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Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

A REPORT TO
SCHOOL VALLEY DEVELOPMENTS LTD.

A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

SOUTHWEST OF OLD SCHOOL ROAD AND
HURONTARIO STREET

TOWN OF CALEDON

REFERENCE NO. 2310-S041

JANUARY 2024

DISTRIBUTION

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1.0 INTRODUCTION

In accordance with the email authorization dated October 2, 2023, from Mr. Frank Filippo of School Valley Developments Ltd., a geotechnical investigation was carried out for a property located southwest of Old School Road and Hurontario Street in the Town of Caledon.

The purpose of the investigation was to reveal the subsurface conditions and to determine the engineering properties of the disclosed soils for the design and construction of a proposed residential development.

2.0 SITE AND PROJECT DESCRIPTION

The subject site is located on the south side of Old School Road, approximately 325 m west of Hurontario Street in the southern region of Town of Caledon. It is located within a physiographic region known as the South Slope, situated in between the Oak Ridges Moraine and the Peel Plain. The soil stratigraphy in the area is characterized by sand and silt deposits layered in between an upper Halton Till and a lower Newmarket Till. The sand and silt deposits in the area were identified as part of the Oak Ridges Moraine (ORM) or equivalent unit in the Hydrogeological Assessment for Mayfield West, Phase 2 Stage 3 Lands, prepared by Palmer Environmental Consulting Group Inc. (PECG) in 2018.

At the time of investigation, the property consists of mainly farm fields. The northern and southern portions of site is separated by a forested natural system of the tributaries to the Etobicoke Creek.

Based on the conceptual site plan, the site will be developed as a low- to medium-density residential subdivision, with park and stormwater management (SWM) pond blocks.

3.0 FIELD WORK

The field work, consisting of 12 boreholes extending to a depth ranging from 6.6 to 12.3 m, was carried out between October 10 and 16, 2023. To facilitate the hydrogeological study by PECG, 50-mm diameter monitoring wells were installed at 7 selected borehole locations. The depth and details of the monitoring wells are shown on the corresponding Borehole Logs. The locations of the boreholes and monitoring wells are shown on Drawing No. 1.

The boreholes were advanced at intervals to the sampling depths by a track-mounted machine equipped with solid and hollow stem augers for soil sampling. Split-spoon samples were recovered for soil classification and laboratory testing. Standard Penetration Tests using the procedures described on the enclosed "List of Abbreviations and Terms" were performed at the sampling depths. The relative density of the non-cohesive strata and the consistency of the cohesive strata are inferred from the 'N' values. The field work was supervised and the findings were recorded by a geotechnical technician.

The ground elevation at each borehole location was determined using a handheld equipment of the Global Navigation Satellite System.

4.0 SUBSURFACE CONDITIONS

Beneath the topsoil veneer, the subsoil profile consists of silty clay till in the upper stratigraphy, overlying a sand and silt unit and interstratified with silty clay layers at various depths and locations. At Boreholes SV-105 and 106, a sandy silt till stratum was observed beneath the sands and silts in the lower stratigraphy. Fine/fine to coarse sand deposits were observed in the northeast quadrant of the site.

Detailed descriptions of the encountered subsurface conditions are presented on the Logs of Borehole, comprising of Figures 1 to 12, inclusive. The soil stratigraphy is illustrated on the Subsurface Profile, Drawing No. 2.

Previous borehole investigations and monitoring well installations were carried out by Terraprobe Inc. and PECG in 2009 and 2017. Relevant borehole data from these investigations have been incorporated in this report, and the associated borehole logs are enclosed in the Appendix for reference. A prefix of T- and MW- refers to the boreholes and monitoring wells installed by Terraprobe and PECG, respectively.

The engineering properties of the disclosed soils are discussed herein.

4.1 Topsoil

The revealed topsoil thickness ranges from 15 to 41 cm. Thicker topsoil may be encountered in areas beyond the borehole locations, especially in local low-lying areas. In MW-4, a surficial topsoil layer has a thickness of 1.07 m.

4.2 Silty Clay/Clayey Silt Till and Silty Clay/Clay

The silty clay till/clayey silt till was generally encountered in the upper stratigraphy across the site except in MW-4, where the borehole was terminated in the clay till mantle at a depth of 10.9 m below grade. The till consists of a mixture of particle sizes ranging from clay to gravel, with silt and clay being the dominant fraction. The silty clay, containing a trace of fine sand, was encountered at various depths and locations. Grain size analyses were performed on 2 representative samples of the silty clay till and on a sample of the silty clay, and the results are plotted on Figures 13 and 14, respectively.

The Atterberg Limits of 2 clay till and 1 clay samples and the natural water content values of all the samples were determined; the results are plotted on the Borehole Logs and summarized below:

	Silty Clay Till	**Silty Clay**
Liquid Limit	30% and 37%	42%
Plastic Limit	17% and 20%	21%
Natural Water Content	10% to 24% (median 15%)	18% to 26% (median 20%)

The results indicate that the clay till is low to medium in plasticity and clay is medium in plasticity. Both the clay and clay till are in moist conditions with natural water content values generally below their plastic limits.

The recorded 'N' values of the clay till range from 3 to 70 (blows per 25 cm of penetration), with a median of 23 blows per 30 cm of penetration. This indicates that the clay till is soft to hard, generally being very stiff in consistency. The obtained 'N' values of the clay range from 15 to 38, with a median of 20 blows per 30 cm of penetration, showing that the clay is very stiff to hard, generally being very stiff in consistency. The low 'N' values are generally encountered near the ground surface where the soil was likely disturbed by farming activities and/or weakened by the weathering process. Intermittent hard resistance to augering was encountered in places, indicating the presence of cobbles in the till mantle.

The engineering properties of the silty clay till and clay are listed below:

- High frost susceptibility and low water erodibility.
- In excavation, the clays will be stable in relatively steep cuts; however, prolonged exposure may lead to localized sloughing.

4.3 Silty Fine Sand/Sandy Silt/Silt/Sand and Silt

Beneath the surficial topsoil, a sandy silt/silt deposit was contacted in Boreholes SV-102, SV-103, SV-104, SV-105, SV-106, SV-110 and SV-111. Furthermore, a silty fine sand/sandy silt/silt/sand and silt deposit was encountered in the lower stratigraphy across the site beneath the silty clay till and silty clay, except in MW-4 where sand and silt deposits dominate the soil stratigraphy. Grain size analyses were performed on representative samples of the silty fine sand, sandy silt and silt, and the results are plotted on Figures 15 to 17, respectively.

The obtained natural water content values range from 3% to 25%, with a median of 20%, indicating that the sands and silts are dry to wet, generally in a very moist to wet condition. Sample examination revealed that the lower zone of the unit, below depths of 4.0 to 6.0 m, is generally water bearing.

The recorded 'N' values range from 5 to 70, with a median of 23 blows per 30 cm penetration, indicating relative densities of loose to very dense, generally being compact. The loose soils encountered near the ground surface were likely disturbed or weakened by weathering.

The engineering properties of the silty fine sand/sandy silt/sand and silt are listed below:

- High capillarity and water retention capability.
- Highly frost susceptible, with high soil-adfreezing potential.
- High water erodibility, the fine particles will migrate through small openings under seepage pressure.
- The shear strength is mainly derived from internal friction. The wet silts and sands are susceptible to dynamic disturbance, which will induce a build-up of pore water pressure, resulting in soil dilation and a reduction in shear strength.
- In excavation, the silts and sands will remain stable for a short period of time and may slough readily. The wet silts and sands will run with seepage, and boil under an approximate piezometric head of 0.4 m.

4.4 <u>Sand</u>

Fine and fine to coarse grained sand layers were found in Boreholes SV-107, SV-108 and MW-8, generally in the northeast quadrant of the site. Both Boreholes SV-107 and MW-8 were terminated in the sand stratum. Occasional fine sand layers were also observed embedded in the silty sand/sandy silt deposit in other boreholes. The sand contains a trace to some silt and a trace of clay. Grain size analyses were performed on 3 sand samples; the gradations are plotted on Figure 18.

Sample examination revealed that the sand is moist in the upper stratigraphy, becoming wet in the lower zone, with natural water content values varying from 6% to 22% and a median of 7%. The sand at the bottom of Boreholes SV-107 and MW-8 is wet.

The sand is loose to dense, generally being compact in relative density, with obtained 'N' values ranging from 9 to 37, and a median of 25 blows per 30 cm of penetration.

The engineering properties of the sand are listed below:

- Water erodible material.
- In excavation, the sand will slough to its angle of repose, run with water seepage and boil with a piezometric head of about 0.3 to 0.4 m.

4.5 Sandy Silt Till

Sandy silt till was encountered beneath the clay till in Borehole SV-109 overlying the silty fine sand/sandy silt stratum. In Boreholes SV-105 and SV-106, the silt till stratum was encountered beneath the sand/silt and clay deposits; both boreholes were terminated in the till stratum. The till is cemented with a trace to some clay, and is laminated with sand and silt seams and layers. Hard resistance to augering was encountered in the lower zone of the boreholes, indicating the presence of cobbles in the till mantle. A grain size analysis was performed on a representative sample of the till; the result is plotted on Figure 19.

The natural water content values of the till range from 7% to 14%, with a median of 8%, indicating that the till is generally in a moist condition.

The obtained 'N' values range from 47 to over 50, with a median of over 50 blows per 30 cm penetration, indicating that the relative density of the till is dense to very dense, being generally very dense.

The engineering properties of the sandy silt till are listed below:

- Highly frost susceptible and moderately low water erodibility.
- The till will be relatively stable in relatively steep excavation; however, if remained open for an extended period of time, localized sloughing may occur.

