Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

GEOTECHNICAL INVESTIGATION
RESIDENTIAL DEVELOPMENT
1196-1210 YONGE STREET AND 2-8 BIRCH AVENUE
TORONTO, ONTARIO

Prepared for: Birch Equities Limited
1133 Yonge Street, Suite 601
Toronto, ON
M4T 2Y7

Attention: Mr. Paul Dydula, Director of Development

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Terraprobe Inc.

Greater Toronto
11 Indell Lane
Brampton, Ontario L6T 3Y3
(905) 796-2650 Fax: 796-2250
brampton@terraprobe.ca

Hamilton – Niagara
903 Barton Street, Unit 22
Stoney Creek, Ontario L8E 5P5
(905) 643-7560 Fax: 643-7559
stoneycreek@terraprobe.ca

Central Ontario
220 Bayview Drive, Unit 25
Barrie, Ontario L4N 4Y8
(705) 739-8355 Fax: 739-8369
barrie@terraprobe.ca

Northern Ontario
1012 Kelly Lake Rd., Unit 1
Sudbury, Ontario P3E 5P4
(705) 670-0460 Fax: 670-0558
sudbury@terraprobe.ca

www.terraprobe.ca

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1 INTRODUCTION

Terraprobe Inc. (Terraprobe) was retained by Birch Equities Limited to conduct a geotechnical investigation for a proposed high-rise residential development at 1196-1210 Yonge Street and 2-8 Birch Avenue, in the City of Toronto, Ontario. The general location of the site is presented on Figure 1.

This report encompasses the results of the geotechnical investigation conducted for the proposed development site to determine the prevailing subsurface soil and groundwater conditions, and on this basis, provides geotechnical engineering design advice and recommendations for the design of building foundations, floor slab, earthquake and earth pressure design parameters, basement drainage, shoring and pavement design. In addition, comments are also included on pertinent construction aspects including excavation, backfill and ground water control.

Terraprobe has also conducted Hydrogeological and Phase 1 & 2 Enviromental Site Assessment studies for this property. The findings of the studies are reported under separate covers.

2 SITE AND PROJECT DESCRIPTION

The subject site is located in the northwest quadrant of the intersection of Yonge Street and Birch Avenue with municipal addresses of 1196-1210 Yonge Street and 2-8 Birch Avenue, Toronto, Ontario. The Property is located in a mixed-use area bounded by commercial properties to the north and the west, Yonge Street to the east, and Birch Street to the south. The site topography is relatively flat and gently slopes down from north to south with a total elevation change (relief) of about 1 m.

It is proposed that the existing structures would be demolished to facilitate redevelopment of the site to include a 15-storey tower element resting on a 3-level underground parking structure. The design drawings prepared by KPMB Architects (*1196-1210 Yonge St*, dated January 29, 2021) indicate that the ground floor elevation will be set at Elev. 122.66 m and the finished floor elevation (FFE) for the third underground parking structure (P3) will be set at 9.34 m depth below grade, implying that the P3 FFE is set at Elev. 113.32 m.

3 INVESTIGATION PROCEDURE

The field investigation was conducted during the period of October 23 to 28, 2019 and January 6 and 28, 2020 and consisted of drilling and sampling a total of six (6) boreholes within the proposed building footprint, extending to 11 to 23.0 m depth below grade. The approximate locations of the boreholes are shown on the enclosed Borehole Location Plan (Figure 2).

Boreholes 1 to 6 were drilled by specialist drilling contractors using continuous flight hollow/solid stem augers and mud rotary method, and were sampled at 0.75 m (up to 3.0 m depth) and 1.5 m (below 3.0 m depth) intervals with a conventional 50 mm diameter split barrel sampler 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 test on selected native soil samples. 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 tests are also summarized in Section 4.5 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 each borehole to facilitate ground water monitoring and for the purpose of the Hydrogeological Study. 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 December 10, 2019 and February 7 and 20, 2020. The results of ground water monitoring are presented in Section 4.6 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. Borehole elevations are provided relative to Geodetic Datum (NAD). The horizontal coordinates are reported relative to the Universal Transverse Mercator geographic coordinate system (UTM Zone 17T).

It should be noted that the elevations provided on the Borehole Log are approximate, 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 in 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 Surficial Layers

An asphalt pavement structure, consisting of 50 mm thick asphaltic concrete underlain by 200 mm thick granular base course was encountered in Boreholes 1 and 3 at the ground surface.

A 60 mm concrete paver underlain by 130 mm thick granular base course was encountered in Borehole 2 at the ground surface.

A 600 mm thick gravel surface course was encountered in Borehole 4 at the ground surface.

The above gravel and pavement structure thicknesses were measured from the borehole drilling and are approximate. We recommend that a shallow test pit investigation be carried out to determine a precise pavement structure thickness present across the site for quantity estimation and costing purposes.

4.2 Earth Fill

Earth fill materials, consisting of clayey to sandy silt/ silty sand/ sand and gravel/silt, with trace amounts of organics were encountered beneath the surficial layer or at the ground surface in each borehole and extended to about 0.8 to 2.3 m depth below grade.

Standard Penetration Test results (N-values) obtained from the cohesionless earth fill zone ranged from 6 to 48 blows per 300 mm of penetration to 50 blows per 125 mm of penetration, indicating a loose to very dense relative density.

Standard Penetration Test results (N-values) obtained from the cohesive earth fill zone ranged from 2 to 5 blows per 300 mm of penetration, indicating a very soft to firm consistency.

The in-situ moisture contents of the earth fill samples ranged from 3 to 19 percent by mass, indicating a moist condition.

4.3 Silty Sand Till

Silty sand till deposits with varying amounts of clay (trace to some) and trace amounts of gravel were encountered beneath the earth fill zone in Boreholes 1, 3, 4 and 6 and beneath the silty sand layer in Borehole 2 and extended to 4.6 and 6.1 m depth below grade.

N-values obtained from the undisturbed silty sand till deposits ranged from 24 to 89 blows per 300 mm of penetration to 50 blows per 25 and 150 mm of penetration, indicating a compact to very dense (typically very dense) relative density.

The in-situ moisture contents of the glacial till soil samples ranged from 5 to 18 percent by mass, indicating a moist condition.

4.4 Sand and Silt to Silty Sand

Sand and silt to silty sand deposit with trace amounts of clay and gravel were encountered beneath the silty sand till deposit in Boreholes 1, 2, 3, 4 and 6 and beneath the earth fill zone in Borehole 5 and extended to the full depth of investigation.

A sandy silt layer with some clay and trace amounts of gravel was encountered beneath the earth fill zone in Borehole 2.

N-values obtained from the sand and silt to silty sand deposit ranged from 14 to 86 blows per 300 mm of penetration to 50 blows per 75 and 150 mm of penetration, indicating a compact to very dense (typically very dense) relative density.

The in-situ moisture contents of the native sand and silt to silty sand samples ranged from 5 to 32 percent by mass, indicating a moist to wet condition.

4.5 Geotechnical Laboratory Test Results

The geotechnical laboratory testing consisted of natural water content determination for all samples, while a 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 are 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 9	9.3	0	59	38	3	SAND AND SILT trace clay
Borehole 2, Sample 10	10.8	2	68	28	2	SILTY SAND trace gravel, trace clay
Borehole 3, Sample 5	3.3	11	55	27	7	SILTY SAND some gravel, trace clay
Borehole 4, Sample 7	4.9	7	66	23	4	SILTY SAND trace gravel, trace clay

Borehole No. Sample No.	Sampling Depth below Grade (m)	Percentage (by mass)				Descriptions (MIT System)
		Gravel	Sand	Silt	Clay	
Borehole 6, Sample 10	10.9	2	67	28	3	SILTY SAND trace gravel, trace clay

4.6 Ground Water

Observations pertaining to the depth of water level and caving were not made in boreholes upon completion of drilling as all of boreholes contained drill water/mud. Therefore, the caving and ground water measurements were not available. Monitoring wells were installed in each borehole to facilitate ground water level monitoring and for the purpose of the hydrogeological study. The ground water level measurements in the monitoring wells were taken on December 10, 2019 and February 7 and 20, and March 4, 2020 and are noted on the enclosed Borehole Logs. A summary of these observations is provided as follows:

Borehole No.	Depth of Borehole (m)	Upon Completion of Drilling		Water Level in Well, Depth/Elev. (m)		
		Depth to Cave (m)	Unstabilized Water Level (m)	Highest Level (m)	Date	Level Range (m)
BH 1	10.9	NA	NA	5.0/118.7	Mar 4, 2020	5.0 118.6 to 118.7
BH 2	13.8	NA	NA	5.8/118.4	Feb 20, 2020	5.8 to 5.9 118.3 to 118.4
BH 3	14	NA	NA	5.4/118.9	Mar 4, 2020	5.4 to 5.7 118.6 to 118.9
BH 4S	7.6	NA	NA	5.6/118.8	Mar 4, 2020	5.6 to 5.9 118.5 to 118.8
BH 4D	23	NA	NA	6.9/117.5	Feb 20, 2020	6.9 to 7.4 117.0 to 117.5
BH 5	14.2	NA	NA	6.2/118.4	Mar 4, 2020	6.2 to 6.4 118.2 to 118.4
BH 6	14.2	NA	NA	6.2/118.5	Feb 27, 2020	6.2 to 6.5 118.2 to 118.5

For practical purposes, the stabilized design ground water table at the site is at Elev. 119.0 ±m (3.5 ±m below grade at Birch Avenue.), generally in the native silt and sand to silty sand deposit. Therefore, any excavation below this level will require positive dewatering.

The earth fill and native silt and sand to silty sand deposit are sufficiently cohesionless to be considered high permeability materials, which will allow for the free flow of water. In general, the excavation to the proposed lowest basement level at Elev. 112.85 ±m will extend 6 ±m depth below the stabilized ground water table.

Construction dewatering at adjacent sites, existing building drains or dewatering systems, and seasonal fluctuations may cause significant changes to the depth of the ground water table over time. Additional information pertaining to ground water at the site is discussed in the hydrogeological report by Terraprobe under a separate cover (File No. 1-19-0603-46).

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.

5.1 Foundations

Boreholes encountered the earth fill zone beneath the surficial layer or at ground surface extending to 0.8 to 2.3 m depth below grade, generally underlain by the compact to very dense silty sand till, extending to 4.6 and 6.1 m depth below grade (Elev. 118.1 to 119.0 m), which was in turn underlain by the dense to very dense sand and silt to silty sand deposit extending to the full depth of the investigation.

The proposed development would include a 15-storey tower resting on a three-level underground parking structure. The design drawings prepared by KPMB Architects (*1196-1210 Yonge St*, dated January 29, 2021) indicate that the finished floor elevation (FFE) for the third underground parking structure (P3) will be set at 9.34 m depth below grade, implying the P3 FFE at Elev. 113.32 m.

Considering that underground parking excavation (P3 FFE at Elev. 113.32 m) would extend about 6 m below the stabilized ground water table and be made in the cohesionless silt and sand to silty sand deposit, Terraprobe recommends two types of foundation systems as follows,

- The structure could be designed using a conventional spread footing approach, supplemented by a continuous interlocking caisson shoring system consisting of deepened pile and filler toes (min. 8 ±m below the lowest bulk excavation, to reduce the flow of groundwater into the excavation for both short-term and permanent purposes) with waterproofed walls (designed to withstand lateral hydrostatic pressure), and a robust drainage system (designed to relieve uplift pressure); and
- Alternatively, a fully waterproofed structure with raft foundation system may be a more feasible option for this project site.

Active positive dewatering prior to any excavation and maintained throughout below-grade construction is a critical requirement for both of the options noted above. The native wet and cohesionless silt and sand to silty sand must be dewatered to a minimum of 1.2 m below the lowest excavation level prior to excavation and maintained at that level throughout construction. Impermeable shoring (i.e. a continuous interlocking caisson wall) must be used to support the entire perimeter of the excavation, and the caisson toes (piles and fillers) should be advanced deep enough (i.e. a minimum toe embedment of 8 ±m) to cut off the ground water table in wet sands and silts deposit, precluding horizontal ground water flow in the excavation. The depth of caisson wall toe embedment can be further refined based on vertical exit gradient consideration for the toe stability during the design detail stage.

If the site soils are not adequately dewatered to a minimum of 1.2 ±m below the lowest excavation elevation across the site prior to any excavation and maintained at that level throughout construction, the site soils will become disturbed, lose integrity to support foundations, and the recommendations for bearing capacity as well as shoring caisson wall toe bearing, will not be valid.

The foundation installations must be reviewed in the field by Terraprobe. The on-site review of the condition of the foundation subgrade as the foundations are constructed is an integral part of the geotechnical engineering design function, and is not to be considered as third-party inspection services. If Terraprobe is not retained to carry out all of the foundation evaluations during construction, then Terraprobe accepts no responsibility for the performance of the foundations.

5.1.1 Conventional Spread Footing

The undisturbed silt and sand to silty sand deposit of dense to very dense relative density is considered to be suitable to support the proposed building foundations. A net geotechnical reaction of 750 kPa (Serviceability Limit States, SLS) and factored geotechnical resistance of 1,000 kPa (at Ultimate Limit States, ULS) may be used for design of conventional spread footing foundations (for vertical and concentric loads) supported on the ‘dewatered’ silt and sand to silt sand deposit of very dense relative density.

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.

Active dewatering prior to any excavation and maintained throughout below-grade construction is required. If the subgrade soils are not adequately dewatered by a minimum of 1.2 ±m below the lowest excavation elevation across the site prior to any excavation and maintained at that level throughout the construction, the site soils will become disturbed, lose its integrity to support and the recommendations for bearing capacity, as well as shoring caisson wall toe bearing, will not be valid.

Footings stepped from one level to another must be at a slope not exceeding 7 vertical to 10 horizontal.

Experience suggests that the temperature in nominally unheated underground parking with two or more levels below grade and normal ventilation provisions is not as severe as the ambient open-air condition. Certainly, the earth cover required to prevent frost effects on foundations in the lower parking levels need not be any greater than 1.2 metres, and unmonitored experience in a number of structures and industry practice indicate that perimeter foundations provided with a minimum of 600 mm of soil cover perform adequately as do the interior isolated foundations with 900 mm of soil cover. Foundations located immediately adjacent to air shafts, entrance and exit doors shall be treated as exterior foundations and should be provided with a minimum of 1.2 m of soil cover or equivalent insulation to ensure that foundations are not affected by the cold air flow.

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. Provisions should be made to minimize disturbance to the exposed foundation subgrade.

5.1.2 Raft Foundation

The design drawing indicates that the dimension of the underground parking garage is approximately 35 m by 36 m. Consideration is given to support the proposed structure on a raft foundation with the fully waterproofed sub-structure (below grade). A total geotechnical reaction of 400 kPa at SLS to allow for up to 25 mm of total settlement and 600 kPa at SLS to allow for up to 50 mm of total settlement may be used for design of the raft foundation supported on the very dense silt and sand to silty sand deposit. The factor geotechnical resistance at ULS would be limited to a 1,500 kPa. The modulus of subgrade reaction appropriate for the preliminary design of this raft is about 16,000 kPa/m for 25 mm of total settlement and 8,000 kPa/m for up to 50 mm of total settlement.

The above bearing capacities are preliminary and will be reviewed and updated during the detailed design stage depending on loading and raft size conditions.

The detailed design of a raft foundation is typically an iterative process between the Structural and Geotechnical Engineers. Should the raft slab design be considered beyond this conceptual level, Terraprobe must be retained as the Geotechnical Engineer to provide engineering recommendations and comments pertaining to bearing capacity (SLS and ULS), differential settlement and other constructability aspects, as the above recommendations are provided as a feasibility option for preliminary purposes only.

It will be necessary to positively dewater the site to a minimum 1.2 m below proposed founding elevation prior to any excavation and maintained at that level during below-grade construction to preserve the in situ integrity of the native soils. If the soils are not adequately dewatered prior to any excavation and maintained at that level during construction, the soils will become disturbed and lose its integrity to support. The site should not be excavated below Elev. 119 ±m without positive dewatering in place, to preserve the native soils in their undisturbed state.

