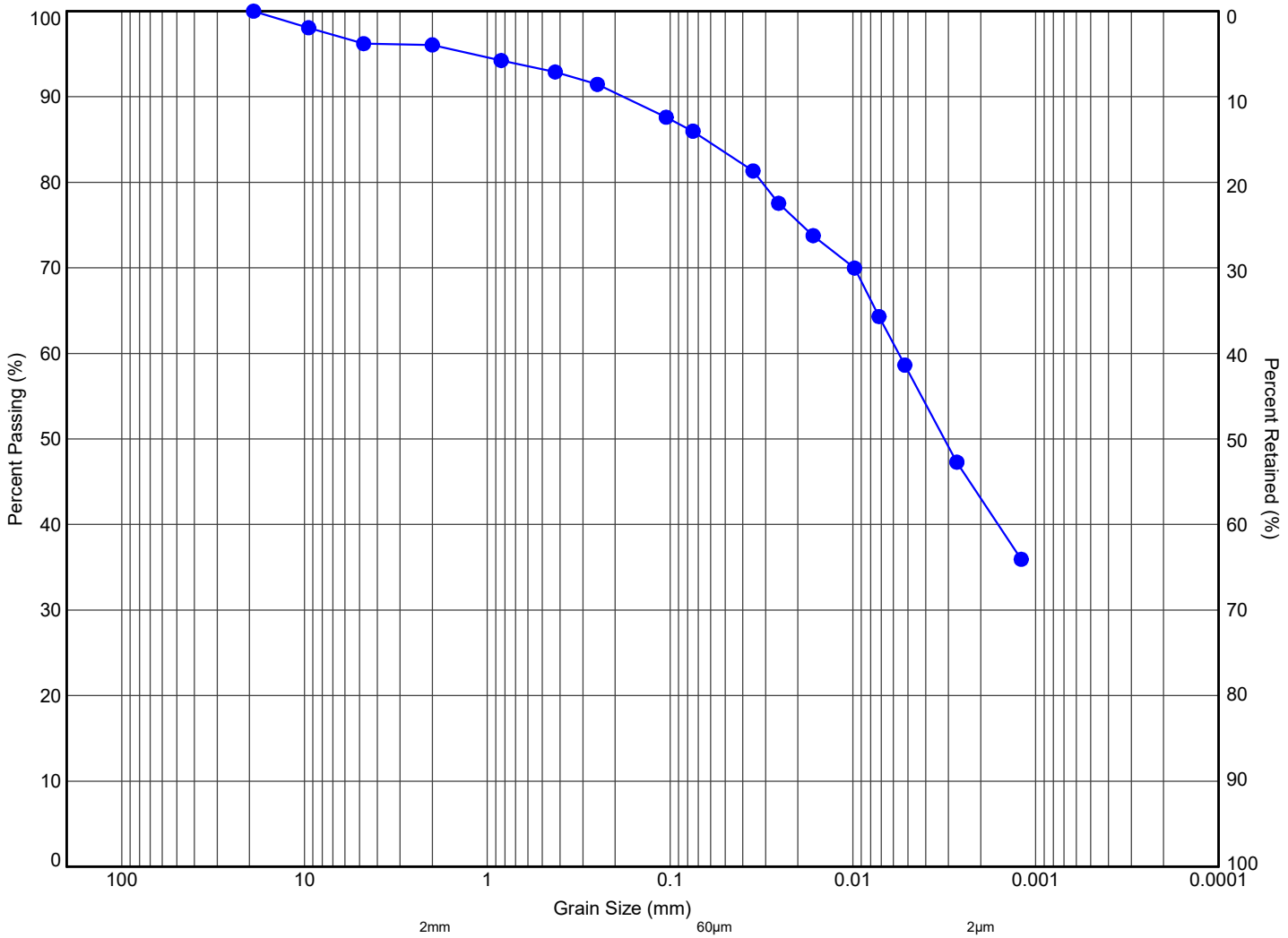
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**5**	SS3	1.8	264.6	0	13	40	47	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
CLAY AND SILT, SOME SAND