4.6 Compaction Characteristics of the Revealed Soils

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied. As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

Table 1 - Estimated Water Content for Compaction

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Silty Clay Till	10 to 24 (median 15)	18	15 to 22
Silty Clay	18 to 26 (median 20)	20	16 to 24
Sandy Silt Till	7 to 14 (median 8)	10	6 to 15
Silty Fine Sand/Sandy Silt/ Silt/Sand and Silt	3 to 58 (median 20)	12	8 to 16
Fine/Fine to Coarse Sand	6 to 22 (median 7)	8 to 9	6 to 11

The above values show that the tills and clay are generally suitable for structural backfill, and the addition of water may be required prior to structural compaction in the dry and warm seasons and in areas where compaction is best performed on the wet side of the optimum. Wet silts and sands can be stockpiled to drain the excess water prior to structural compaction.

The lifts for compaction should be limited to 20 cm, or to a suitable thickness assessed by test strips performed by the compaction equipment. Boulders larger than 15cm in size must be sorted and removed from the backfill.

5.0 GROUNDWATER CONDITION

Groundwater levels were detected in 5 of the 12 boreholes upon completion of drilling in October 2023. In December 2023, stabilized groundwater levels were recorded from the installed monitoring wells in by PECG; these levels are tabulated in Table 2.

Stabilized water levels were recorded at depths ranging from 3.54 to 8.83 metres below ground surface (mbgs), or from El. 262.08 to 255.44 m. The groundwater records are generally consistent with or near the observed wet sands and silts at the boreholes. The groundwater regime is subject to seasonal fluctuations. Detailed groundwater profile and monitoring records should be referred to the hydrogeological study by PECG.

Table 2 - Groundwater Levels

Borehole/ Monitoring Well No.	Ground El. (m)	Well Depth (m)	Measured Groundwater Levels					
			On Completion		Dec. 6, 2023		Dec. 12-13, 2023	
			Depth (m)	El. (m)	Depth (m)	El. (m)	Depth (m)	El. (m)
SV-101	266.1	-	3.7	262.4	No Well			
SV-102	264.6	5.8	N/A[a]	-	4.02	262.08	-	-
SV-103	264.1	6.1	N/A[a]	-	3.54	260.56	-	-
SV-104	264.1	-	5.5	258.6	No Well			
SV-105	264.7	-	Dry	-	No Well			
SV-106	264.9	9.1	N/A[a]	-	6.13	258.77	6.11	258.79
SV-107	265.1	10.7	10.1	255.0	8.65	256.45	-	-
SV-108	264.3	10.7	9.1	255.2	7.00	257.30	7.96	256.34
SV-109	263.6	6.1	5.9	257.7	4.61	258.99	4.64	258.96
SV-110	263.6	-	Dry	-	No Well			
SV-111	263.7	-	Dry	-	No Well			
SV-112	262.9	6.1	Dry	-	Dry	-	Dry	-
T-1	263.0	9.6	6.4[b]	256.6	6.59	256.65	-	-
T-2	264.3	9.6	8.8[b]	255.5	8.70	255.44	-	-
MW-4	266.0	7.92	4.59[c]	261.41	4.48	261.52	-	-
MW-8	265.0	11.28	9.00[c]	256.00	8.83	256.17	-	-

[a] Water was used during the drilling operation; measurement of groundwater level was not feasible upon completion of drilling.

[b] Water level measured on completion on February 12, 2009.

[c] Water level measured on completion on November 15, 2017.

6.0 DISCUSSION AND RECOMMENDATIONS

Beneath the topsoil veneer, the subsoil profile consists of generally very stiff silty clay till in the upper stratigraphy, overlying a generally compact sand and silt unit and interstratified with very stiff silty clay at various depths and locations. At Boreholes SV-105 and 106, a very dense sandy silt till stratum was observed beneath the sands and silts in the lower stratigraphy. Generally compact sand deposits were observed in the northeast quadrant of the site. The surficial weathered zone extends to depths of 0.6 to 1.2 m below grade.

Stabilized water levels were recorded at depths ranging from 3.54 to 8.83 mbgs, or from El. 262.08 to 255.44 m. The groundwater records are generally consistent with or near the observed wet sands and silts at the boreholes. The groundwater regime is subject to seasonal fluctuations.

It is understood that the site will be developed as a low- to medium-density residential subdivision with park and SWM pond blocks. A bridge crossing will also be constructed in the vicinity of Boreholes SV-105 and SV-106 to connect the development north and south of the natural tributaries system. The development will be provided with municipal services and paved roadways meeting municipal standards. The following geotechnical considerations warrant special attention:

1. The topsoil must be stripped for development; it can be reused for general landscaping purposes only.
2. The weathered soil should be inspected prior to any placement of earth fill for site grading purpose. Where required, the weathered soil should be subexcavated, sorted free of any organic, topsoil, and/or other deleterious material, before reusing for structural backfill.
3. Where additional fill is required for site grading, the earth fill can be placed in an engineered manner for conventional footing construction, site services support and road construction.
4. The engineered fill and the sound native soils are suitable for supporting structures founded on conventional spread and strip footings.
5. In view of the underlying wet sands and silts, it is recommended that the basement floor be founded at least 1.0 m above the seasonal high groundwater level. Otherwise, underfloor subdrain systems and/or waterproofing of basements should be implemented to relieve any groundwater upfiltration due to seasonal fluctuation of the groundwater.
6. A Class ‘B’ bedding, consisting of compacted 19-mm Crusher-Run Limestone (CRL), is recommended for the construction of underground services. Where services installation extends into the saturated sands and silts, or where dewatering is required, a Class ‘A’ concrete bedding should be considered for pipe support.
7. Groundwater seepage from the tills and clay will likely be removable by conventional pumping from sumps during construction. Excavation extending into the saturated soils will require construction dewatering.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes, and the assessment given herein is general in nature based on the borehole findings. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 Site Preparation

The topsoil and vegetation at the ground surface must be removed for development. Where additional fill is required for site grading, the earth fill can be placed in an engineered manner for conventional footing construction, site services support and road construction. The engineering requirements for a certifiable fill are presented below:

1. The subgrade must be inspected and proof-rolled prior to any fill placement. Badly weathered soils should also be subexcavated, sorted free of topsoil inclusions and deleterious materials, if any, aerated and properly compacted in layers.
2. Inorganic soils must be used for the fill, and they must be uniformly compacted in lifts of 20 cm thick to at least 98% Standard Proctor Dry Density (SPDD) up to the proposed finished grade. The soil moisture must be properly controlled near the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% SPDD.
3. If the engineered fill is compacted with the moisture content on the wet side of the optimum, the underground services and pavement construction should not begin until the pore pressure within the fill mantle has completely dissipated. This must be further assessed at the time of the engineered fill construction.
4. If imported fill is to be used, it should be inorganic soils, free of deleterious or any material with environmental issue or contamination. Any potential imported earth fill from off-site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before being hauled to the site.
5. The fill operation must be inspected on a full-time basis by a technician under direction of a geotechnical engineer.
6. The engineered fill should not be placed during period when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow. If the engineered fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.

7. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors.
8. The foundations and underground services subgrade must be inspected by the geotechnical consulting firm that inspected the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
9. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the foundations must be properly reinforced, or be designed by the structural engineer for the project. The total and differential settlements of 25 mm and 20 mm, respectively, should be considered in the design of the foundation founded on engineered fill.
10. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of the excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.

6.2 Foundation

Based on the borehole information, the following bearing pressures are recommended for house structures supported on conventional strip and spread footings founded onto engineered fill or sound native soils below the disturbed or weathered soils.

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 100 kPa
- Factored Ultimate Bearing Pressure at Ultimate Limit State (ULS) = 150 kPa

The total and differential settlements of footing designed for the recommended bearing pressure at SLS are estimated at 25 mm and 20 mm, respectively.

The footing subgrade must be inspected by a geotechnical engineer, or a senior geotechnical technician, under the supervision of a geotechnical engineer, to ensure that the revealed conditions are compatible with the design of the foundation.

Footings exposed to weathering, or in unheated areas, should have at least 1.2 m of earth cover for protection against frost action.

Where the footing excavation consists of wet sands and/or silts, or the footing subgrade is saturated, a concrete mud-slab of lean mix concrete, 8 to 10 cm in thickness, should be poured immediately after subgrade preparation and inspection to protect the approved subgrade against disturbance by the construction traffic.

The foundation should meet the requirements specified by the latest Ontario Building Code, and the structures can be designed to resist a minimum earthquake force using Site Classification ‘D’ (stiff soil).

Higher bearing pressures may be provided depending on location and foundation design depth. This can be confirmed once the design and grading specifications are available for review.

6.3 **Basement Structure**

Where house basements are proposed, they should be designed for the lateral earth pressure using the soil parameters provided in Table 5.

Wet sand and silt deposits were observed throughout the site at various depths. It is therefore recommended that the basement floor be founded at least 1.0 m above the seasonal high groundwater level. In conventional basement design, perimeter walls of the basement structure should be damp-proofed and provided with perimeter subdrains at the wall base. Backfill of the open excavation should consist of free-draining granular material (Drawing No. 3) unless prefabricated drainage board is installed over the entire wall below grade.

Should the basement floor be founded less than 1.0 m above the groundwater table, underfloor subdrains (Drawing No. 4) should be provided to supplement the perimeter subdrain system to relieve any groundwater upfiltration due to seasonal fluctuation. If the basement floor is to be founded less than 0.5 m above the groundwater table, the basement structure should be waterproofed and designed for hydrostatic uplift pressure. The subdrains, connected to a positive outlet, should be encased in a fabric filter to protect them against blockage by silting.