The raft slab must be fully waterproofed, and the structure must therefore be designed to resist uplift and lateral hydrostatic pressure on foundation walls. During construction, it will be necessary to consider the potential uplift pressure on the underside of a raft foundation due to hydrostatic forces. Positive dewatering operations during construction must begin prior to excavation and must continue until such time as the structural dead load exceeds the potential uplift forces (with suitable partial factors (LRFD) included in this assessment).

If deemed necessary by the Structural Engineer, micropile or helical pier tiedowns can be designed to resist uplift. In the very dense soils below Elev. 112 ±m, it is expected that post-grouted anchors can be made such that an anchor will safely carry up to 60 kN/m of adhered anchor length (at a nominal diameter of 200 mm). Conventional earth anchors made in these soils below Elev. 112 ± m can be designed using a working adhesion of 50 kPa. Helical piers (SS5 square shaft HPs) anchored in the very dense soils below Elev. 112 ±m can be designed to resist uplift, however the helical pile may have practical limitations to penetrate to sufficient depth into the very dense soils. One or more prototype anchors must be performance-tested to 200% of the design load to demonstrate the anchor capacity and validate design assumptions.

5.2 Basement Floor Slab

The excavated surface should be assessed by a qualified geotechnical engineer. The modulus of subgrade reaction appropriate for the slab design constructed on undisturbed dewatered silt and sand to silty sand deposit subgrade is 40,000 kPa/m.

Prior to the construction of the slab, it is recommended that the subgrade be cut-neat, approved and inspected under the supervision of Terraprobe for obvious loose or disturbed areas as exposed, or for areas containing excessively deleterious materials or moisture. All sub excavated areas shall be replaced with Granular B placed as compacted fill (in lifts 150 mm thick or less and compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density, SPMDD).

The basement floor slab should be provided with a capillary moisture barrier and drainage layer. This can be made by placing the slab on a minimum of 300 mm thick 19 mm clear stone layer (OPSS.MUNI 1004) compacted by vibration to a dense state. This material also serves as the drainage media for the subfloor drainage system. Provision of subfloor drainage is required in conjunction with the perimeter drainage of the structure. 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 subfloor drainage system is an important building element, as such the storm sumps which ensure the performance of this system must have a duplexed pump arrangement for 100 percent pumping redundancy provided with emergency power. Basement and subfloor drainage provisions are further discussed in Section 5.5 of this report.

Considering the soil subgrade contains a high percentage of fines (i.e. silt), and to further mitigate the risk of fines migrating upward into the subfloor drainage layer, Terraprobe recommends sub-excavating an additional 150 mm of the soil subgrade and backfilling with compacted Granular ‘A’, conforming to OPSS.MUNI 1010 specification, prior to the placement of the non-woven geotextile filter and the HL-8 Coarse Aggregate or 19 mm clear stone.

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:

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

Where:

$\mathbf{P}$ = the horizontal pressure (kPa)

$\mathbf{K}$ = the earth pressure coefficient

$\mathbf{h}$ = 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, (γ_{sat} - γ_w)

$\mathbf{q}$ = 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:

$$\mathbf{P = K[\gamma h + q]}$$

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 walls subjected 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	**γ**	**Φ**	**K_a**	**K_o**	**K_p**
Earth Fill	18.0	28	0.36	0.53	2.77
Silty Sand Till	21.0	34	0.28	0.44	3.54
Silt and Sand to Silty Sand	21.0	36	0.26	0.41	3.85

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 (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 4.1.8.4.A. 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 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 depth of about 23 m below grade), it is understood that the proposed buildings will generally be founded on dense to very dense silt and sand to silty sand deposits. 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, 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 N-values obtained from the boreholes advanced at the site to a maximum depth of about 23 m below grade. A site-specific Multichannel Analysis of Surface Waves (MASW) is recommended which may confirm the site seismic classification if required.

5.5 Basement Drainage

The ground water levels measured on December 10, 2019 and February 7 and 22, and March 4, 2020 in the monitoring wells installed in each borehole ranged from Elev. 117.0 to 118.9 m. For practical purposes, the stabilized ground water table at the site is at Elev. 119 ±m (3.5 ±m below grade at Birch Avenue) generally in the native silt and sand to silty sand deposit.

The exterior grade around the building should be sloped away at a 2 percent gradient or more for a distance of at least 1.2 m to assist in maintaining basement dry from seepage.

In the case of the conventional spread footing with the waterproofed foundation wall, the sub-floor drainage system should consist of perforated pipes (minimum 150 mm diameter) located at a spacing of about 3.0 m centre to centre (Refer to Figure 3 Basement Floor Subdrain Detail). The pipes must be surrounded by a minimum of 100 mm thick 19 mm clear stone, and the pipe inverts should be a minimum 350 mm into the subgrade. The subdrain system should be outlet to a suitable discharge point under gravity flow, or connected to a sump located in the lowest level of the basement. The water from the sump must be pumped out to a suitable discharge point/positive outlet. The installation of the drains as well as the outlet must conform to the applicable plumbing code requirements.

The elevator pit would likely extend 1 to 2 m deeper than the lowest basement floor level. Drainage for the elevator pit may be provided by incorporating perimeter and subfloor drainage system outletting to a sump, or the elevator pit structure can be waterproofed below the lowest basement subfloor drainage system level.

The size of the sump should be adequate to accommodate the anticipated water seepage. An industrial duplex pumping arrangement (main pump with a provision of a backup pump) on emergency backup power is recommended. The pump capacity must be adequate to accommodate peak flow conditions expected during the wet seasons (i.e., spring melt and fall). Refer to the Hydrogeological report for ground water seepage rates and volumes.

The subfloor drainage system is a critical important building element at this site, since it keeps water pressure from acting on the basement floor slab, as such the storm sump that ensures the performance of this system must have an industrial duplexed pump arrangement on emergency power, as noted above, for 100 percent pumping redundancy.

Additional information pertaining to ground water at the site is discussed in the hydrogeological report by Terraprobe under a separate cover (File No. 1-19-0603-46).

5.6 Pavement

Design recommendations for the entrance driveway pavement structure are provided in this section. For pavement structure supported on concrete deck, recommendations can be provided during the detailed design stage in consultation with the design team.

5.6.1 Pavement Design

The asphalt pavement design for the entrance driveways supported on soil subgrade is provided in the following table.

Pavement Structural Layers	Entrance Driveway
HMA Surface Course, TS 1151 SP 9.5	40
HMA Binder Course, TS 1151 SP 19.0	60
Granular Base Course, TS 1010 Granular A	150
Granular Subbase Course, TS 1010 Granular B Type I	400
Total Pavement Thickness	650

5.6.2 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. Continuous pavement subdrains (designed to drain into catchbasins) should also be provided along both sides of the driveway curblines. All sub-drain arrangements should comply with the City's Standard Drawing T-310-050-8.

5.6.3 General Pavement Recommendations

SP 9.5 and SP 19.0 hot mix asphalt mixes should be designed, produced and placed in conformance with TS 1151 and TS 310 requirements and pertinent City's standards. These Superpave mixes should be designed for Traffic Category B.

Granular base and subbase materials should meet the requirements of TS 1010. Granular materials should be compacted to 100 percent Standard Proctor Maximum Dry Density (SPMDD).

PG 58-28, conforming to TS 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.

5.6.4 Subgrade Preparation

All topsoil, organics, soft/loose and otherwise disturbed/weathered soils should be stripped from the subgrade areas. The exposed subgrade is expected to consist of the earth fill materials, which 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 during 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 Optimum Moisture Content (OMC). Fill material should be placed and compacted in accordance with TS 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.

5.7 Excavations

The boreholes data indicate that the earth fill 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 materials encountered in the boreholes are classified as Type 3 Soil, while the undisturbed native soils would be classified as Type 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.

The overburden soils can be removed by conventional excavation equipment. Excavations at this site may encounter construction debris, deleterious materials and other obstructions in the earth fill and native cobble/boulder obstructions in the native soil deposits. Larger size particles (cobbles and boulders) that are not specifically identified in the boreholes may be present in the native soils. The size and distribution of cobbles/boulders/obstructions cannot be predicted with boreholes, as the sampler size is insufficient to secure representative particles of this size. The risk and responsibility for the removal and disposal of cobbles/boulders/obstructions must be addressed in the contract documents for foundations, excavations and shoring contractors.

5.8 Ground Water Control

Terraprobe has completed Hydrogeological Report (File No. 1-19-0603-46) for this site to provide ground water control measures and estimate ground water discharge volume (Refer to this report for detailed information about ground water volumes, quality and control provisions).

The ground water levels measured on December 10, 2019 and February 7 and 22, 2020 in the monitoring wells installed in each borehole ranged from about Elev. 117.0 to 118.9 m. For practical purposes, the stabilized ground water table is at Elev. 119 ±m.

Within the zone of excavation, the silty sand glacial till and silt and sand to silty sand deposit are considered moderate to high permeability materials, which will permit the free flow of water when penetrated.

Active dewatering prior to any excavation and maintained throughout below-grade construction is a critical requirement. If the site soils are not adequately dewatered by a minimum of 1.2 m below the lowest excavation elevation across the site prior to any excavation and maintained at that level throughout construction, the site soils will become disturbed and the recommendations for bearing capacity (provided in Section 5.1), as well as shoring caisson wall toe bearing, will not be valid.

Without prior positive dewatering, the native silt and sand to silty sand below the ground water table at this site will become disturbed and will lose their integrity to support foundations. The installation of a skim coat of lean concrete (mud-slab) is recommended to preserve the subgrade integrity, and to provide a working platform.

At this site, impermeable shoring (i.e. a continuous interlocking caisson wall) must be used to support the excavation and to aid with temporary ground water control. The caisson pile and filler toes must be advanced to deeper depth (min. 8 ±m below the lowest bulk excavation as a general guidance) to reduce the flow of ground water into the excavation and for caisson wall toe stability. The water table must be lowered prior to excavation (including shoring caisson installation) and during excavation by means and methods as determined by the professional dewatering contractor. The caisson wall toe embedment depth can be further refined during the detailed design stage.

The subsurface information must be provided to a professional dewatering contractor who will be responsible for the design and installation of the dewatering systems. The dewatering system must be properly installed and screened to ensure that sediment and fine soils are not removed, which could result in settlement of the ground or structures near the site. Once the dewatering method and shoring system are designed, Terraprobe should be retained to evaluate the potential impacts (i.e. settlement) to nearby structures and land caused by lowering the water table.

The dewatering system must remain functional until such time as the subfloor drainage system and sumps are fully operational, or for a fully waterproofed raft, until the raft has sufficient factored dead loads that exceed the factored uplift.

5.8.1 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.

5.9 Backfill

The native soils are considered suitable for backfill provided the moisture content of these soils is within 3 percent of the Optimum Moisture Content (OMC). It should be noted that there may be wet zones within the subsurface soils which could be too wet to compact. Any soil material with 3 percent 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 percent Standard Proctor Maximum Dry Density (SPMDD) at a water content close to OMC (within 3 percent). The upper 1.2 m of the pavement subgrade must be compacted to a minimum of 98 percent SPMDD.

5.10 Shoring Design Consideration

Decisions regarding shoring methods and sequencing are the responsibility of the Contractor. Temporary shoring system design should be carried out by a licensed Professional Engineer experienced in shoring design.

A special attention should be made along the proposed excavation shoring sections adjacent to the limits of the existing building. The site is bounded by Birch Avenue, Yonge Street and existing building at the north. No excavation shall extend below a line cast as one vertical to one horizontal from foundations of the existing structure without adequate alternate support being provided. Underpinning guidelines are provided in Figure 4.

For ground water control purposes, Terraprobe recommends that the shoring system consist of a continuous interlocking caisson wall at this site. The caisson pile and filler toes must be advanced deeper (min. 8 ±m below the lowest bulk excavation as a preliminary guidance) to reduce ground water flow into the excavation, supplemented with active dewatering prior to any excavation and maintained throughout below-grade construction. The side walls of the permanent structure must be waterproofed and designed to withstand hydrostatic pressure. The depth of caisson wall toe embedment can be further refined during the detailed design stage.

The shoring system would best be supported by pre-stressed soil anchors extending beneath the adjacent lands and municipal roads. Pre-stressed anchors are installed and stressed in advance of excavation and this limits movement of the shoring system as much as is practically possible. The use of anchors on adjacent properties requires the consent of the adjacent land owners, expressed in encroachment agreements. The City Transportation and Works Department negotiates "permits" for the encroachment in City lands, which are generally allowed.

5.10.1 Earth Pressure Distribution

A single level of support would be likely required for shoring system, and a triangular earth pressure distribution similar to that used for the basement wall design, is appropriate for this case,

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

Where:

P = the horizontal pressure (kPa)
K = the earth pressure coefficient (see Section 5.3)
H = the total depth of excavation (m)
γ = the bulk unit weight of soil (kN/m^3)
q = the complete surcharge loading (kPa)

Where multiple supports are used to support the excavation, research has shown that a distributed pressure diagram more realistically approximates the earth pressure on a shoring system of this type, when restrained by pre-tensioned anchors.

The borehole data indicate that silty sand till / sand and silt to silty sand depoists would be encountered in the excavations. For the cohesionless soils (silty sand till / sand and silt to silty), a multi-level supported shoring system can be designed based on an earth pressure distribution consisting of a rectangular pressure distribution with a pressure defined by:

$$P = 0.65\ K(\gamma H + q)$$

Where:
P = the horizontal pressure (kPa)
K = the earth pressure coefficient
γ = the bulk unit weight of soil (kN/m^3)
H = the total depth of excavation (m)
q = the complete surcharge loading (kPa)

5.10.2 Caisson Pile and Filler Toe Design

Caisson pile and filler toes will be made in the competent native soils below the proposed P3 level, and must be deepened (min. 8 ±m below the lowest bulk excavation as a preliminary guidance, this depth can be refined during the detailed design stage) to reduce ground water flow into the excavation. The toe embedment and corresponding ground water volumes must be reviewed in advance with the most updated drawings. The horizontal resistance of the pile and filler toes will be developed by embedment below the base of the excavation, where resistance is developed from passive earth pressure depending upon the dewatering details and sequencing. Without adequate dewatering, the soil bearing and passive support for shoring caisson wall toes may be diminished.

The soils at this site are cohesionless, permeable and sufficiently wet such that augered borings made into these soils will be unstable. It is necessary to advance temporarily cased holes to prevent excess caving during the soldier pile and all augered hole installations. Drill holes for piles, caissons, and/or fillers, utilizing temporary liners, mud polymer drilling techniques, and/or other methods as deemed necessary by the contractor may be required to prevent issues such as: groundwater inflow or loss of soil into the drill holes, and disturbance to placed concrete. It is likely that mud/polymer drilling technique will be required to stabilize against basal instability for shoring caisson installation.

The ground water table must be lowered a minimum of 1.2 m below the lowest excavation elevation prior to any excavation (including shoring caissons) and maintained at that level during construction. Once the dewatering method and shoring system are designed, Terraprobe should be retained to evaluate the potential impacts (i.e. settlement) to the shoring system (ex. pile and filler toes) caused by lowering the water table. Significant project cost and schedule implications may occur if adequate ground water control measures are not implemented to lower the ground water levels prior to any excavation, as recommended in this engineering report.

5.10.3 Lateral Bracing Elements

If anchor support is necessary and determined to be feasible, the shoring system should be supported by pre-stressed soil anchors extending beneath the adjacent lands. Pre-stressed anchors are installed and stressed in advance of excavation and this limits movement of the shoring system as much as is practically possible. The use of anchors on adjacent properties requires the consent of the adjacent land owners, expressed in encroachment agreements.