File No.: **1-20-0222-01**



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

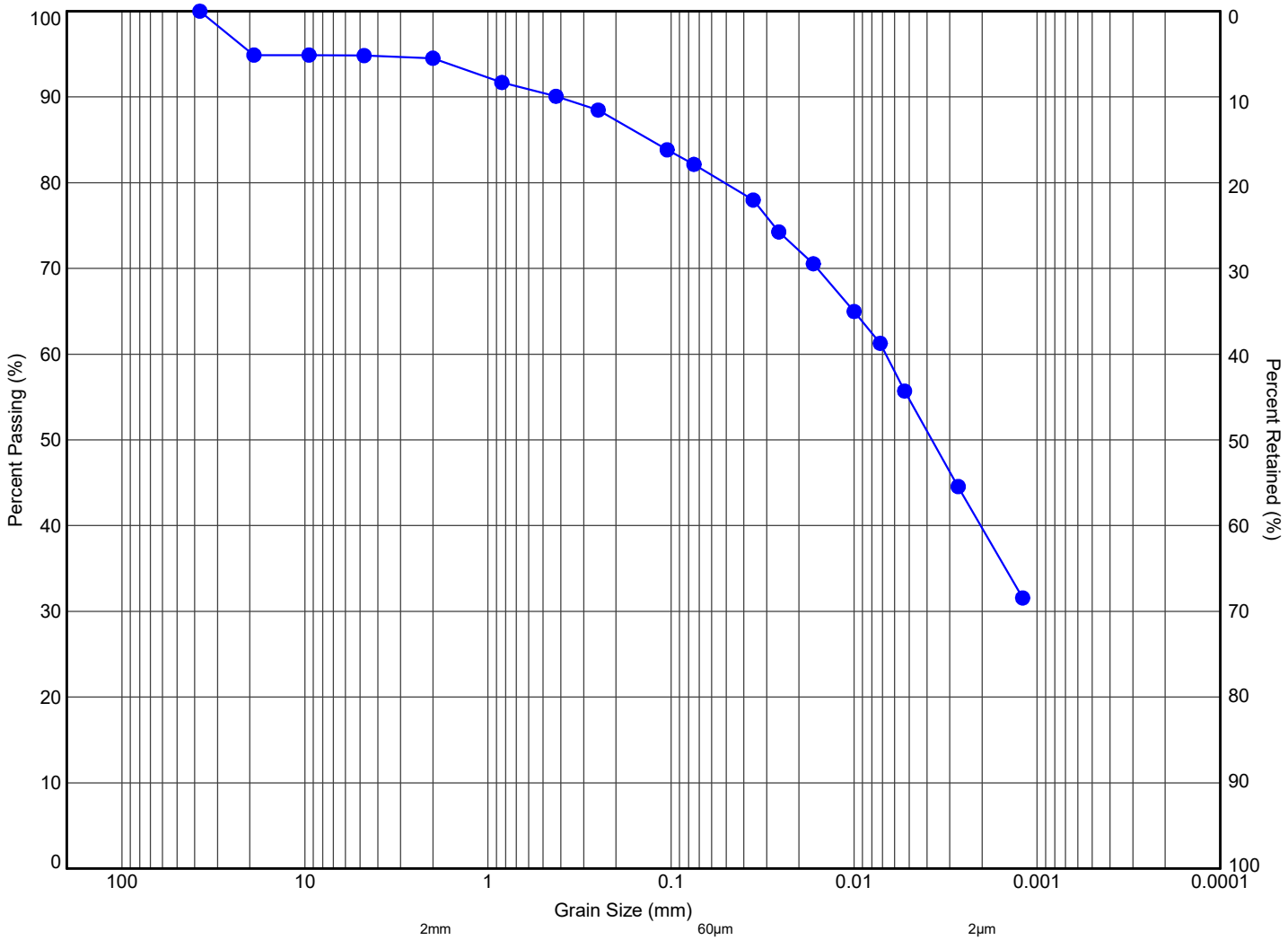
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**8**	SS2	1.0	266.0	4	11	42	43	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
CLAY AND SILT, SOME SAND, TRACE GRAVEL

File No.: **1-20-0222-01**



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**11**	SS2	0.9	266.2	6	13	41	40	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SILT AND CLAY, SOME SAND, TRACE GRAVEL

File No.: **1-20-0222-01**