The subgrade of the basement slab must consist of sound native soil or well compacted inorganic earth fill or engineered fill. The subgrade should be inspected and assessed by proof-rolling prior to slab-on-grade construction. Where loose or soft subgrade is detected, it should be subexcavated and replaced with inorganic material, compacted to at least 98% SPDD.

The concrete slab should be constructed on a minimum 15 cm thick granular base, consisting of 19-mm CRL, or equivalent, compacted to its maximum SPDD. Where underfloor weepers are required, the bedding should be increased to 30 cm in thickness. In addition, a vapor barrier should be placed between the granular bedding and the concrete slab to prevent upfiltration of water vapour.

The external grading must be designed to drain surface runoff away from the structures to minimize the frost heave phenomenon generally associated with the disclosed soils.

6.4 Underground Services

A Class 'B' bedding is recommended for construction of the underground services. The bedding material should consist of compacted 19-mm CRL, or equivalent, compacted to at least 98% SPDD. In the saturated sand and silt deposits, a Class 'A' bedding should be considered for proper pipe support.

The subgrade for underground services should consist of sound native soils or properly compacted earth fill. Where soft or loose soil is encountered at the invert level, it must be subexcavated and replaced with properly compacted bedding material.

The pipe joints connecting into manholes and catch basins should be leak-proof or wrapped with an appropriate waterproof membrane to prevent migration of fines due to leakage, leading to a loss of subgrade support and subsequent pipe collapse.

Openings to subdrains and catch basins should be shielded by a fabric filter to prevent silting. In order to prevent pipe floatation when the service trench is deluged with water derived from precipitation, a soil cover with a thickness of at least the diameter of the pipe should be in place at all times after completion of the pipe installation.

The service pipes and metal fittings should be protected against corrosion. For estimation of anode weight requirements, the electrical resistivities of the disclosed soils presented in Table 5 can be used. The proposed anode weight must meet the minimum requirements as specified by the Town of Caledon or Region of Peel.

6.5 Backfilling Trenches and Excavated Areas

The on-site inorganic soils are suitable for trench backfill. The addition of water may be required for the tills and clay prior to structural compaction during dry and warm weather and in areas where compaction is best performed on the wet side of the optimum. Wet sands and silts will require aeration prior to their use as structural backfill. The tills should be sorted free of large cobbles and boulders (over 15 cm in size).

The backfill material should be compacted to at least 95% SPDD. In areas below the slab-on-grade and in the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% SPDD with a moisture content 2% to 3% drier than the optimum. This is to provide the required stiffness for floor or pavement construction. The lift of each backfill layer should be limited to a thickness of 20 cm, or the thickness should be determined by test strips at the time of compaction.

In normal construction practice, the problem areas of pavement settlement largely occur adjacent to foundation walls, columns, manholes, catch basins and services crossings. In areas which are inaccessible to a heavy compactor, sand backfill which can be appropriately compacted using a smaller vibratory compactor should be used.

One must be aware of possible consequences during trench backfilling and exercise caution as described below:

- To backfill a deep trench, one must be aware that the future settlement is to be expected, unless the sides is flattened to 1V:2H, and the lifts of the fill and its moisture content are stringently controlled; i.e. lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 98% SPDD, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand and the compaction must be carried out diligently, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section.
- In areas where the underground services construction is carried out during the winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to the final surfacing of the new pavement and slab-on-grade construction.
- When construction is carried out in the winter, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in-situ soil have a water content on the dry side of the optimum, it would be impossible to wet the soil due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction.

Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as when the trench box is removed. The above will invariably cause backfill settlement that may become evident within several years after construction.

- In areas where groundwater movement is expected in the sand fill mantle, anti-seepage collars should be provided.

6.6 Pavement Design

The recommended pavement design for residential local and neighbourhood collector/through roads, satisfying the minimum requirement from the Town of Caledon, is provided in Table 3.

Table 3 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface		
Local Residential	40	HL3
Collector/Through Road	40	HL3
Asphalt Binder		
Local Residential	65	HL8
Collector/Through Road	90	HL8
Granular Base	150	Granular ‘A’ or equivalent
Granular Sub-base		Granular ‘B’ or equivalent
Local Residential	300	
Collector/Through Road	450	

In preparation of the pavement subgrade, all topsoil and compressible material should be removed. The subgrade should be proof-rolled and inspected. Any soft spots identified must be subexcavated and replaced with inorganic earth fill. The subgrade within 1.0 m below the underside of the granular sub-base must be compacted to at least 98% SPDD, with a water content at 2% to 3% drier than the optimum. All the granular bases should be compacted to 100% SPDD.

The pavement subgrade will suffer a strength regression if water is allowed to infiltrate the mantle. The following measures should be incorporated in the construction procedures and pavement design:

- The pavement subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.

- Lots areas adjacent to the road should be properly graded to prevent ponding of large amounts of water. Otherwise, the water will seep into the subgrade mantle and induce a regression of the subgrade strength, with costly consequences for the pavement construction.
- In extreme cases during the wet seasons, if soft or weak subgrade is identified, it can be replaced by compacted granular material to compensate for the inadequate strength of the soft or weak subgrade. This can be assessed during construction.
- Fabric filter-encased curb subdrains are required to meet the Town of Caledon requirements.

6.7 Bridge Crossing

A new bridge crossing will be constructed across the natural system in the vicinity of Boreholes SV-105 and SV-106. Detail design of the bridge crossing is not available for review at the time of report preparation.

Shallow Foundation

The bridge abutments may be supported on conventional spread footings with restricted bearing capacities, founded onto the stiff to very stiff silty clay and silty clay till while remaining above the sandy/silty deposit. The recommended bearing pressures at or above an approximate founding depth of El. 261.0 m are as follows:

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 200 kPa
- Factored Bearing Pressure at Ultimate Limit State (ULS) = 300 kPa

The total and differential settlements of footing designing for SLS are estimated at 25 mm and 20 mm, respectively.

Deep Foundation for the Abutments and Piers

Due to the proximity of the tributary and wet subsoils with limited bearing capacity, construction of shallow foundations may be difficult. Deep foundation, such as driven H-piles, can be considered for bridge abutments and piers extending past the wet silty sand/silty sand unit and into the very dense sandy silt till below El. 254.0 m. The piles must not rest in the silty sand/sandy silt unit which is subject to dilation under vibratory driving forces. It is recommended that the piles be extended at least 3 m into the hard or very dense till with ‘N’ values greater than 50 blows. In view that there is insufficient subsoil data to support this design, deeper boreholes should be carried out once the bridge crossing location and details are confirmed.

For preliminary design with typical driven pile sizes of HP310x110 and HP360x174, the recommended geotechnical resistances are 625 kN (SLS) and 750 kN (ULS), and 875 kN (SLS) and 1000 kN (ULS), respectively. Other specific sizes and associated resistance capacities can be provided upon request. The actual refusal criteria of pile driving should be established once the chosen pile size and the design loads are known. Cast steel drive shoes, as per OPSD 3000.100, will be required in order to protect the driven pile toe into the till deposit. Full time monitoring of the pile driving operation by a geotechnical technician is necessary in order to assess the pile capacity at refusal. In order to verify the design pile capacity, static load test or Pile Driving Analyser (PDA) must be performed on selected piles at each abutment and pier. Integral abutments can also be supported on H-piles, with a minimum pile embedment of 0.6 m into the concrete cap.

The settlement of piles designed for the load resistance at SLS are estimated to be less than 25 mm.

Lateral Resistance

Lateral loading can be resisted fully or partially by the use of battered steel H-piles. For vertical piles, the resistance to lateral loading will have to be derived from the soil in front of the pile support. The geotechnical lateral resistance may be calculated using the coefficient of horizontal subgrade reaction (k_s) and the ultimate lateral resistance (p_{ult}):

Cohesive Soil:	$k_s = 67\ S_u/D$	and	$p_{ult} = 9\ S_u$
Cohesionless Soil:	$k_s = n_h\ z/D$	and	$p_{ulkt} = 3\ \gamma z\ K_p$

where
S_u = undrained shear strength (kPa)
z = depth of pile embedment (m)
n_h = coefficient related to soil relative density (MN/m^3)
D = pile width/diameter (m)
γ = bulk unit weight of soil in overburden [or γ' in submerged condition] (kN/m^3)
K_p = coefficient of passive earth pressure

The soil parameters for the calculation of k_s are summarized in Table 4.

Table 4 - Soil Parameters for Lateral Resistance of Pile

Soil Type	γ (kN/m^3)	n_h (MN/m^3)	S_u (kPa)	K_p
Silty Clay	20.5	-	100	-
Silty Clay Till	22.0	-	150	-
Silty Sand/Sandy Silt	10.5 (submerged)	4.4	-	3.12
Sandy Silt Till	22.5	18	-	3.39

The computed resistance should be multiplied by a geotechnical resistance factor of 0.5. The design of piles and load capacities should be reviewed by the geotechnical engineer before finalization.

Group Pile Efficiency

Where multiple piles are required to support the structure, it is recommended that the spacing between piles must be at least 3 times the diameter or width of the pile. Pile group action for axial resistance should be considered, and can be evaluated by applying a reduction factor as listed below:

Pile Spacing:	8B	6B	4B	3B
Reduction Factor:	1.0	0.9	0.75	0.7

Pile group action for lateral resistance can also be evaluated as listed below:

Pile Spacing:	8B	6B	4B	3B
Reduction Factor:	1.0	0.7	0.4	0.25

Wing Wall Foundation

Wing walls, constructed with cast-in-place concrete, can be supported on strip footings founded below the frost penetration depth of at least 1.2 m below the proposed grade, onto the sound native soil or engineered fill with the following recommended soil bearing pressures:

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 150 kPa
- Factored Bearing Pressure at Ultimate Limit State (ULS) = 250 kPa

The total and differential settlements of wall footings, designing for the bearing pressure at SLS, are estimated to be 25 mm and 20 mm, respectively.