Conventional earth anchors could be made with a continuous hollow stem augers or alternatively post-grouted wash bored anchors can be made. The design adhesion for earth anchors is controlled as much by the installation technique as the soil and therefore a proto-type anchor must be made in each anchor level executed to demonstrate the anchor capacity and validate the design assumptions. A proto-type anchor must be made to demonstrate the anchor capacity (performance tested to 200% of the design load). All production anchors must be proof-tested to 133% of the design load, to validate the design assumptions.

The subsurface soils are sufficiently cohesionless, permeable and/or wet that augered holes could experience caving. It will be necessary to advance temporarily cased holes to maintain sidewall support and to prevent the ingress of water during soldier pile (and caisson wall fillers, if applicable) installation, use slurry, etc. or other means or methods deemed necessary by the contractor.

Conventional earth anchors made in the competent native soils (silty sand till and silt and sand to silty sand) may be designed using a working adhesion of 50 kPa. Depending upon the location and elevation of the soil anchors, the post-grouted anchors made in the silt and sand to silty sand at this site may carry an transfer load of 60 to 70 kN/metre of post-grouted anchor length (for 150 mm nominal diameter of anchor) depending upon the material type as confirmed by a performance/load test.

If adjacent land owners are not agreeable to anchored support then internal bracing or rakers would be necessary. The dense to very dense native soils at the proposed P3 level (Elev. 112.85 ±m) are suitable for the placement of raker foundations. The footings for the rakers would be made in very dense undisturbed native soils where they could be designed for a maximum factored geotechnical resistance at ULS of 400 kPa when inclined at 45 degrees.

5.11 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, as well as 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 conducted 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.

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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.

LICENSED PROFESSIONAL ENGINEER
M. RAJAEI
100230597
2021-10-21
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
L. ZHANG
100108685
2021-10-21
PROVINCE OF ONTARIO

Ali Rajaei, M. Eng, P. Eng.
Geotechnical Engineer

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

ENCLOSURES

TERRAPROBE INC.

FIGURES

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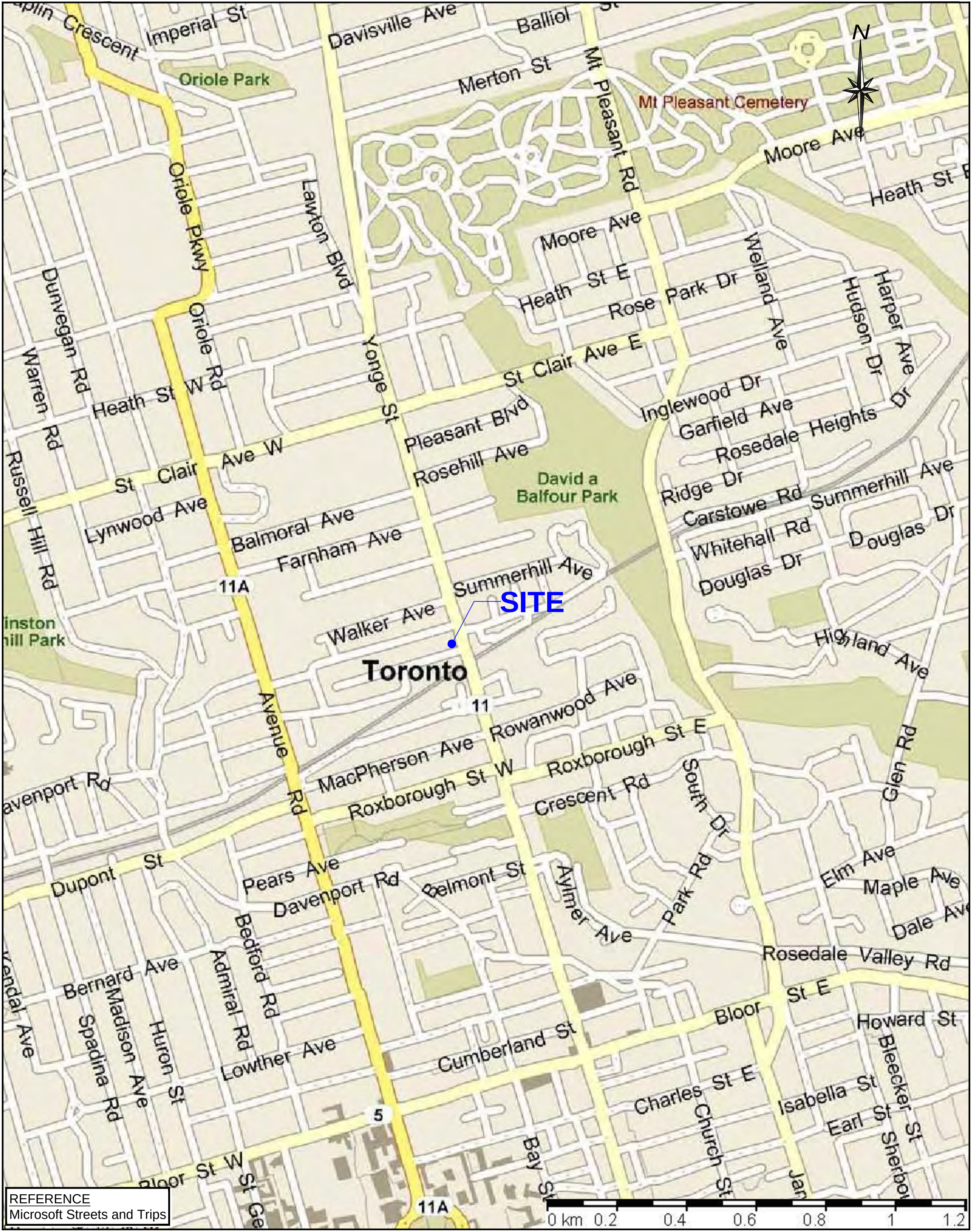


REFERENCE
Microsoft Streets and Trips

Terraprobe

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

Title:

SITE LOCATION PLAN

File No.: 1-19-0603-01

FIGURE : 1

Z:\1-Project Files\2019\1-19-0603 - 1196-1210 Yonge. 2-8 Birch, Toronto\01-GEO Investigation\A. Dwgs. Logs\AutoCAD\1-19-0603-01 Figure 1 & 2.dwg.
Kamal

REFERENCE
Image ©2019 Google Earth

LEGEND
⌖ Approximate Borehole Location

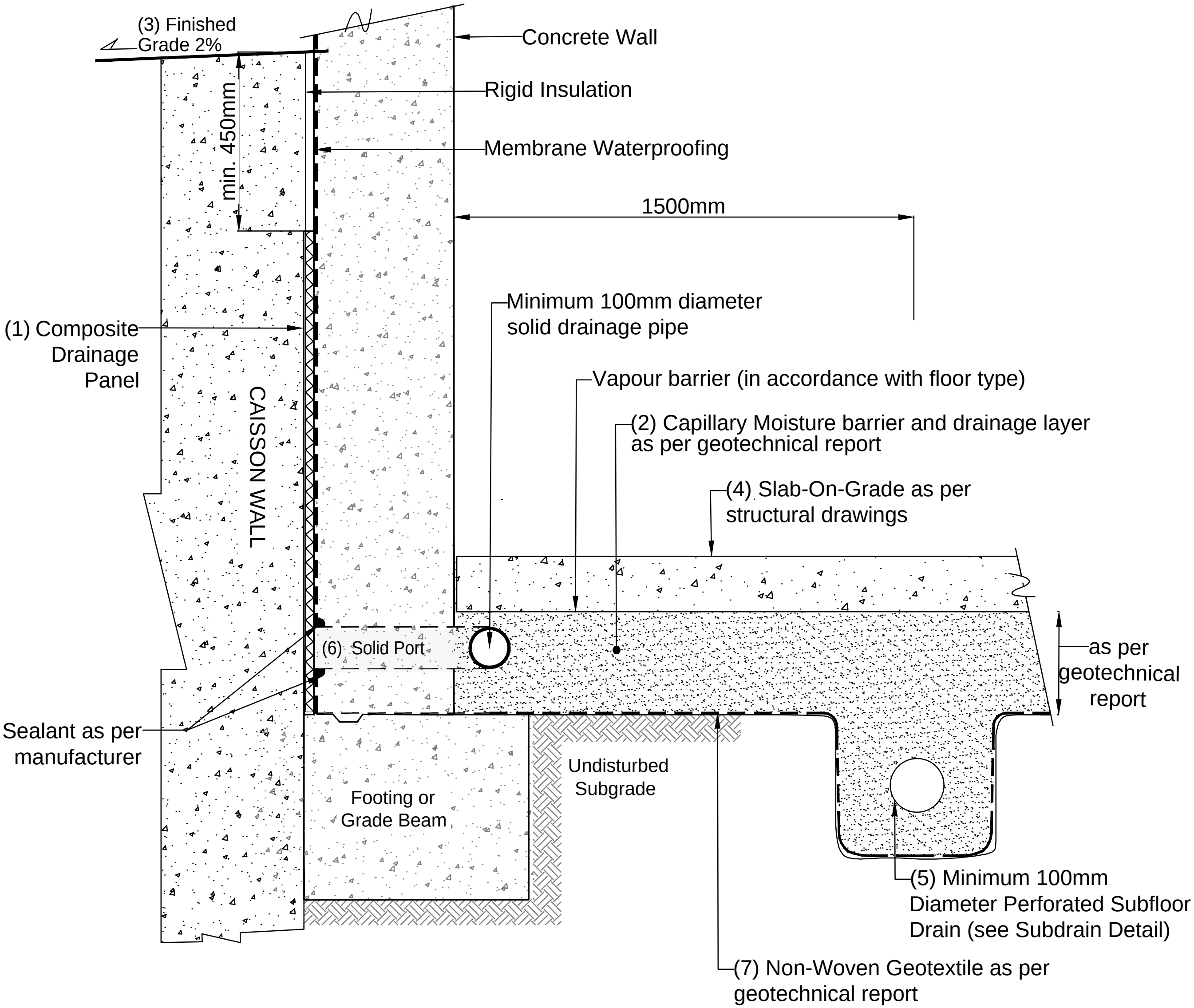
Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Title:
BOREHOLE LOCATION PLAN

File. No.: 1-19-0603-01

FIGURE : 2

Z:\1-Project Files\2019\1-19-0603 - 1196-1210 Yonge. 2-8 Birch, Toronto\01-GEO Investigation\A. Dwgs, Logs\AutoCAD\1-19-0603-01 Figure 1 & 2.dwg, Sandy



NOTES

1) Prefabricated composite drainage panels to consist of Miradrain 6000, or approved equivalent. Panels should provide continuous cover as per manufacturer's requirements.
2) Capillary moisture barrier/drainage layer to consist of a minimum 200mm layer of 19mm clear stone (OPSS. MUNI 1004), or as indicated in geotechnical report, compacted to a dense state. Upper 50mm can be replaced with Granular “A” (OPSS. MUNI 1010) compacted to 98% SPMDD where vehicular traffic is required. A vapour barrier may be required depending on floor type.
3) Exterior finished grade away from wall at a minimum grade of 2% for min. 1.2m.
4) Building floor slab-on-grade shall not be structurally connected to foundation wall or footing.
5) Subfloor drain invert to be a minimum of 300mm below underside of floor slab, to be set in parallel rows, one way, and at the spacing specified in the geotechnical report. Don't connect subfloor drains to perimeter drains.
6) Embedded ports to be set a distance of maximum 3m on-centre. Each port to have a minimum cross-sectional area of 1500mm². Perimeter drainage must be collected and conveyed directly to the building sumps in solidpipe.
7) When the subgrade consists of a cohesionless soil, the subgrade must be separated from the subfloor drainage layer using a non-woven geotextile (Terrafix 360R or approved equivalent).
8) Geotechnical report contains specific details. Final detail must be reviewed before system is considered acceptable to use.

N.T.S

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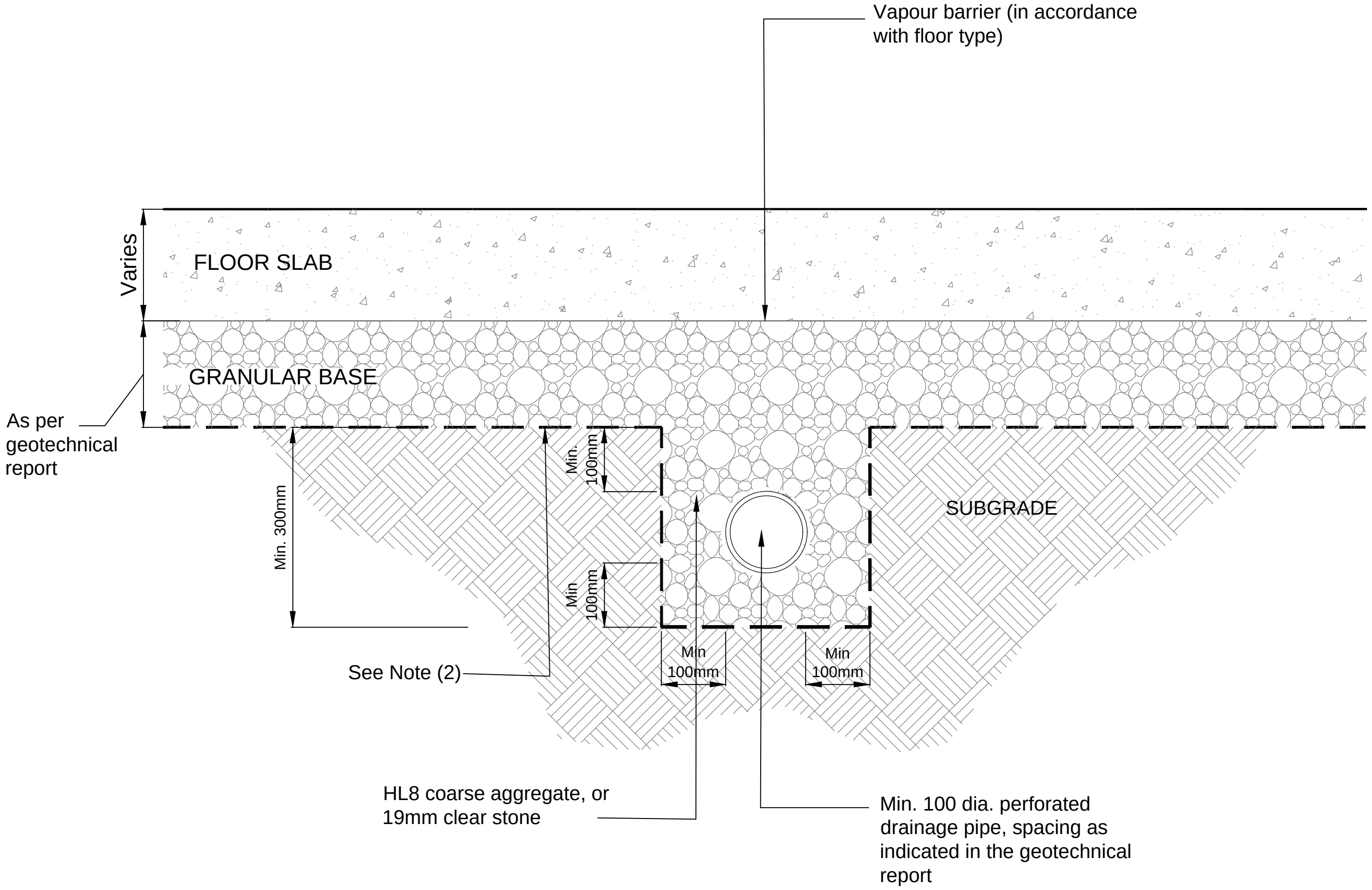
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Title:

SCHEMATIC BASEMENT DRAINAGE DETAIL
CAISSON WALL SHORING SYSTEM
(ONE-SIDED WALL CONSTRUCTION)



NOTES:
1. Typical schematic only. Must be read in conjunction with Geotechnical Report.
2. When the subgrade consists of cohesionless soil, it must be separated from the subfloor drainage layer using a non-woven geotextile (Terrafix 360R or approved equivalent).
3. Not to Scale