Alternatively, Reinforced Soil Slope (RSS) wall can be used for the wing wall. The RSS wall should be designed in accordance with the MTO Guideline. A 300 mm thick granular bedding, consisting of Granular 'A' compacted to 100% SPDD, will be required beneath the wall facing units after the subgrade is inspected.

The footing subgrade must be inspected prior to the construction of the wing walls. Stepped down footings may be specified with a maximum step height of 0.6 m and a minimum step length of 1.2 m, founded on the sound native soil or engineered fill.

Frost and Scour Protection

All pile caps and footings should be founded below the frost penetration depth, with a soil cover not less than 1.2 m. Where the abutments are constructed in close proximity of the watercourse/tributary, the foundation should extend either below the scouring depth or the frost depth, whichever is greater.

Scouring protection scheme, such as using R10 Rip-Rap, at least 300 mm in thickness, should be provided along the watercourse.

Seismic Consideration

Based on the Canadian Highway Bridge Design Code, the bridge abutments on piles driven into the very dense tills should be designed to resist an earthquake force using Site Classification 'C'. Conventional shallow bridge foundation and wing wall foundations can be designed using Site Classification 'D' (stiff soil).

General Construction

A construction platform and access driveway will be required for the access of machinery and construction equipment near the crossing. Temporary erosion and sediment control plan must be implemented during construction to prevent unnecessary disturbance to the natural system and the tributary. The erosion and sediment control plan should be reviewed and approved by the Toronto and Regional Conservation Authority (TRCA).

For construction of the bridge abutments and piers, the tributary may be temporarily diverted, where necessary. Where excavation extends into the wet silty sand/sandy silt unit, dewatering will be required to draw down the groundwater to approximately 1 m below the intended bottom of excavation. Dewatering details such as the method, rate and volumes should be verified with the hydrogeologist and the dewatering contractor. Sheeting enclosures may also be required to limit the extent of excavation and disturbance into the natural system.

Embankment and Wing Wall Backfill

Should embankment heights be raised significantly higher than the original grade, consolidation settlement of the subsoils will occur. Primary consolidation settlement in the fine-grained subsoil can be expected. This should be further assessed once detailed embankment design is available for review.

Prior to the construction of embankment, the ground must be free of compressible topsoil and deleterious material. The subgrade must be proof-rolled and inspected before earth filling. Any soft/weak material as identified must be subexcavated and replaced with properly compacted inorganic earth fill.

The wing walls should be backfilled with free draining, non-frost susceptible granular fill to at least 1.2 m behind the wall structure. This is to prevent the build up of hydrostatic pressure and the development of any frost action against the wall structure. Weep holes and/or subdrains should be specified to dissipate any water collected behind the walls.

The road embankment towards the bridge crossing should be graded with a slope gradient of 1V:3H or gentler. Where applicable, flood protection should be considered for any portions of the embankment that will extend to below the flood line.

The sloping ground of embankment should be covered with 300-mm thick topsoil layer, sodded or vegetated to prevent surficial erosion. Prior to sodding and growth of vegetation, an erosion control blanket may be utilized.

6.8 Stormwater Management Ponds

Three SWM ponds (SWM 10, 11 and 12) are proposed in different regions of the subdivision, adjacent to the natural system. Detailed designs of the ponds were not available for review at the time of report preparation.

Pond Liner

SWM 10

Based on the findings of Borehole SV-112, the area of SWM 10 is underlain by firm to hard silty clay till, overlying moist, dense silty fine sand/sandy silt at or below an approximate depth of 5.6 m below grade. The borehole remained dry upon completion of drilling and the monitoring well remained dry during water level measurement in December 2023. The need of a clay liner is not anticipated should the pond design remain within the silty clay till deposit, with sufficient thickness of the low-permeable overburden above the underlying sand/silt unit. However, should the pond extend close to or into the sandy/silty deposit, an earthen clay liner (with an estimated permeability of 10^{-7} cm/sec or less) or a geosynthetic clay liner (GCL) with soil ballast will be required.

SWM 11 and 12

The subsoil profile at both SWM 11 (Borehole SV-104) and 12 (SV-108) consists of a clay or clay till cap within the surficial 2 m below grade, beyond which the ponds will likely extend into the silty fine sand/sandy silt deposit. The water level records from the nearby MW-4 and SV-108 suggests that the shallow groundwater regime lies within the sand/silt deposit at depths of 4.48 to 7.0 m, or at El. 261.52 m and El. 257.3 m, respectively, and may be higher during wet seasons. An earthen clay liner or GCL with a soil ballast will be required for SWM 11 and 12 construction.

The appropriate thickness of the clay liner or ballast to counteract hydrostatic uplift concerns, if any, and the extent of the liner can be established once the pond elevations are available for review.

Pond Berm Construction

The side slopes of the ponds should be graded at 1V:3H or flatter for stability above the wet perimeter, and 1V:4H or flatter below the wet perimeter. All exposed side slopes must be vegetated and/or sodded to prevent surface erosion.

Any proposed earth embankments should be constructed using selected on-site inorganic clay or clay till material, compacted to at least 98% SPDD in lifts of no more than 20 cm in thickness. The subgrade must be inspected and proof-rolled prior to any fill placement. The construction of the berms must be supervised and certified by the site geotechnical engineer. The pond side slopes should be surface compacted.

Control Structures

The following bearing pressures can be used for the design of control structures supported on conventional footings founded on sound native soils or on engineered fill:

- Soil Bearing Pressure at SLS: 120 kPa
- Factored Ultimate Soil Bearing Pressure at ULS: 600 kPa

The footings must be placed below the scouring depth and be provided with a minimum earth cover of 1.2 m to protect them from frost damage. The inlets and outlets of the ponds must be lined with gabion mats, rip rap or equivalent measures for protection against scouring.

The foundation for the control structures should meet the requirements specified by the latest Ontario Building Code, and the structures should be designed to resist a minimum earthquake force using Site Classification 'D' (stiff soil).

General Considerations

The excavation for the liner construction may extend below the groundwater table. During construction of the SWM ponds, the groundwater should be depressed, or any seepage must be removed by pumping from sumps to provide a stable subgrade for installation.

One should be aware that minor maintenance may be required after rapid drawdown as the water recedes from a flood level to normal level. Routine visual inspection and maintenance will be required to rectify any observed deficiency.

6.9 Soil Parameters

The recommended soil parameters for the project design are given in Table 5.

Table 5 - Soil Parameters

Unit Weight and Bulk Factor	Unit Weight (kN/m^3)		Estimated Bulk Factor	
	Bulk	Submerged	Loose	Compacted
Silty Clay Till	22.0	12.0	1.33	1.03
Sandy Silt Till	22.5	12.5	1.33	1.05
Silty Sand/Sandy Silt/Silt	20.5	10.5	1.20	1.00
Sand	20.0	10.0	1.25	1.00

Table 5 - Soil Parameters (Cont'd)

Lateral Earth Pressure Coefficients	**Active K_a**	**At Rest K_o**	**Passive K_p**
Compacted Earth Fill and Silty Clay	0.40	0.55	2.50
Silty Clay Till	0.33	0.50	3.00
Sandy Silt Till	0.29	0.46	3.39
Silty Sand/Sandy Silt/Silt	0.32	0.48	3.12
Sand	0.29	0.46	3.39

Estimated Coefficients of Permeability (K) and Percolation Time (T)	**K (cm/sec)**	**T (min/cm)**
Silty Clay Till and Silty Clay	10^{-7}	80+
Sandy Silt Till	10^{-5} to 10^{-6}	20 to 50
Silty Sand/Sandy Silt	10^{-3} to 10^{-4}	8 to 12
Silt	10^{-5}	20
Sand	10^{-2} to 10^{-3}	4 to 8

Estimated Electrical Resistivities	**(ohm·cm)**
Silty Clay Till	4000
Silty Clay	3500
Sandy Silt Till	4500
Silty Sand/Sandy Silt/Silt	5500
Sand	5500

Coefficients of Friction	
Between Concrete and Granular Base	0.50
Between Concrete and Native Soils or Compacted Earth Fill	0.35

6.10 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91. The types of soils to be excavated are classified in Table 6.

Table 6 - Classification of Soils for Excavation

Material	Type
Sound Tills and Silty Clay	2
Weathered Soils, Silt and Sand (above groundwater)	3
Saturated Soils	4

In excavation, the groundwater seepage from the tills and clay will likely be limited in quantity and can be removed by conventional pumping from sumps. However, excavation extending into the saturated soils will require more extensive construction dewatering. The wet silty fine sand/sandy silt and silt, will slump readily, leading to sloughing and migrate/run with seepage and boil under an approximate piezometric head of 0.4 m.

In order to provide a stable subgrade for the services or foundation construction, the groundwater should be depressed to at least 1.0 m below the intended bottom of excavation. Detailed groundwater profile and dewatering needs should be referred to the hydrogeological report by PEGG.

Excavation into the very stiff to hard and dense to very dense tills containing cobbles and boulders will require extra effort and the use of a heavy-duty, properly equipped backhoe.

Prospective contractors should assess the in situ subsurface conditions for soil cuts by digging test pits to at least 0.5 m below the intended bottom of excavation prior to excavating. These test pits should be allowed to remain open for a period of at least 4 hours to assess the trenching conditions.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of School Valley Developments Ltd. and for review by its designated consultants, contractors and government agencies. The material in the report reflects the judgement of Hui Wing Yang, P.Eng. and Kin Fung Li, P.Eng., in light of the information available to it at the time of preparation.

Use of the report is subject to the conditions and limitations of the contractual agreement. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

SOIL ENGINEERS LTD.

Hui Wing Yang, P.Eng.

Kin Fung Li, P.Eng.
HWY/KFL

LICENSED PROFESSIONAL ENGINEER
Jan 18, 2024
H. W. YANG
100126690
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
Jan 18, 2024
K. F. LI
100169280
PROVINCE OF ONTARIO

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open (split spoon)
DS	Denison type sample
FS	Foil sample
RC	Rock core (with size and percentage recovery)
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance or 'N' Value:

The number of blows of a 63.5 kg hammer falling from a height of 76 cm required to advance a 51 mm outer diameter drive open sampler 30 cm into undisturbed soil, after an initial penetration of 15 cm.

Plotted as '○'

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows per each 30 cm of penetration of a 51 mm diameter, 90° point cone driven by a 63.5 kg hammer falling from a height of 76 cm.

Plotted as '—•—'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/30 cm)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
>50	very dense

Cohesive Soils:

Undrained Shear Strength (kPa)	'N' (blows/30 cm)	Consistency
<12	<2	very soft
12 to <25	2 to <4	soft
25 to <50	4 to <8	firm
50 to <100	8 to <15	stiff
100 to 200	15 to 30	very stiff
>200	>30	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0	Field vane test in borehole; the number denotes the sensitivity to remoulding
△	Laboratory vane test

METRIC CONVERSION FACTORS

1 ft = 0.3048 m
1 inch = 25.4 mm
1 lb = 0.454 kg
1 ksf = 47.88 kPa

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-101

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

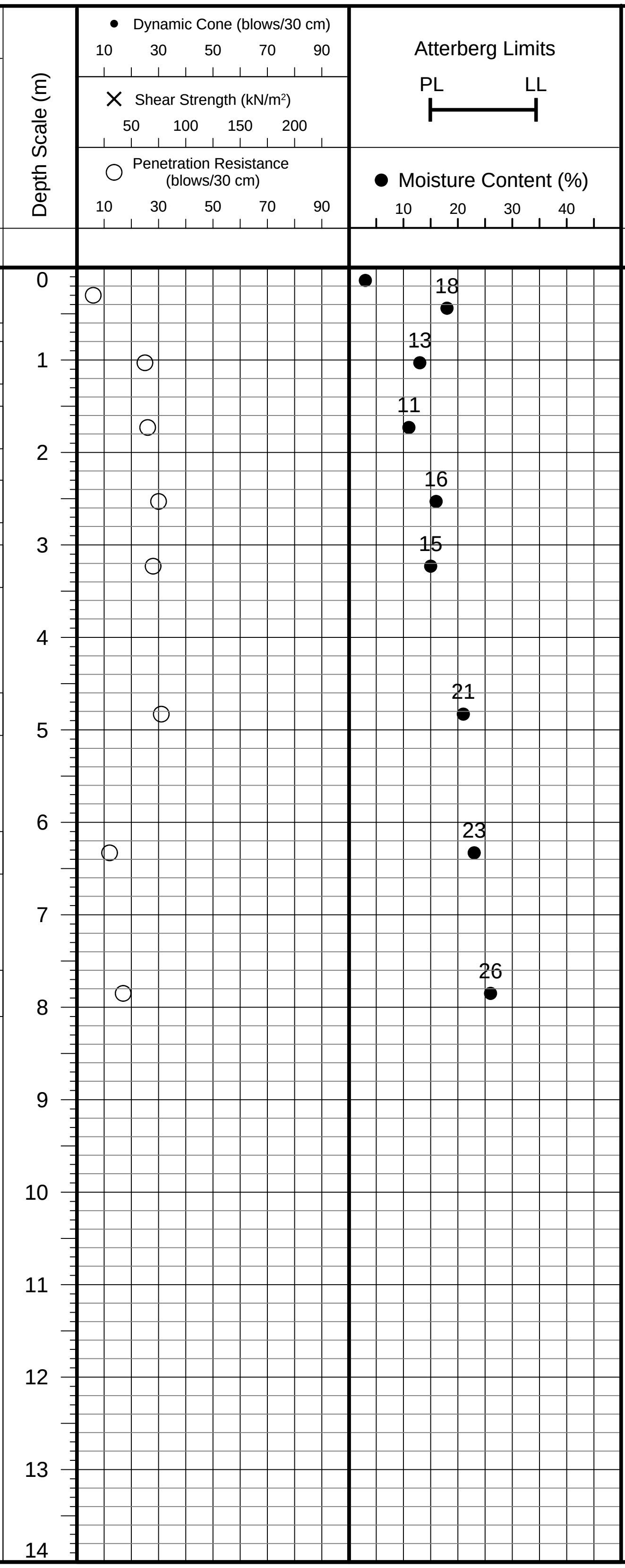
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 10, 2023

El. (m) Depth (m)	SOIL DESCRIPTION
266.1	Ground Surface
0.0	**28 cm TOPSOIL**
	Firm to very stiff — weathered **SILTY CLAY TILL** some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles — — brown grey
262.1 4.0	Brown, compact to dense, wet **SILTY FINE SAND/SANDY SILT** a trace of clay occ. silt and sand layers
258.9 7.2	Grey, compact, wet **SILT** occ. sand and clay layers
258.0 8.1	**END OF BOREHOLE**

SAMPLES		
Number	Type	N-Value
1A 1B	DO	6
2	DO	25
3	DO	26
4	DO	30
5	DO	28
6	DO	31
7	DO	12
8	DO	17



WATER LEVEL

W.L. @ El. 262.4 m on completion

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-102

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

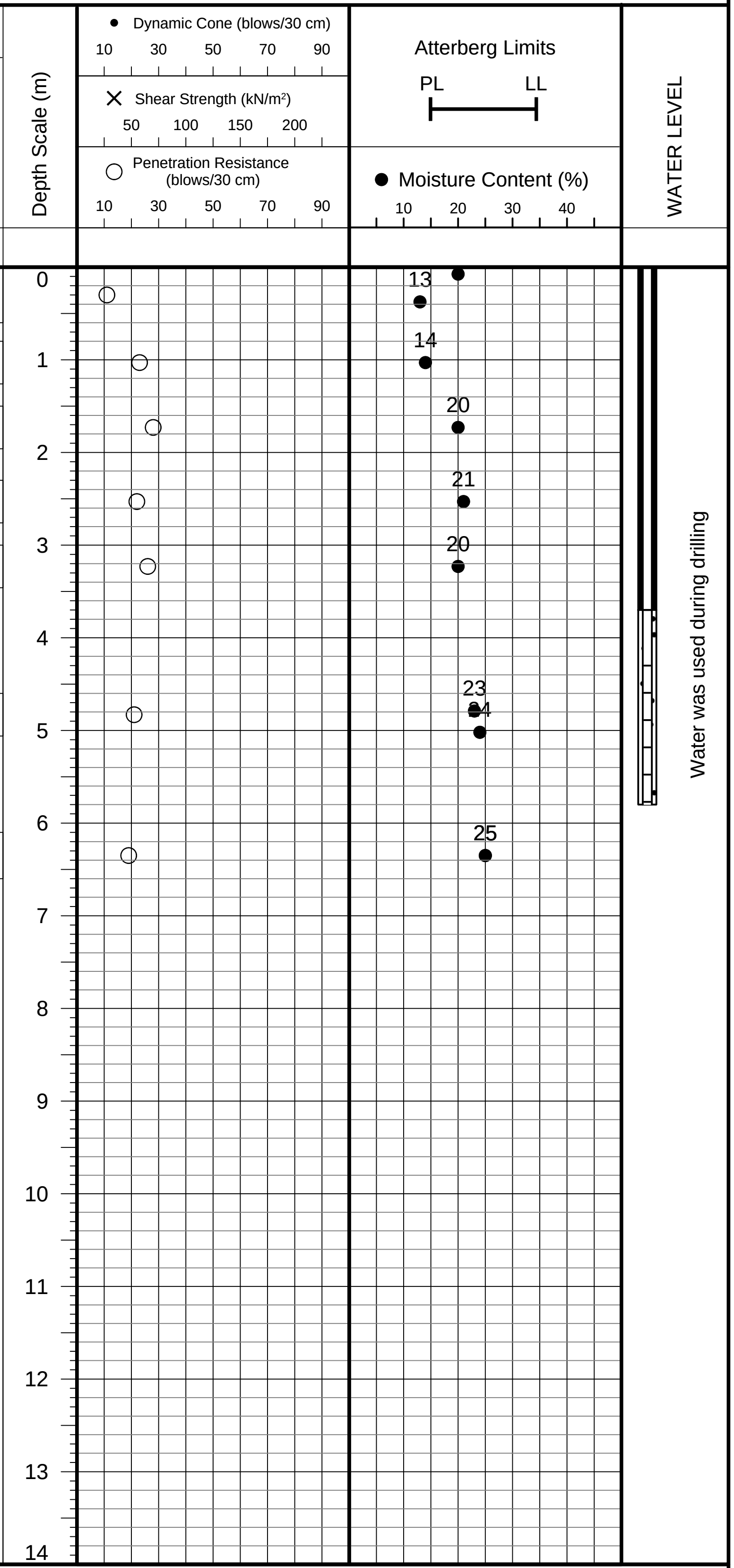
METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 11, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
264.6	Ground Surface			
0.0	**15 cm TOPSOIL**	1A		
	Brown, compact, weathered **SANDY SILT** with roots inclusions	1B	DO	11
263.8 0.8	Brown, very stiff **SILTY CLAY TILL** some sand, a trace of gravel occ. sand and silt seams and layers (weathered)	2	DO	23
		3	DO	28
262.5 2.1	Brown, compact, moist **SILTY FINE SAND/SANDY SILT** a trace of clay grey below 5.0 m possibly transitioning to till below 6.1 m	4	DO	22
		5	DO	26
	wet, occ. gravel	6A	DO	21
	grey clay layer	6B		
	wet silt and clay layers	7	DO	19
258.0 6.6	**END OF BOREHOLE**			