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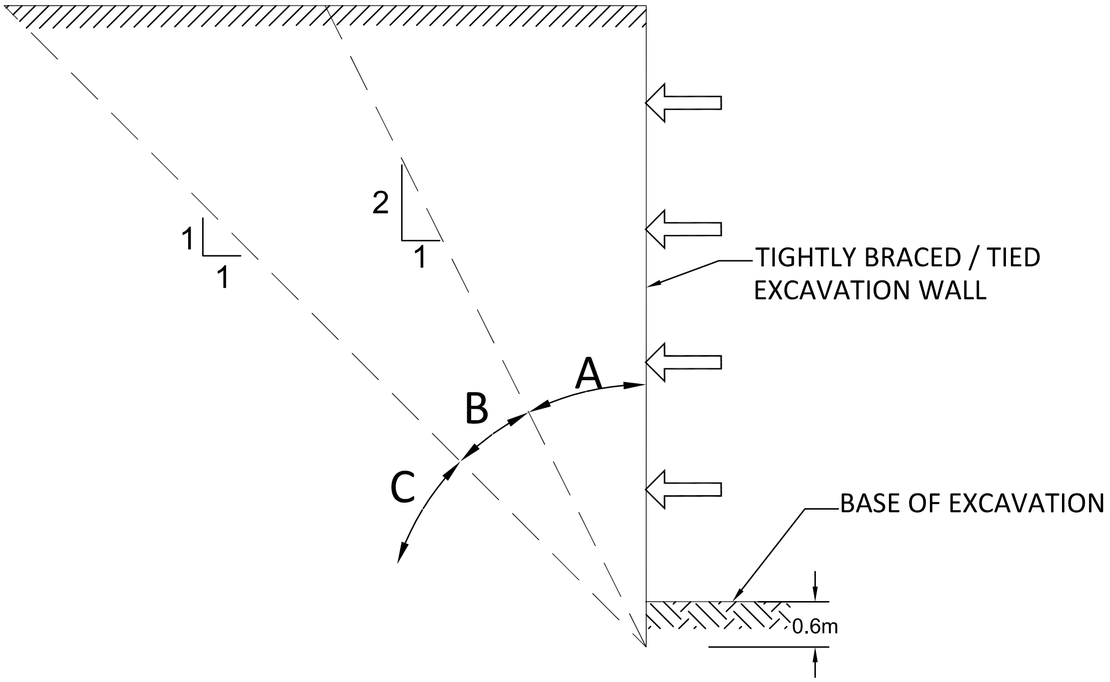
Tel: (905) 796-2650 Fax: (905) 796-2250

Title:

TYPICAL BASEMENT SUBDRAIN DETAIL



Zone A: Foundations within this zone often require underpinning. Horizontal and vertical pressures on excavation wall of non-underpinned foundations must be considered.

Zone B: Foundation within this zone often do not require underpinning. Horizontal and vertical pressures on excavation wall of non-underpinned foundations must be considered.

Zone C: Foundations within this zone usually do not require underpinning.

REFERENCE:

User's Guide - NBC 2005 Structural Commentaries
(Part 4 of Division B) - Commentary K

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

Title:

GUIDELINES FOR UNDERPINNING SOILS

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 or close to plastic limit) but does not have visible pore water
Wet	refers to a soil sample that has visible pore water

Terraprobe

LOG OF BOREHOLE 1

Project No. : 1-19-0603-01
Client : Birch Equities Limited
Originated by : SM
Date started : January 28, 2020
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Compiled by : AR
Sheet No. : 1 of 2
Location : Toronto, Ontario
Checked by : SZ

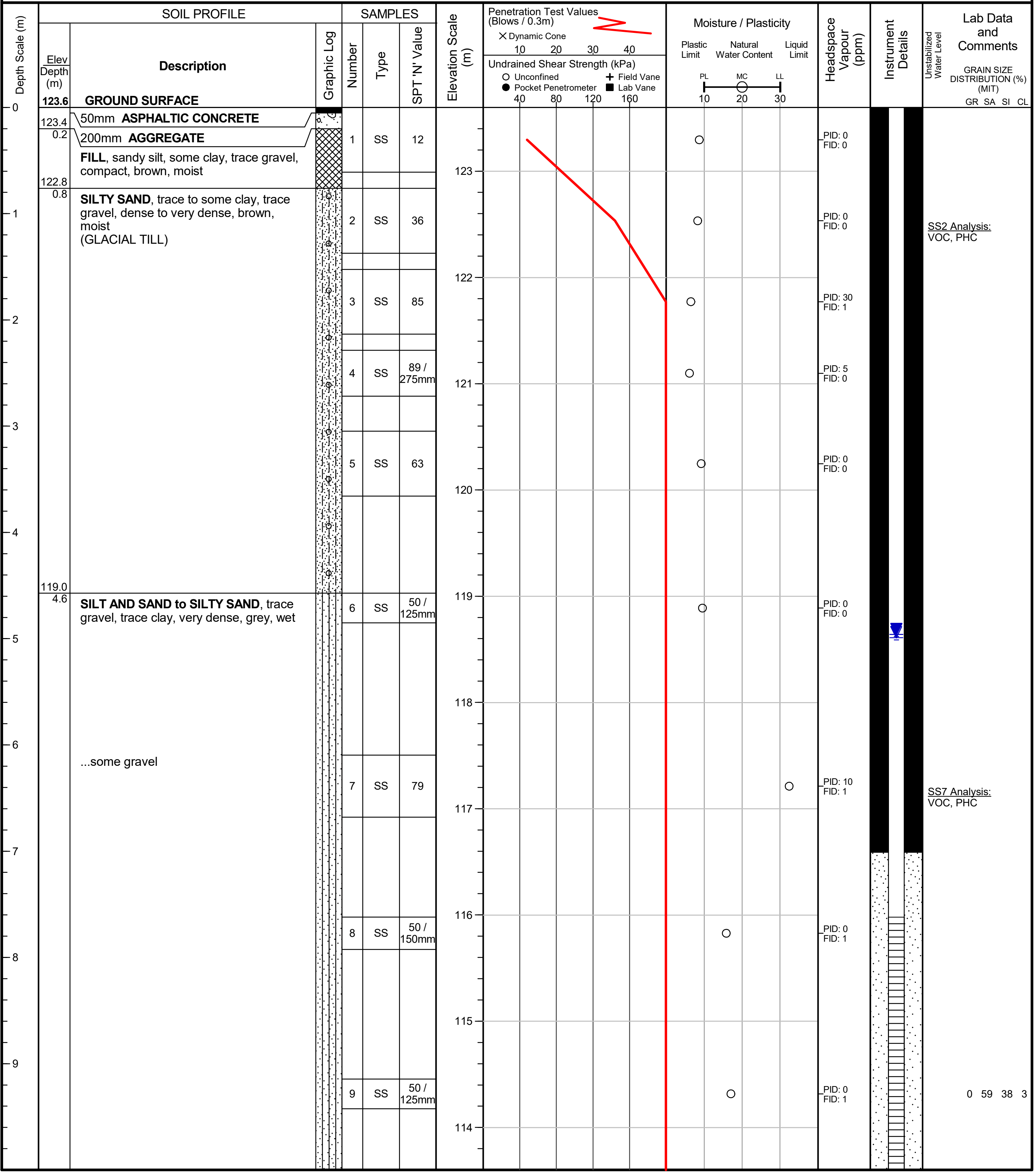
Position : E: 629619, N: 4837747 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Truck-mounted
Drilling Method : Hollow stem augers

SOIL PROFILE

Elev Depth (m)	Description
123.6	**GROUND SURFACE**
123.4	50mm **ASPHALTIC CONCRETE**
0.2	200mm **AGGREGATE**
	FILL, sandy silt, some clay, trace gravel, compact, brown, moist
122.8 0.8	**SILTY SAND**, trace to some clay, trace gravel, dense to very dense, brown, moist (GLACIAL TILL)
119.0 4.6	**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, very dense, grey, wet ...some gravel

SAMPLES

Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	Lab Data and Comments
1	SS	12	PID: 0 FID: 0	
2	SS	36	PID: 0 FID: 0	SS2 Analysis: VOC, PHC
3	SS	85	PID: 30 FID: 1	
4	SS	89 / 275mm	PID: 5 FID: 0	
5	SS	63	PID: 0 FID: 0	
6	SS	50 / 125mm	PID: 0 FID: 0	
7	SS	79	PID: 10 FID: 1	SS7 Analysis: VOC, PHC
8	SS	50 / 150mm	PID: 0 FID: 1	
9	SS	50 / 125mm	PID: 0 FID: 1	0 59 38 3



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Terraprobe

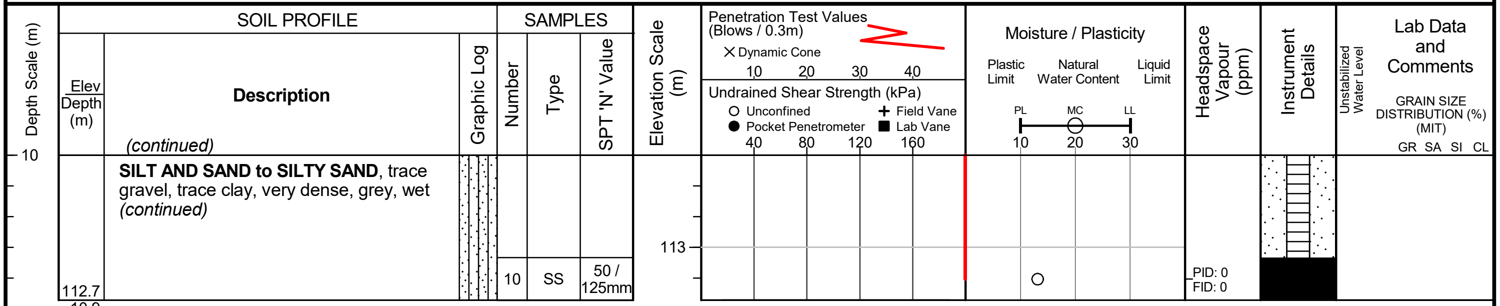
LOG OF BOREHOLE 1

Project No. : 1-19-0603-01
Date started : January 28, 2020
Sheet No. : 2 of 2

Client : Birch Equities Limited
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Location : Toronto, Ontario

Originated by : SM
Compiled by : AR
Checked by : SZ

Position : E: 629619, N: 4837747 (UTM 17T)
Rig type : Truck-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers



Depth Scale (m)	Elev Depth (m)	Description	Number	Type	SPT 'N' Value	Elevation Scale (m)	Headspace Vapour (ppm)
10		**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, very dense, grey, wet *(continued)*				113	
	112.7 10.9		10	SS	50 / 125mm		PID: 0 FID: 0

END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 7, 2020	5.0	118.6
Feb 20, 2020	5.0	118.6

file: 1-19-0603-01 bh logs.gpj

LOG OF BOREHOLE 2

Project No. : 1-19-0603-01	Client : Birch Equities Limited	Originated by : SM
Date started : January 6, 2020	Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue	Compiled by : AR
Sheet No. : 1 of 2	Location : Toronto, Ontario	Checked by : SZ

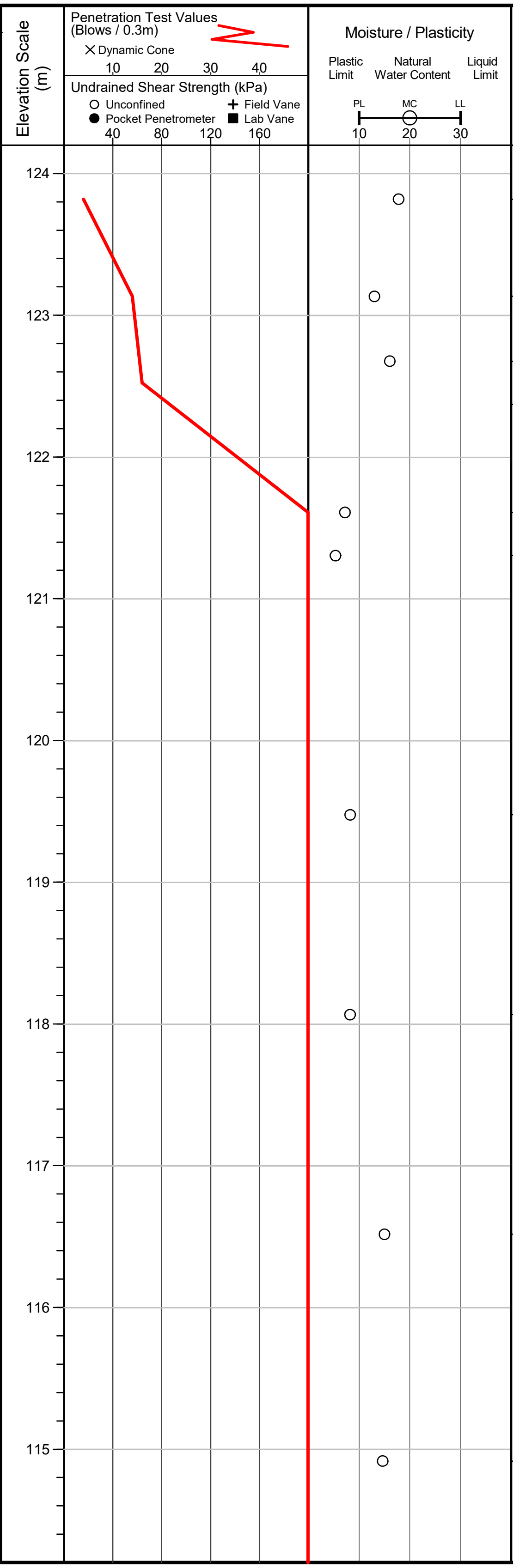
Position : E: 629626, N: 4837750 (UTM 17T)
Elevation Datum : Geodetic
Rig type : LAR drill rig w/ 70lb hammer
Drilling Method : Tri-cone (mud rotary)

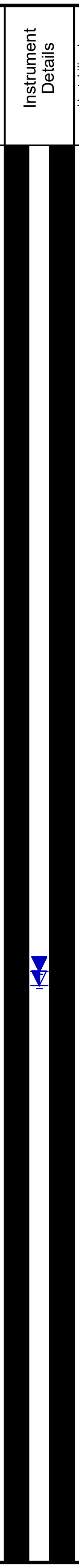
SOIL PROFILE

Elev Depth (m)	Description
124.2	**GROUND SURFACE**
	60mm **CONCRETE PAVERS**
	FILL, clayey silt, trace sand, soft, dark brown, moist
123.4 0.8	**SANDY SILT**, some clay, trace gravel, compact, brown, moist ...wet
122.2 2.0	**SILTY SAND**, trace to some clay, trace gravel, very dense, brown, moist (GLACIAL TILL) ...grey
118.1 6.1	**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, very dense, grey, wet

SAMPLES

Number	Type	SPT 'N' Value*	Headspace Vapour (ppm)
1	SS	4	PID: 0 FID: 0
2	SS	14	PID: 0 FID: 0
3A 3B	SS	16	PID: 0 FID: 0 PID: 0 FID: 0
4	SS	52 / 150mm	PID: 20 FID: 1
5	SS	50 / 150mm	PID: 20 FID: 1
6	SS	50 / 150mm	PID: 25 FID: 0
7	SS	50 / 75mm	PID: 5 FID: 0
8	SS	50 / 125mm	PID: 75 FID: 0
9	SS	50 / 125mm	PID: 45 FID: 0





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

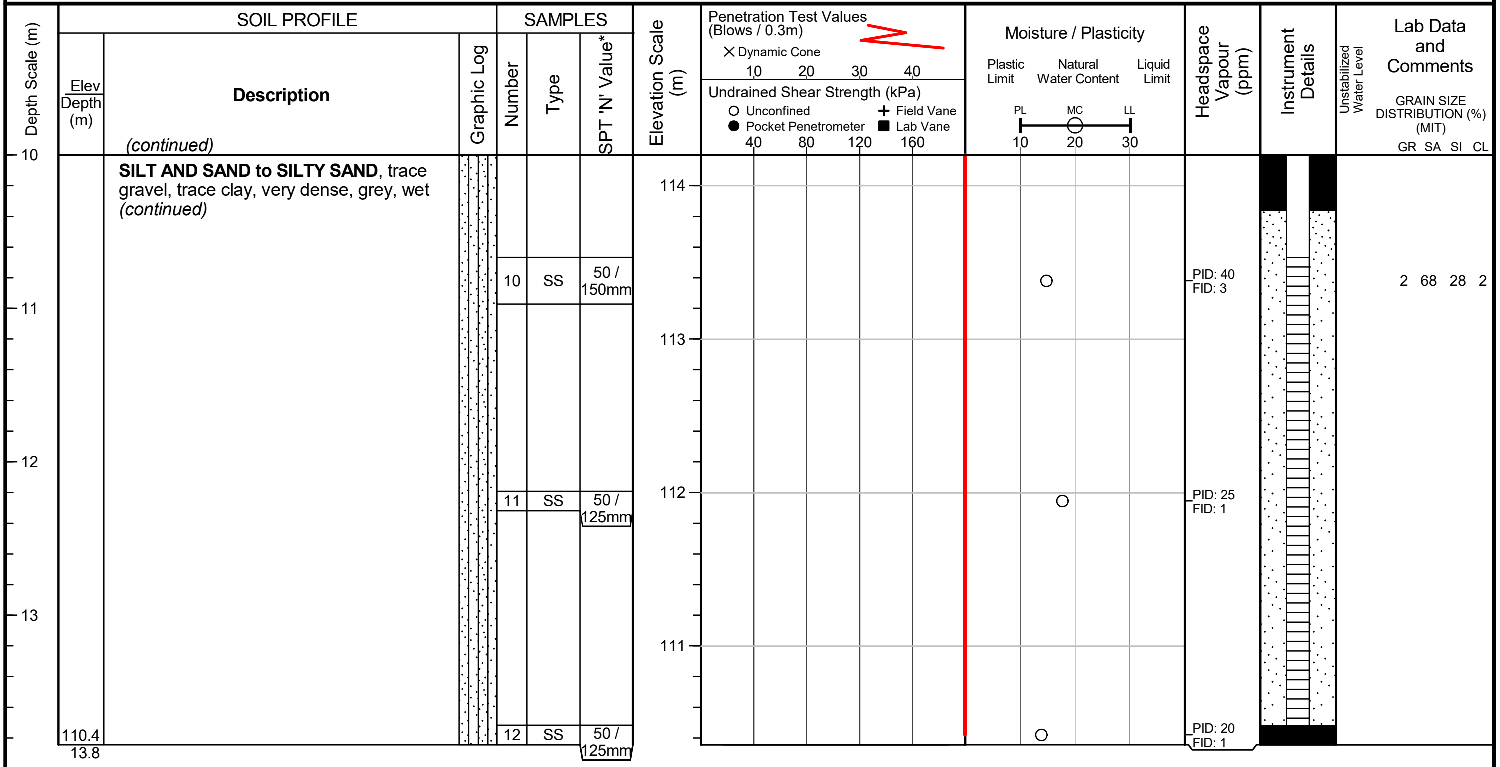
(continued next page)

* SPT N-values corrected based on energy of 32 kg hammer dropped 760 mm

LOG OF BOREHOLE 2

Project No. : 1-19-0603-01
Client : Birch Equities Limited
Originated by : SM
Date started : January 6, 2020
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Compiled by : AR
Sheet No. : 2 of 2
Location : Toronto, Ontario
Checked by : SZ

Position : E: 629626, N: 4837750 (UTM 17T)
Elevation Datum : Geodetic
Rig type : LAR drill rig w/ 70lb hammer
Drilling Method : Tri-cone (mud rotary)



SILT AND SAND to SILTY SAND, trace gravel, trace clay, very dense, grey, wet *(continued)*

Number	Type	SPT 'N' Value*	Headspace Vapour (ppm)	GR	SA	SI	CL
10	SS	50 / 150mm	PID: 40 FID: 3	2	68	28	2
11	SS	50 / 125mm	PID: 25 FID: 1				
12	SS	50 / 125mm	PID: 20 FID: 1				

END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 7, 2020	5.9	118.3
Feb 20, 2020	5.8	118.4

file: 1-19-0603-01 bh logs.gpj

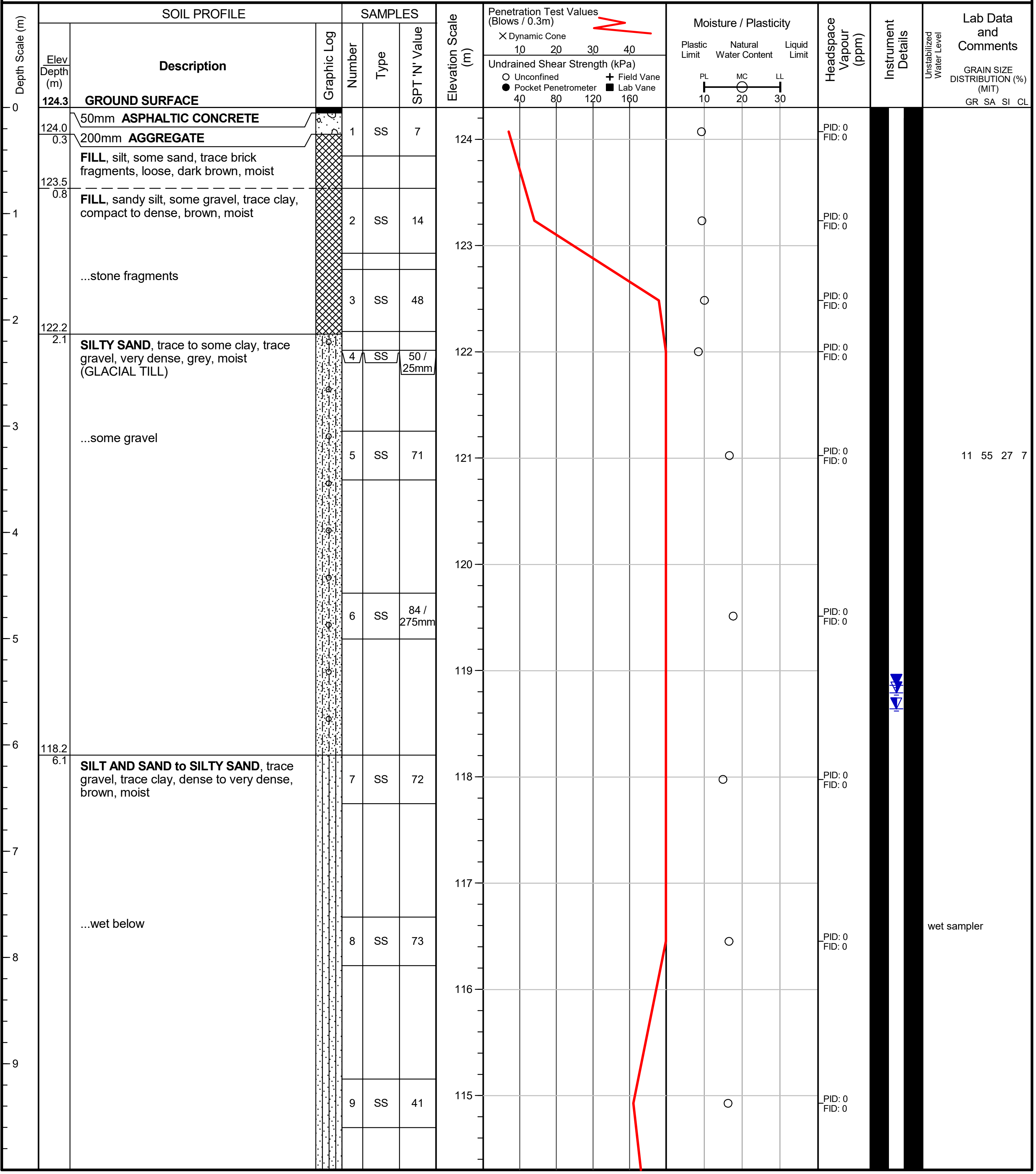
* SPT N-values corrected based on energy of 32 kg hammer dropped 760 mm

Terraprobe

LOG OF BOREHOLE 3

Project No. : 1-19-0603-01
Client : Birch Equities Limited
Originated by : DH
Date started : October 24, 2019
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Compiled by : AR
Sheet No. : 1 of 2
Location : Toronto, Ontario
Checked by : SZ

Position : E: 629619, N: 4837749 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Hollow stem augers



Elev Depth (m)	Description
124.3	**GROUND SURFACE**
	50mm **ASPHALTIC CONCRETE**
124.0 0.3	200mm **AGGREGATE**
	FILL, silt, some sand, trace brick fragments, loose, dark brown, moist
123.5 0.8	**FILL**, sandy silt, some gravel, trace clay, compact to dense, brown, moist ...stone fragments
122.2 2.1	**SILTY SAND**, trace to some clay, trace gravel, very dense, grey, moist (GLACIAL TILL) ...some gravel
118.2 6.1	**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, dense to very dense, brown, moist ...wet below

Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
1	SS	7	PID: 0 FID: 0	
2	SS	14	PID: 0 FID: 0	
3	SS	48	PID: 0 FID: 0	
4	SS	50 / 25mm	PID: 0 FID: 0	
5	SS	71	PID: 0 FID: 0	11 55 27 7
6	SS	84 / 275mm	PID: 0 FID: 0	
7	SS	72	PID: 0 FID: 0	
8	SS	73	PID: 0 FID: 0	wet sampler
9	SS	41	PID: 0 FID: 0	

(continued next page)

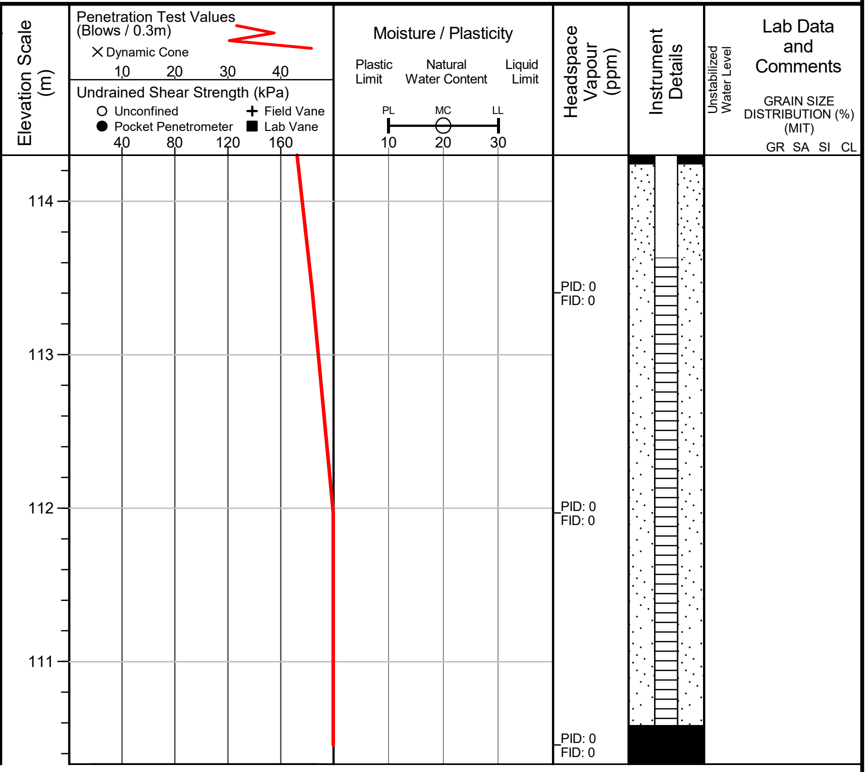
Terraprobe

LOG OF BOREHOLE 3

Project No. : 1-19-0603-01
Client : Birch Equities Limited
Originated by : DH
Date started : October 24, 2019
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Compiled by : AR
Sheet No. : 2 of 2
Location : Toronto, Ontario
Checked by : SZ

Position : E: 629619, N: 4837749 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
10		*(continued)* **SILT AND SAND to SILTY SAND**, trace gravel, trace clay, dense to very dense, brown, moist *(continued)*				
11				10	SS	46
12				11	SS	50 / 125mm
13				12	SS	50 / 100mm
	110.3 14.0					



END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	5.7	118.6
Feb 7, 2020	5.5	118.8
Feb 20, 2020	5.4	118.9

file: 1-19-0603-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 4

Project No. : 1-19-0603-01
Date started : October 23, 2019
Sheet No. : 1 of 3

Client : Birch Equities Limited
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Location : Toronto, Ontario

Originated by : NK
Compiled by : AR
Checked by : SZ

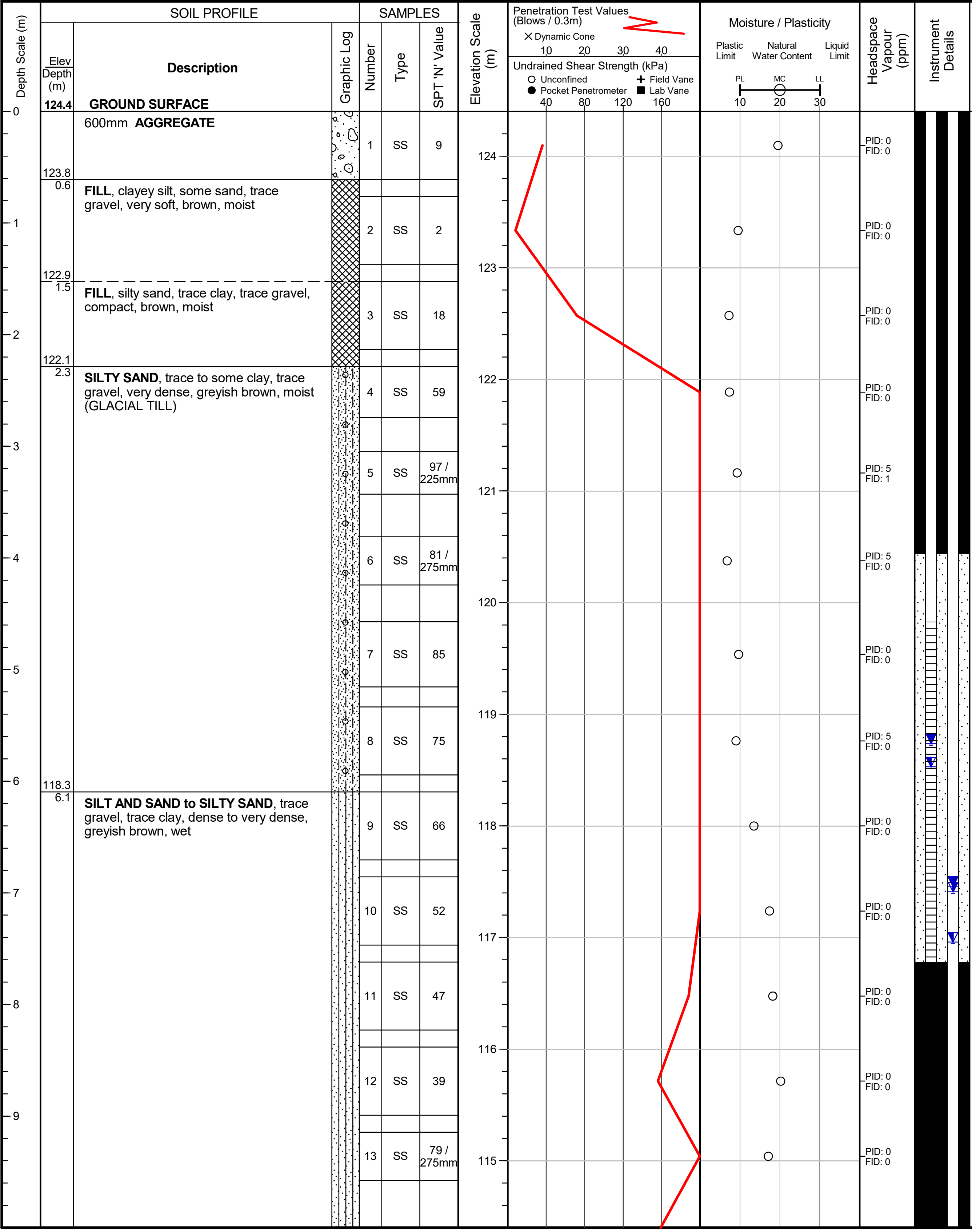
Position : E: 629616, N: 4837760 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

SOIL PROFILE

Elev Depth (m)	Description
124.4	**GROUND SURFACE**
	600mm **AGGREGATE**
123.8 0.6	**FILL**, clayey silt, some sand, trace gravel, very soft, brown, moist
122.9 1.5	**FILL**, silty sand, trace clay, trace gravel, compact, brown, moist
122.1 2.3	**SILTY SAND**, trace to some clay, trace gravel, very dense, greyish brown, moist (GLACIAL TILL)
118.3 6.1	**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, dense to very dense, greyish brown, wet

SAMPLES

Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
1	SS	9	PID: 0 FID: 0	
2	SS	2	PID: 0 FID: 0	
3	SS	18	PID: 0 FID: 0	
4	SS	59	PID: 0 FID: 0	
5	SS	97 / 225mm	PID: 5 FID: 1	
6	SS	81 / 275mm	PID: 5 FID: 0	
7	SS	85	PID: 0 FID: 0	7 66 23 4
8	SS	75	PID: 5 FID: 0	
9	SS	66	PID: 0 FID: 0	
10	SS	52	PID: 0 FID: 0	
11	SS	47	PID: 0 FID: 0	
12	SS	39	PID: 0 FID: 0	
13	SS	79 / 275mm	PID: 0 FID: 0	



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Terraprobe

LOG OF BOREHOLE 4

Project No. : 1-19-0603-01
Date started : October 23, 2019
Sheet No. : 2 of 3

Client : Birch Equities Limited
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Location : Toronto, Ontario

Originated by : NK
Compiled by : AR
Checked by : SZ

Position : E: 629616, N: 4837760 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

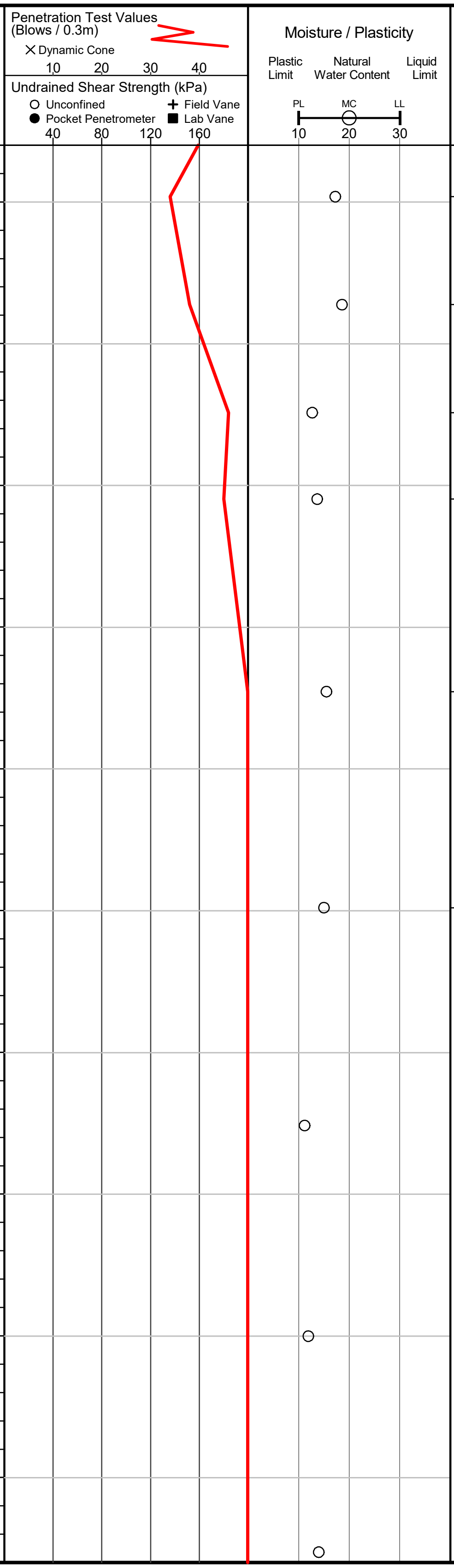
SOIL PROFILE — Depth Scale (m): 10 to 19

(continued)

SILT AND SAND to SILTY SAND, trace gravel, trace clay, dense to very dense, greyish brown, wet *(continued)*

...at 10.8 m, grey below

Number	Type	SPT 'N' Value	Headspace Vapour (ppm)
14	SS	34	PID: 0 FID: 0
15	SS	38	PID: 0 FID: 0
16	SS	46	PID: 0 FID: 0
17	SS	45	PID: 0 FID: 0
18	SS	50 / 125mm	PID: 0 FID: 0
19	SS	50 / 125mm	PID: 0 FID: 0
20	SS	89 / 150mm	
21	SS	50 / 75mm	
22	SS	50 /	



Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

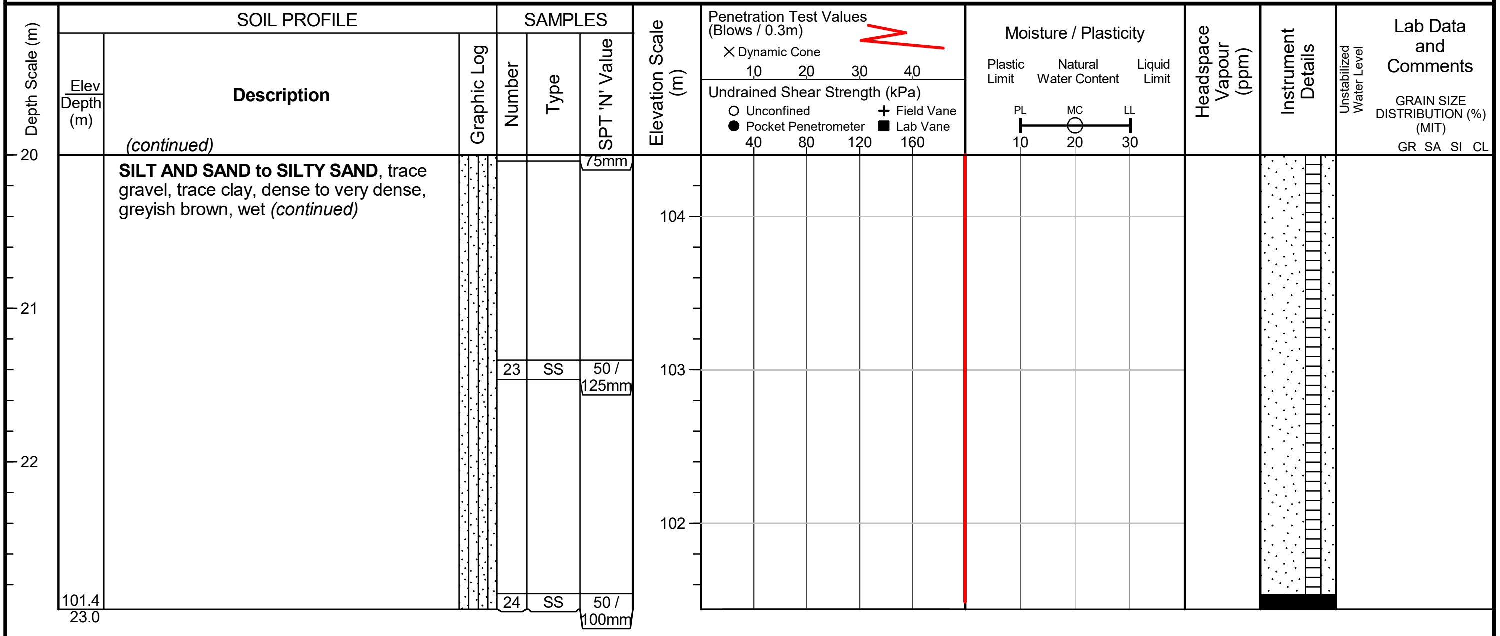
GR SA SI CL

(continued next page)

LOG OF BOREHOLE 4

Project No. : 1-19-0603-01	Client : Birch Equities Limited	Originated by : NK
Date started : October 23, 2019	Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue	Compiled by : AR
Sheet No. : 3 of 3	Location : Toronto, Ontario	Checked by : SZ

Position : E: 629616, N: 4837760 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Hollow stem augers



Depth Scale (m)	Elev Depth (m)	Description	Number	Type	SPT 'N' Value
		(continued)			
20		**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, dense to very dense, greyish brown, wet *(continued)*			75mm
21					
			23	SS	50 / 125mm
22					
	101.4 23.0		24	SS	50 / 100mm

END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

W1 WATER LEVELS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	5.9	118.5
Feb 7, 2020	5.7	118.7

W2 WATER LEVELS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	7.4	117.0
Feb 7, 2020	7.0	117.4
Feb 20, 2020	6.9	117.5

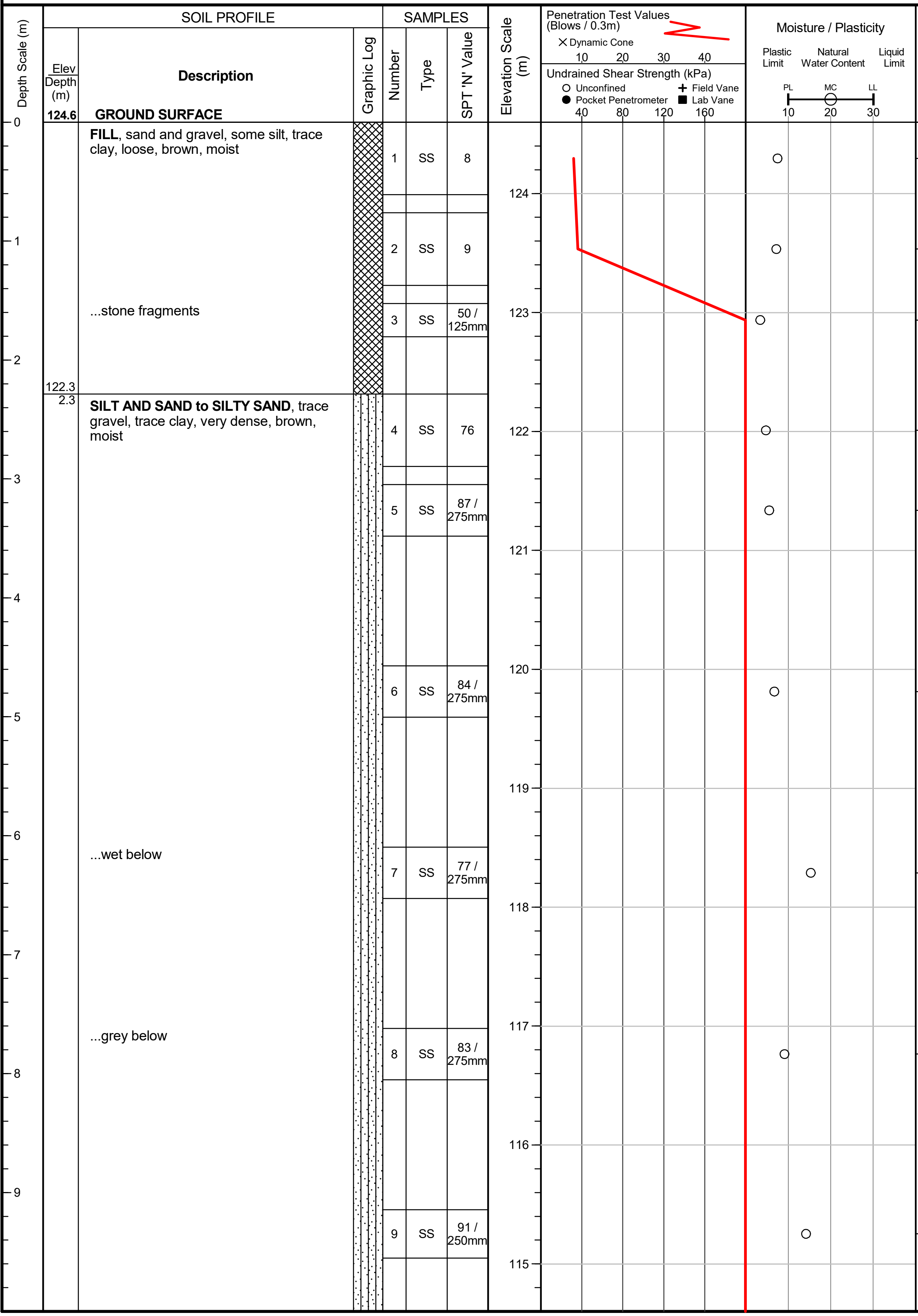
Terraprobe

LOG OF BOREHOLE 5

Project No. : 1-19-0603-01
Client : Birch Equities Limited
Originated by : SD
Date started : October 25, 2019
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Compiled by : AR
Sheet No. : 1 of 2
Location : Toronto, Ontario
Checked by : SZ

Position : E: 629615, N: 4837767 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Hollow stem augers

Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
124.6	**GROUND SURFACE**							
	FILL, sand and gravel, some silt, trace clay, loose, brown, moist		1	SS	8	PID: 0 FID: 0		
			2	SS	9	PID: 0 FID: 0		
	...stone fragments		3	SS	50 / 125mm	PID: 0 FID: 0		
122.3 2.3	**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, very dense, brown, moist		4	SS	76	PID: 0 FID: 0		
			5	SS	87 / 275mm	PID: 0 FID: 0		
			6	SS	84 / 275mm	PID: 0 FID: 0		
	...wet below		7	SS	77 / 275mm	PID: 0 FID: 0	▼	
	...grey below		8	SS	83 / 275mm	PID: 0 FID: 0		
			9	SS	91 / 250mm	PID: 0 FID: 0		



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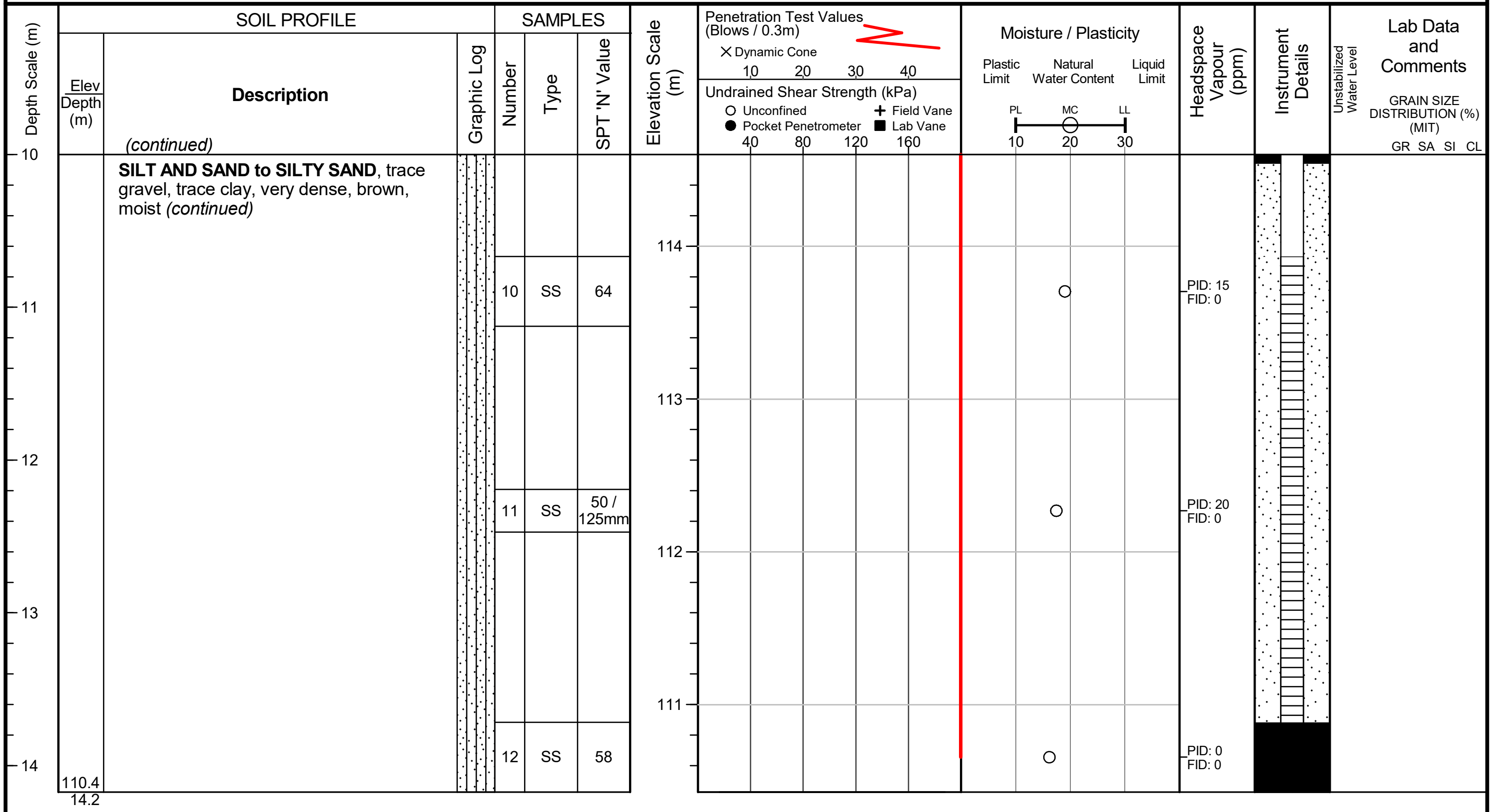
file: 1-19-0603-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 5

Project No. : 1-19-0603-01
Client : Birch Equities Limited
Originated by : SD
Date started : October 25, 2019
Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue
Compiled by : AR
Sheet No. : 2 of 2
Location : Toronto, Ontario
Checked by : SZ

Position : E: 629615, N: 4837767 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Hollow stem augers



END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	6.4	118.2

file: 1-19-0603-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 6

Project No.	: 1-19-0603-01	Client	: Birch Equities Limited	Originated by	: SD
Date started	: October 28, 2019	Project	: 1196 - 1210 Yonge St & 2 - 8 Birch Avenue	Compiled by	: AR
Sheet No.	: 1 of 2	Location	: Toronto, Ontario	Checked by	: SZ

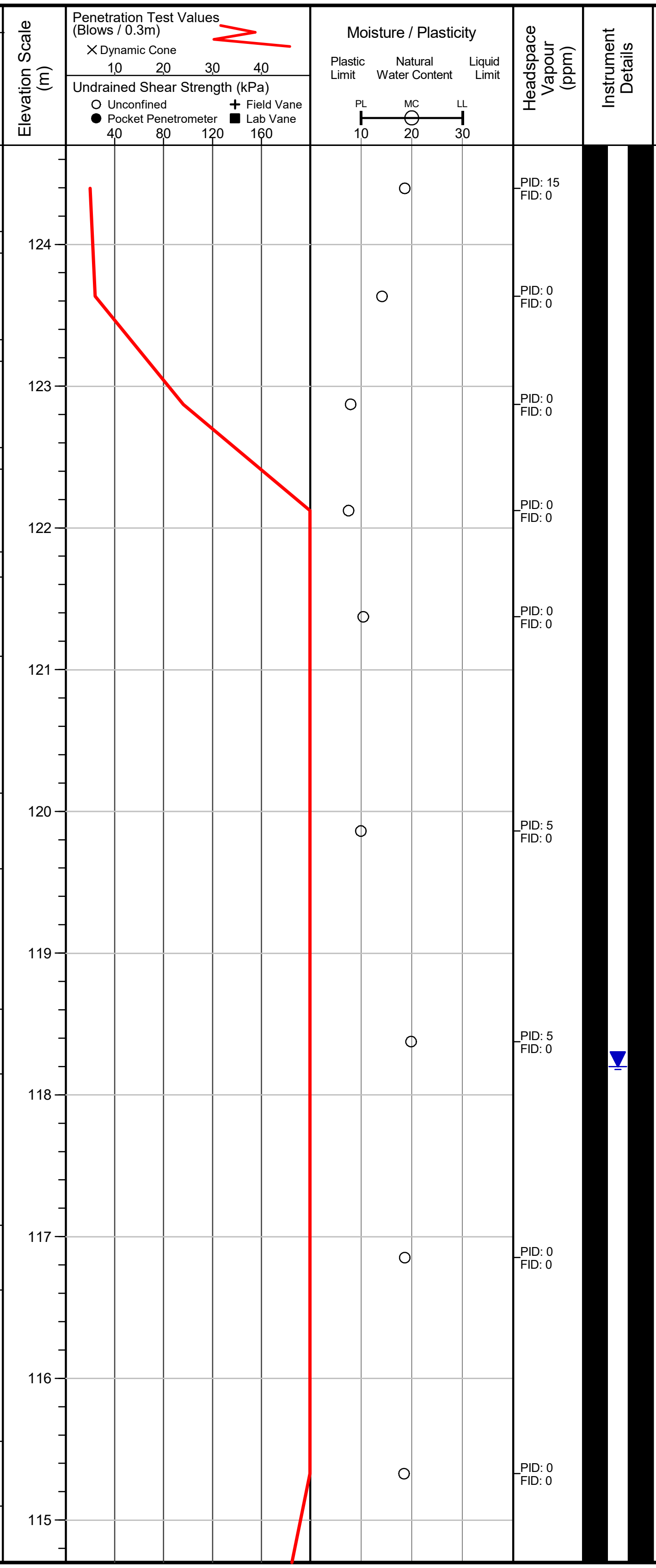
Position	: E: 629619, N: 4837769 (UTM 17T)	Elevation Datum	: Geodetic
Rig type	: Track-mounted	Drilling Method	: Hollow stem augers

SOIL PROFILE

Elev Depth (m)	Description
124.7	**GROUND SURFACE**
	FILL, clayey silt, sandy, trace rootlets, firm, dark brown, moist
123.9 0.8	**FILL**, sandy silt, trace clay, trace gravel, loose, brown, moist
123.2 1.5	**SILTY SAND**, trace to some clay, trace gravel, compact to very dense, greyish brown, moist (GLACIAL TILL)
118.6 6.1	**SILT AND SAND to SILTY SAND**, trace gravel, trace clay, very dense, grey, wet

SAMPLES

Number	Type	SPT 'N' Value	Headspace Vapour (ppm)
1	SS	5	PID: 15 FID: 0
2	SS	6	PID: 0 FID: 0
3	SS	24	PID: 0 FID: 0
4	SS	72	PID: 0 FID: 0
5	SS	89	PID: 0 FID: 0
6	SS	76	PID: 5 FID: 0
7	SS	55	PID: 5 FID: 0
8	SS	65	PID: 0 FID: 0
9	SS	65	PID: 0 FID: 0



Depth Scale (m): 0 1 2 3 4 5 6 7 8 9

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

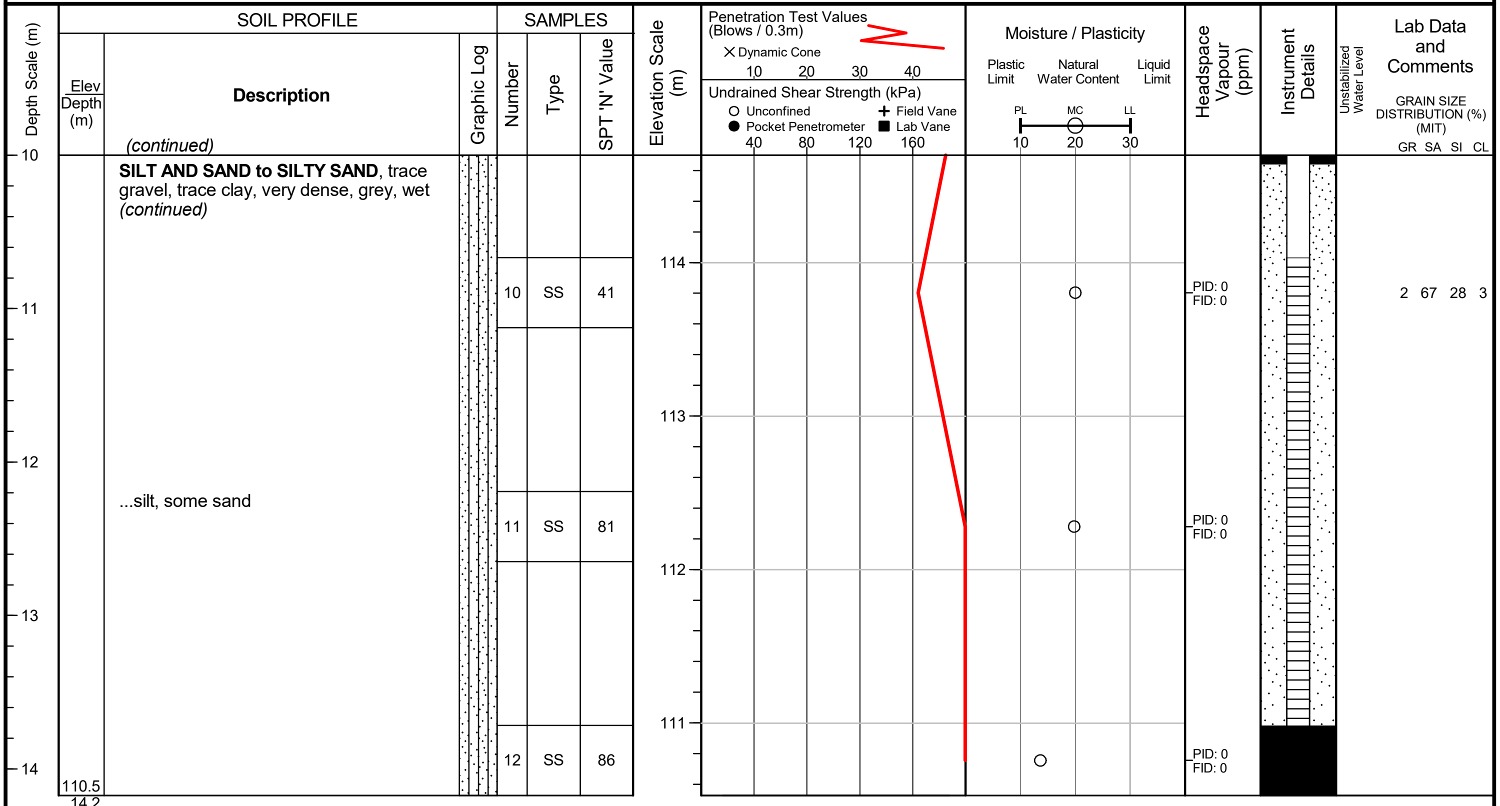
(continued next page)

LOG OF BOREHOLE 6

Terraprobe

Project No.	: 1-19-0603-01	Client : Birch Equities Limited	Originated by : SD
Date started	: October 28, 2019	Project : 1196 - 1210 Yonge St & 2 - 8 Birch Avenue	Compiled by : AR
Sheet No.	: 2 of 2	Location : Toronto, Ontario	Checked by : SZ

Position : E: 629619, N: 4837769 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Hollow stem augers



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SILT AND SAND to SILTY SAND, trace gravel, trace clay, very dense, grey, wet *(continued)*

...silt, some sand

110.5
14.2

Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	GR	SA	SI	CL
10	SS	41	PID: 0 FID: 0	2	67	28	3
11	SS	81	PID: 0 FID: 0				
12	SS	86	PID: 0 FID: 0				

END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

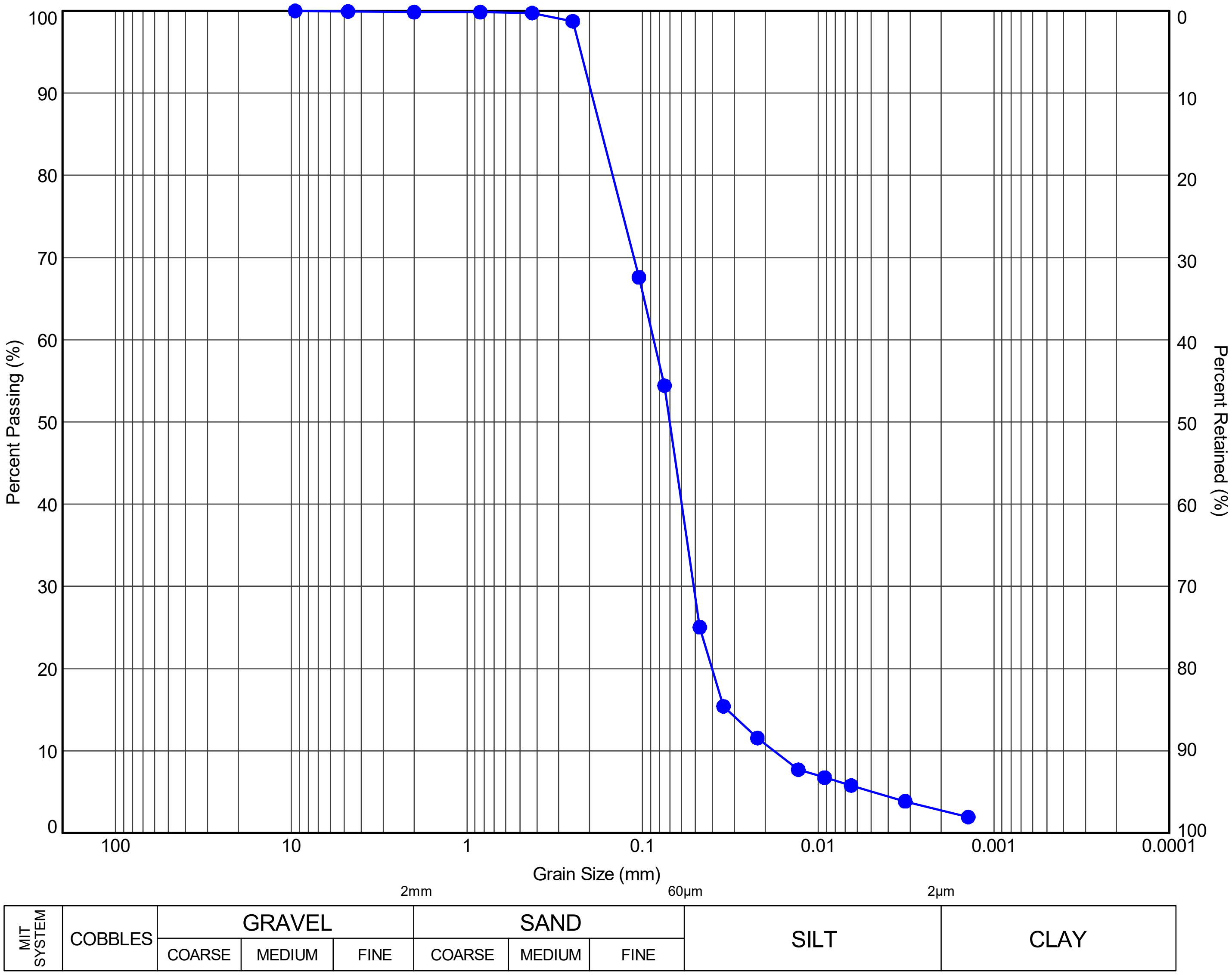
50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	6.5	118.2

APPENDIX B

TERRAPROBE INC.



MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**1**	SS9	9.3	114.3	0	59	38	3	

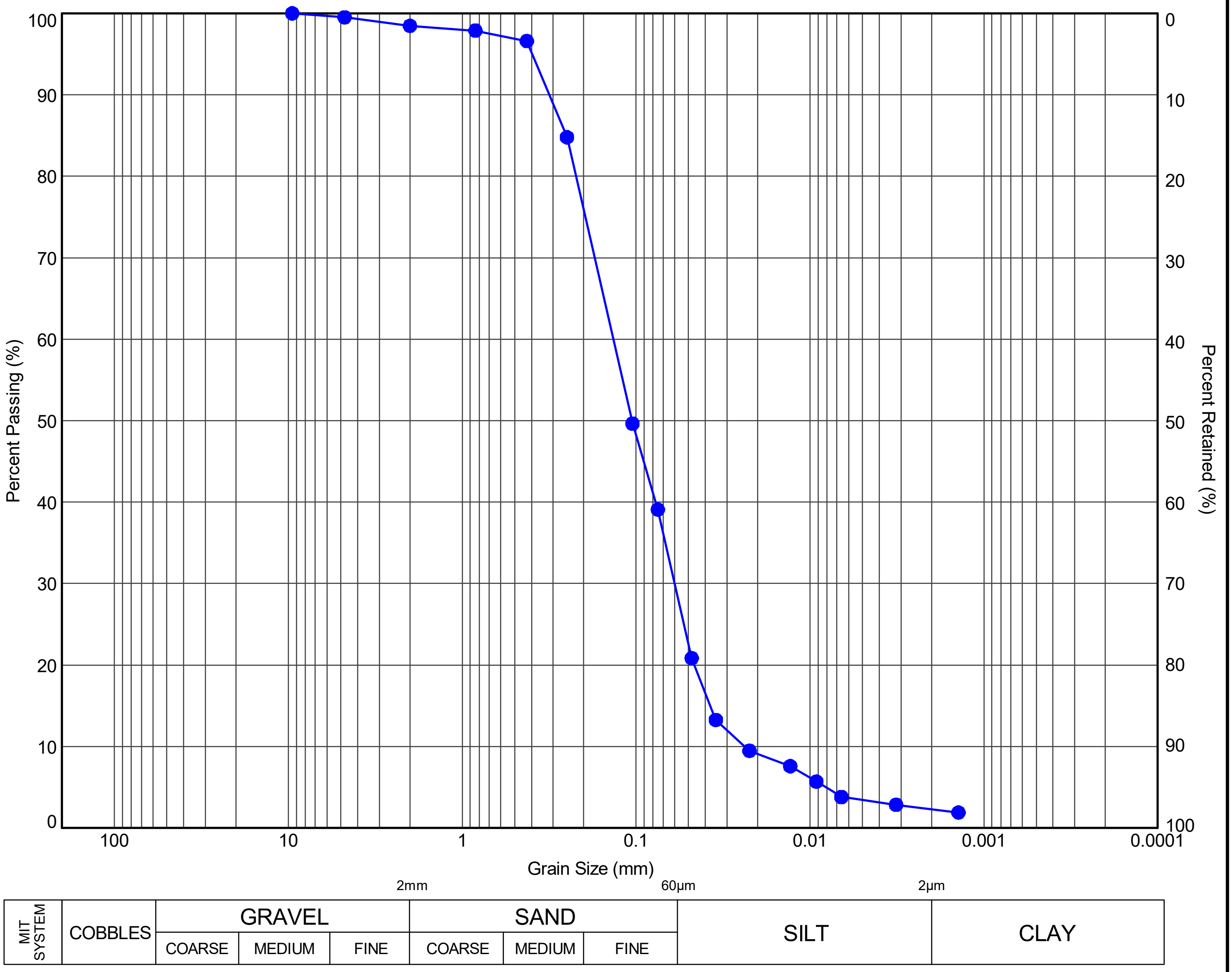
Terraprobe

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

Title:

GRAIN SIZE DISTRIBUTION
SAND AND SILT, TRACE CLAY

File No.: **1-19-0603-01**



MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**2**	SS10	10.8	113.4	2	68	28	2	

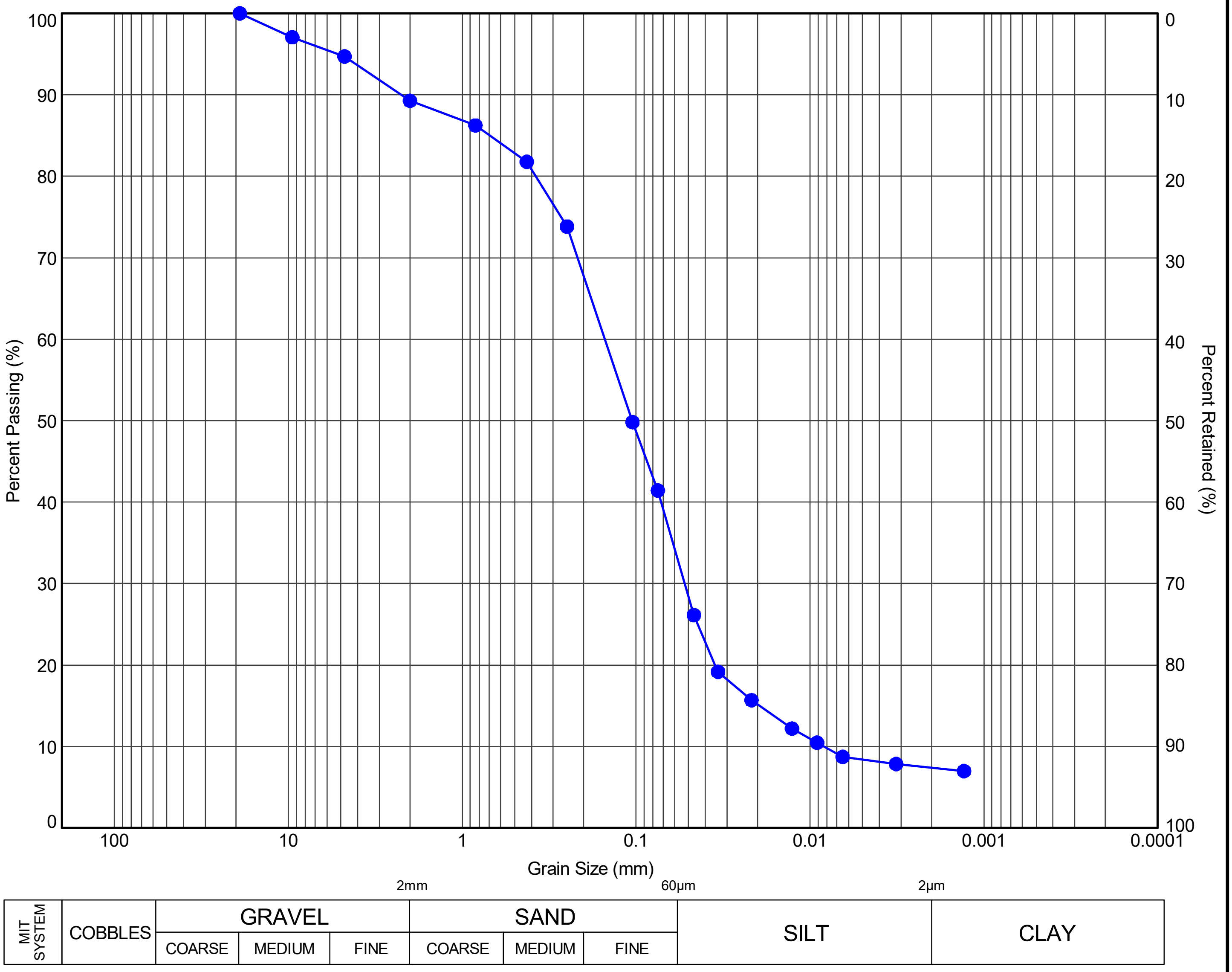
Terraprobe

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

Title:

GRAIN SIZE DISTRIBUTION
SILTY SAND, TRACE CLAY, TRACE GRAVEL

File No.: **1-19-0603-01**



				MIT SYSTEM				
Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
● **3**	SS5	3.3	121.0	11	55	27	7	

Terraprobe

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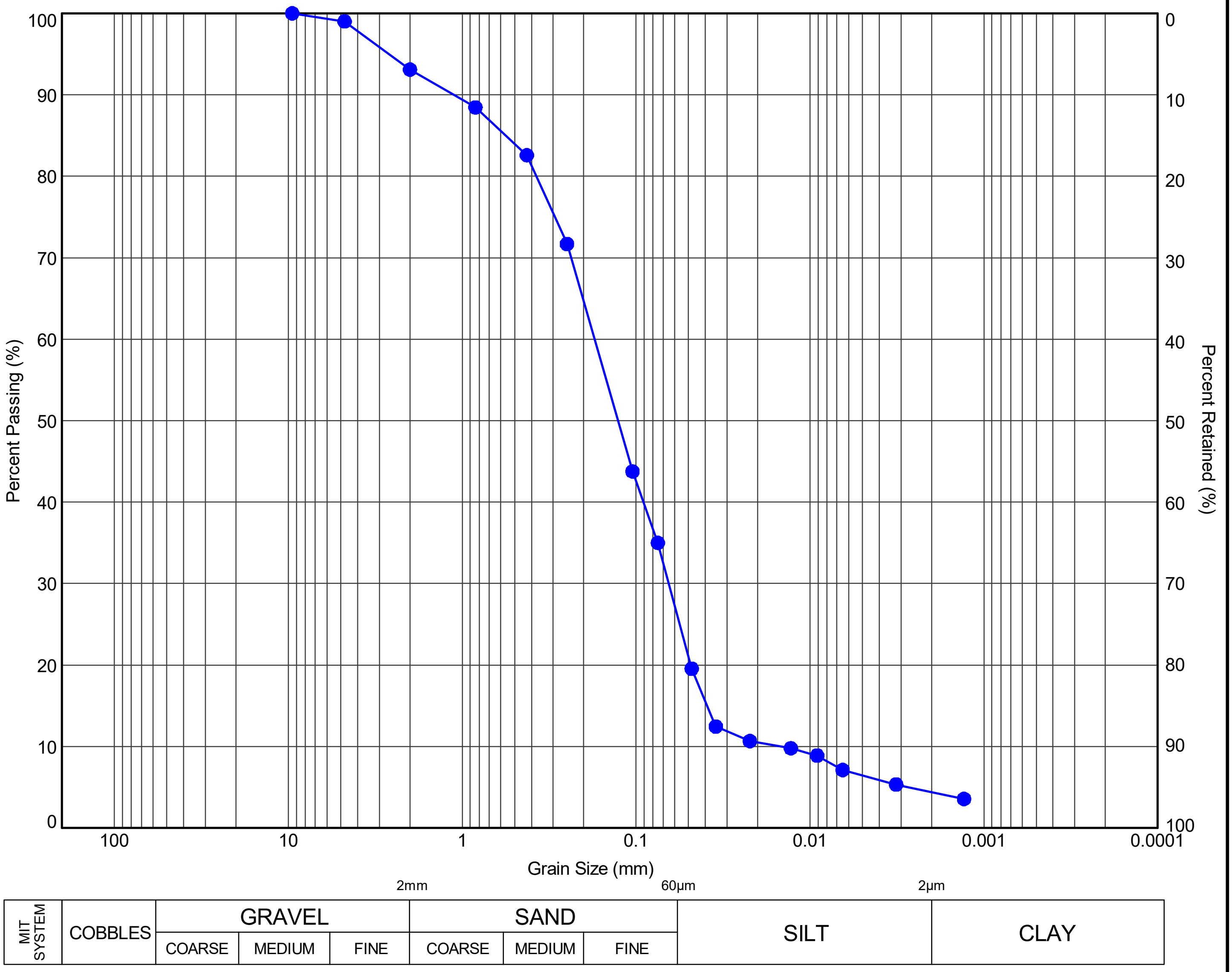
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SILTY SAND, SOME GRAVEL, TRACE CLAY

File No.: **1-19-0603-01**



MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**4**	SS7	4.9	119.5	7	66	23	4	

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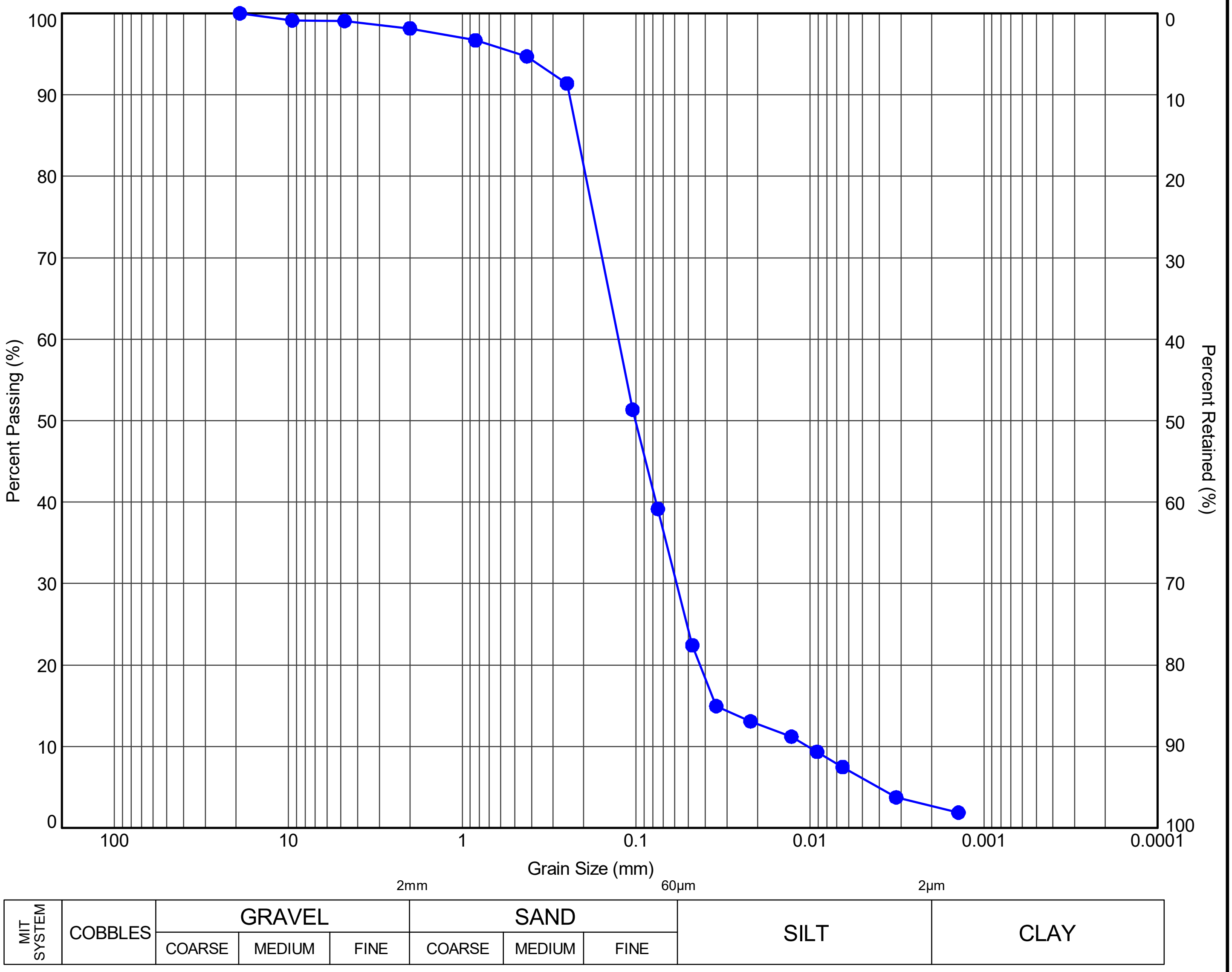
File No.: **1-19-0603-01**



					MIT SYSTEM				
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**6**	SS10	10.9	113.8	2	67	28	3	

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