Installed 50-mm Ø PVC monitoring well to 5.8 m, completed with 1.5 m screen
Sand backfill from 3.7 to 5.8 m
Bentonite seal from 0.0 to 3.7 m
Provided with a steel monument casing



JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-103

FIGURE NO.: 3

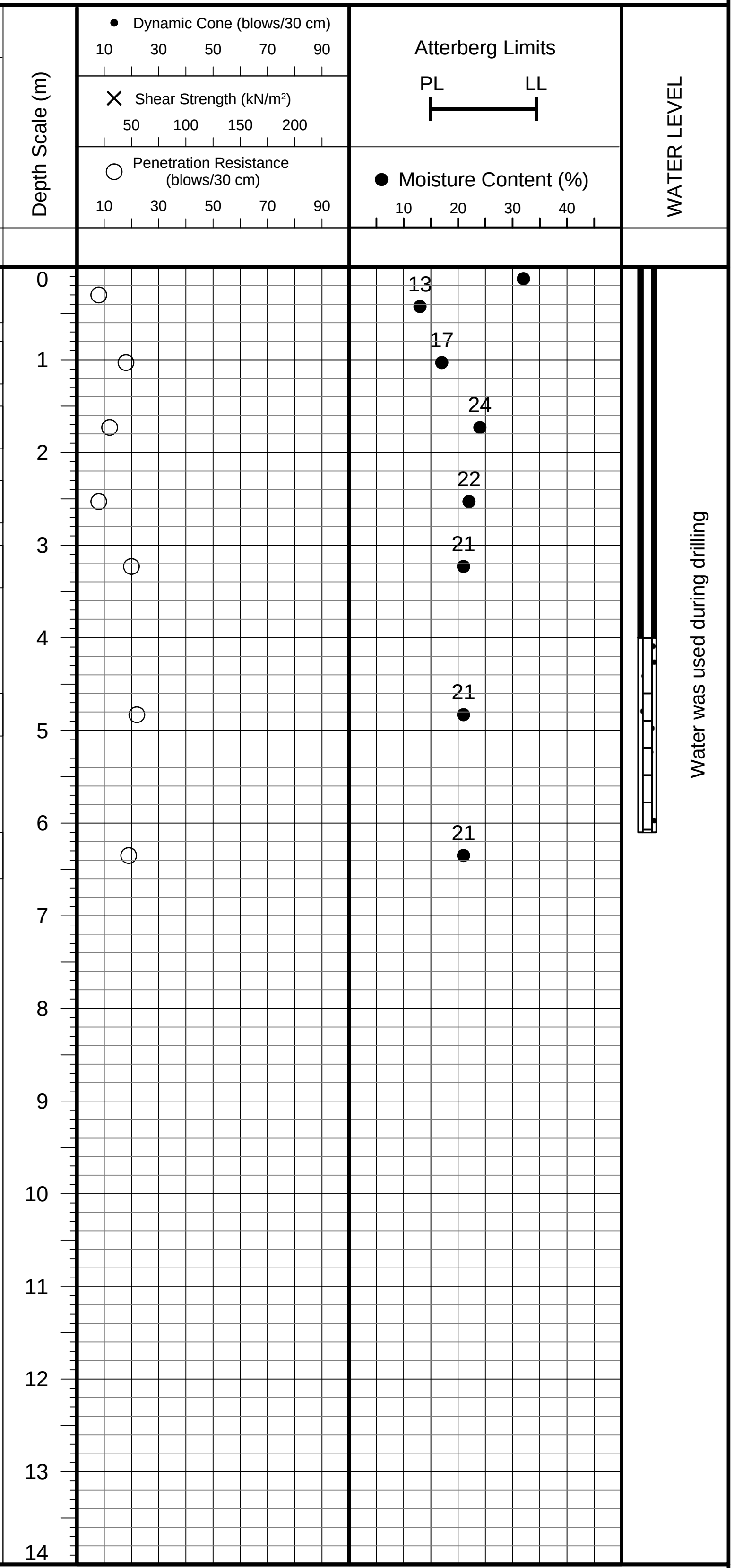
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 11, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
264.1	Ground Surface			
0.0	**25 cm TOPSOIL** Brown, loose, weathered **SANDY SILT**	1A 1B	DO	8
263.3 0.8	Brown, stiff to very stiff weathered **SILTY CLAY TILL** some sand, a trace of gravel occ. sand seams and clay layers	2	DO	18
		3	DO	12
262.0 2.1	Loose to compact, wet **SILTY FINE SAND/SANDY SILT** a trace of clay occ. fine sand layers	4	DO	8
		5	DO	20
	fine sand, some silt	6	DO	22
	brown grey			
		7	DO	19
257.5 6.6	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing			



Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-104

FIGURE NO.: 4

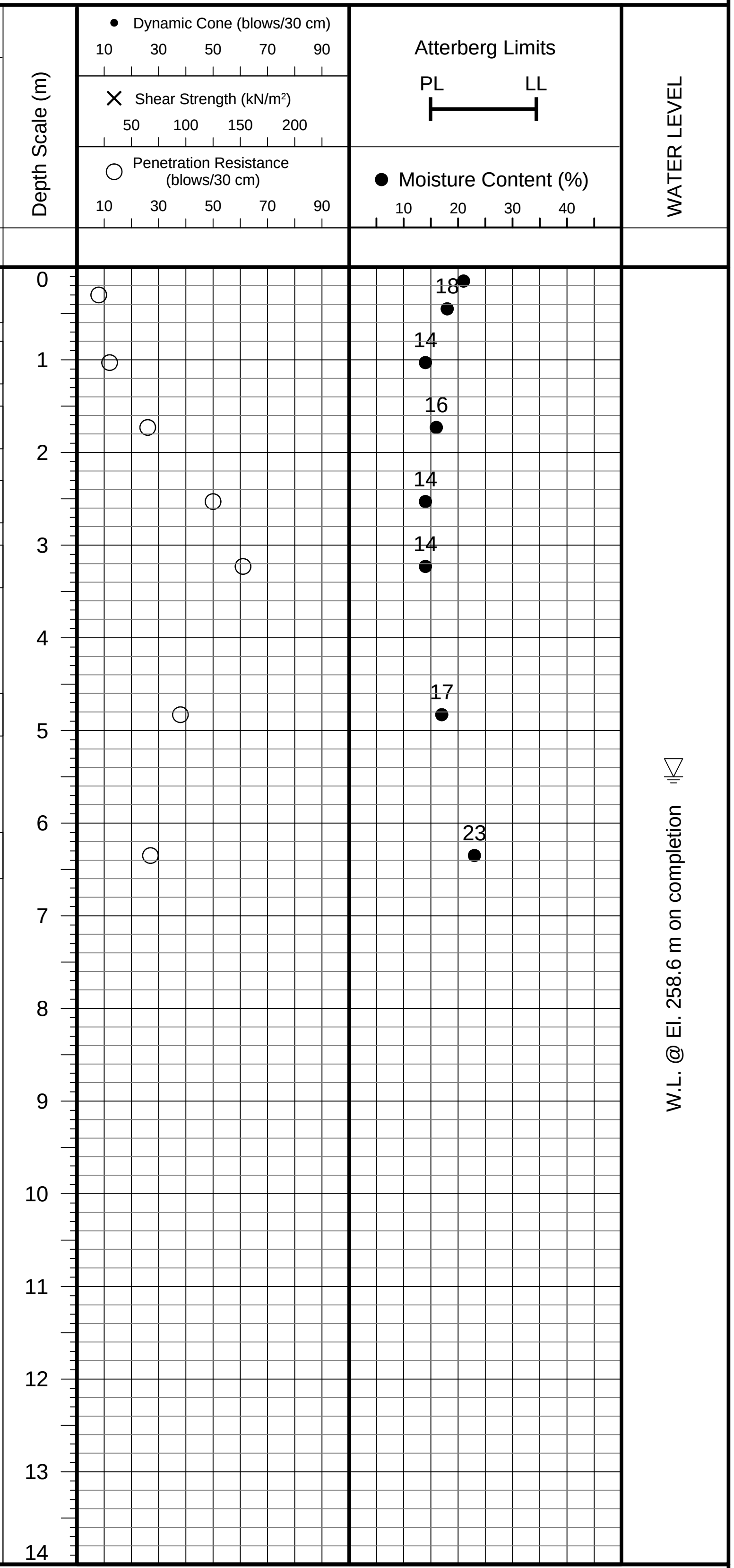
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 10, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
264.1	Ground Surface			
0.0	**30 cm TOPSOIL**	1A	DO	8
	Brown, loose, weathered **SANDY SILT**	1B		
263.3 0.8	Brown, stiff to very stiff weathered **SILTY CLAY TILL** some sand, a trace of gravel occ. sand seams and clay layers	2	DO	12
		3	DO	26
262.0 2.1	Brown, compact to very dense, moist **SILTY FINE SAND/SANDY SILT** a trace of clay occ. silt and fine sand layers wet below 6.1 m	4	DO	50
		5	DO	61
		6	DO	38
		7	DO	27
257.5 6.6	**END OF BOREHOLE**			



Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-105

FIGURE NO.: 5

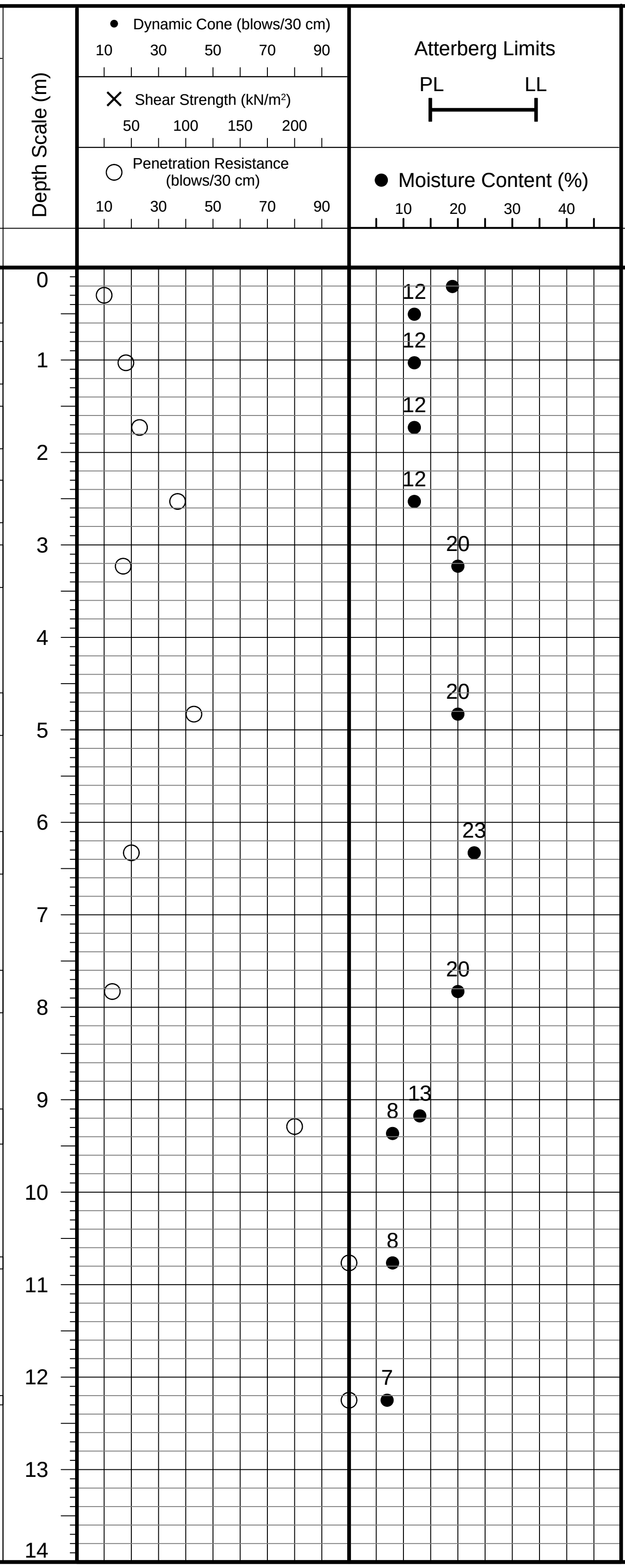
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 10, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
264.7	Ground Surface			
0.0	**41 cm TOPSOIL**	1A 1B	DO	10
	Brown, loose, weathered **SANDY SILT** with clay and roots inclusions weathered			
263.9 0.8	Brown, very stiff to hard **SILTY CLAY TILL** some sand, a trace of gravel occ. sand and silt seams and layers	2	DO	18
		3	DO	23
		4	DO	37
261.8 2.9	Grey, very stiff **SILTY CLAY** a trace of sand	5	DO	17
260.7 4.0	Compact to dense, wet **SILTY FINE SAND/SANDY SILT** a trace of clay	6	DO	43
		7	DO	20
	brown grey	8	DO	13
255.5 9.2	Brown, very dense **SANDY SILT TILL** traces of clay and gravel occ. sand seams and cobbles	9A 9B	DO	80/23
		10	DO	50/13
252.4 12.3	**END OF BOREHOLE**	11	DO	50/10



WATER LEVEL

Dry on completion

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-106

FIGURE NO.: 6

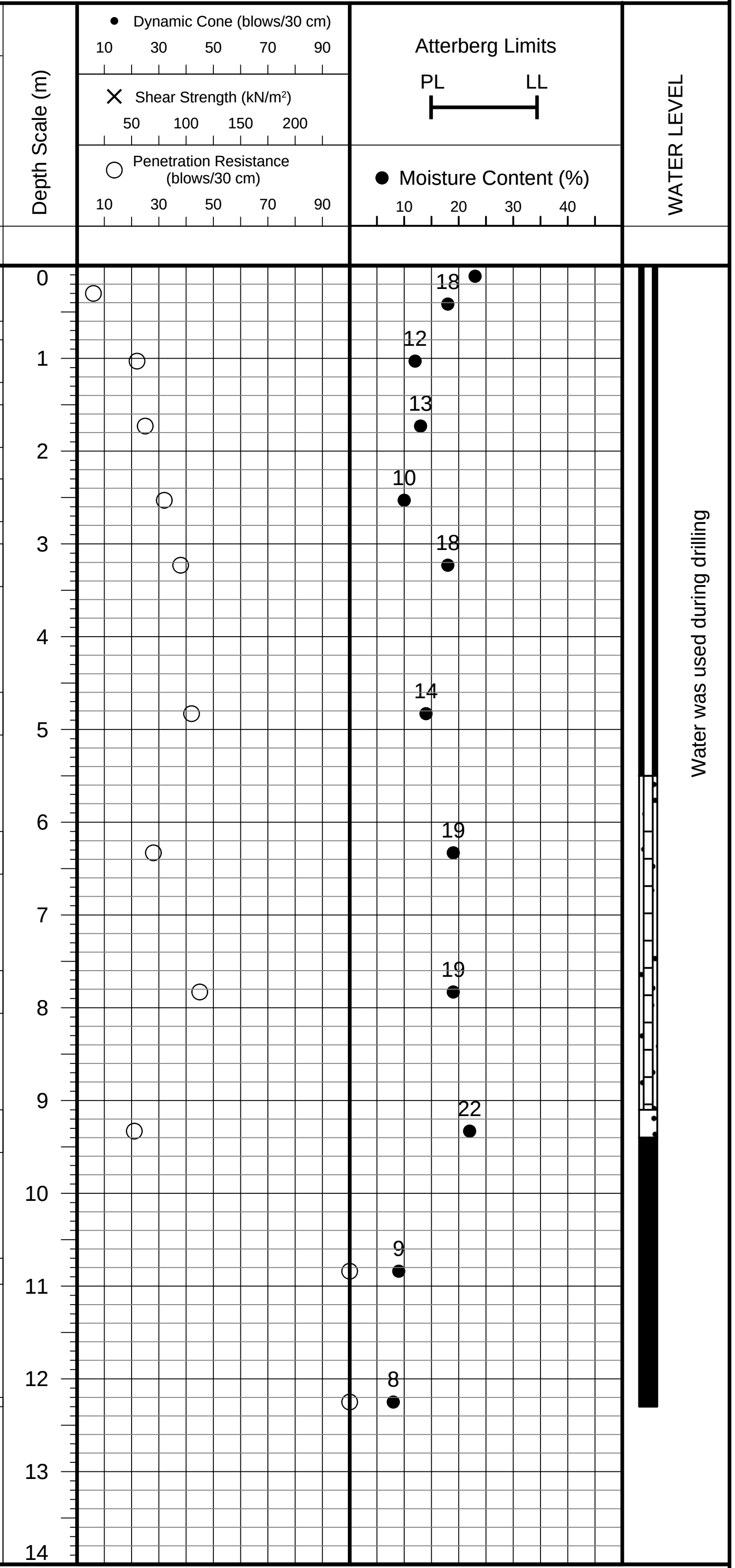
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Hollow Stem Augers and Tricone

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 12, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
264.9	Ground Surface			
0.0	**23 cm TOPSOIL**	1A	DO	6
	Brown, loose, weathered **SANDY SILT** occ. gravel — weathered	1B		
264.1 0.8	Brown, very stiff to hard **SILTY CLAY TILL** some sand to sandy, a trace of gravel occ. sand and silt seams and layers	2	DO	22
		3	DO	25
		4	DO	32
261.9 3.0	Brown, hard **SILTY CLAY** a trace of sand, occ. sand seams	5	DO	38
260.9 4.0	Compact to dense, moist to wet **SILTY FINE SAND/SANDY SILT** a trace of clay occ. fine sand layers occ. clay and silt lenses — — brown grey	6	DO	42
		7	DO	28
		8	DO	45
256.2 8.7	Grey, very stiff **SILTY CLAY** a trace of sand, with silt layers	9	DO	21
254.7 10.2	Brown, very dense **SANDY SILT TILL** a trace to some clay a trace of gravel occ. sand and silt seams and layers, cobbles	10	DO	50/13
		11	DO	50/13
252.6 12.3	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 9.1 m, completed with 3.0 m screen. Backfill from 9.1 to 12.3 m. Sand backfill from 5.5 to 9.1 m. Bentonite seal from 0.0 to 5.5 m. Provided with a monument casing.			



Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-107

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Residential Development

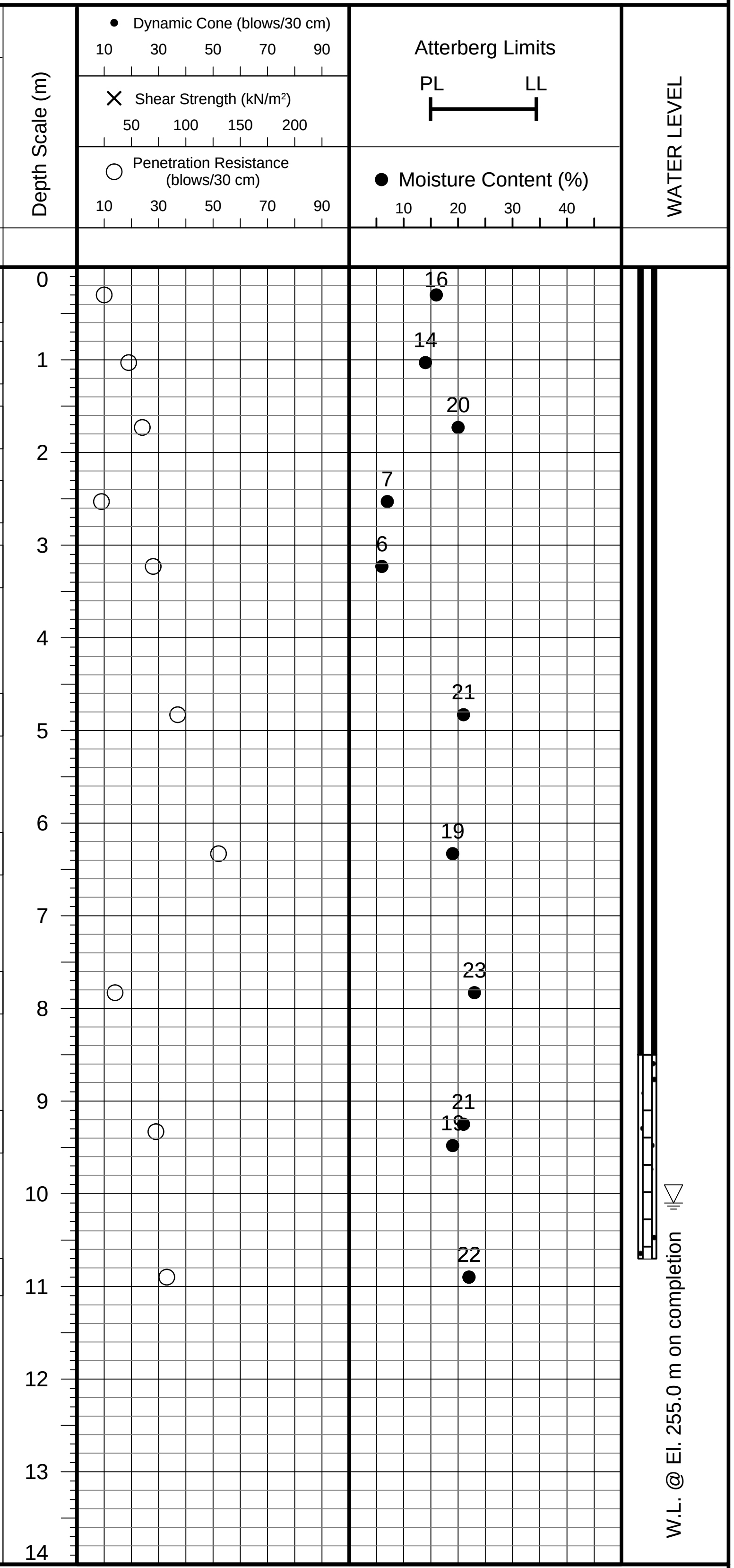
METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) Depth (m)	SOIL DESCRIPTION
265.1	Ground Surface
0.0	**25 cm TOPSOIL** Brown, stiff to very stiff **SILTY CLAY TILL** — weathered some sand to sandy, a trace of gravel occ. sand and silt seams and layers
263.7 1.4	Brown, very stiff **SILTY CLAY** occ. gravel
263.0 2.1	Brown, loose to compact, moist **FINE SAND** some silt, a trace of clay
261.1 4.0	Brown, dense to very dense, moist to very moist **SILTY FINE SAND/SANDY SILT** a occ. silt layers
257.9 7.2	Grey, compact, very moist to wet **SILT** traces of clay and fine sand occ. sand and clay layers
254.9 10.2	Grey, dense, wet **FINE SAND** a trace of silt
254.0 11.1	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 10.7 m, completed with 1.5 m screen Sand backfill from 8.5 to 10.7 m Bentonite seal from 0.0 to 8.5 m Provided with a steel monument casing

SAMPLES		
Number	Type	N-Value
1	DO	10
2	DO	19
3	DO	24
4	DO	9
5	DO	28
6	DO	37
7	DO	52
8	DO	14
9A 9B	DO	29
10	DO	33



Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-108

FIGURE NO.: 8

PROJECT DESCRIPTION: Proposed Residential Development

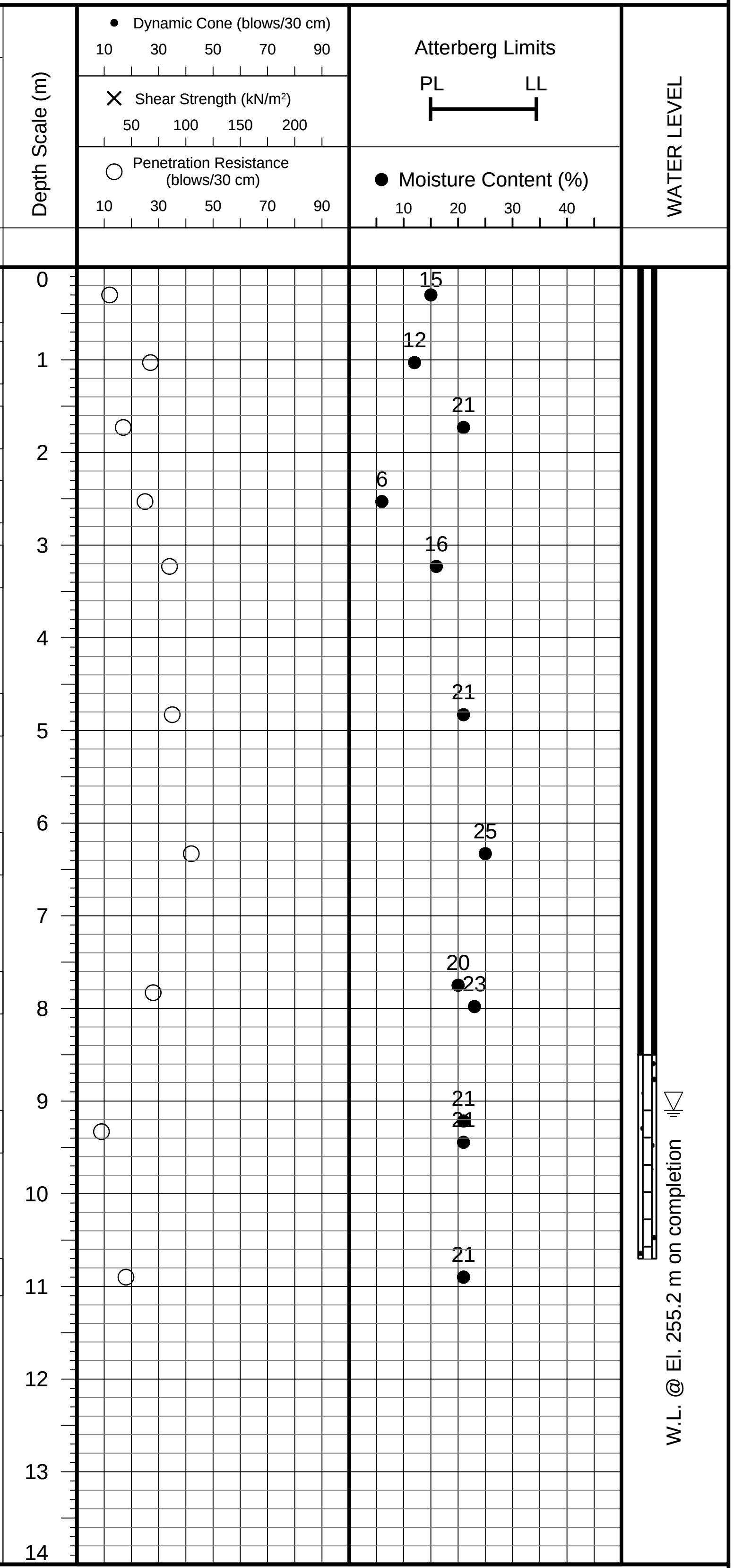
METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 16, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
264.3	Ground Surface			
0.0	**30 cm TOPSOIL**			
	Brown, stiff to very stiff **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers	1	DO	12
	weathered	2	DO	27
262.9 1.4	Brown, very stiff **SILTY CLAY** occ. gravel	3	DO	17
262.2 2.1	Brown, compact to dense, moist **FINE SAND** a trace to some silt	4	DO	25
		5	DO	34
260.3 4.0	Brown, loose to very dense, very moist to wet **SILTY FINE SAND/SANDY SILT** a trace of clay occ. silt layers	6	DO	35
		7	DO	42
	grey clay	8A 8B	DO	28
255.0 9.3	Grey, compact, wet **SILT** some sand and clay occ. clay lenses	9A 9B	DO	9
		10	DO	18
253.2 11.1	**END OF BOREHOLE**			

Installed 50-mm Ø PVC monitoring well to 10.7 m, completed with 1.5 m screen
Sand backfill from 8.5 to 10.7 m
Bentonite seal from 0.0 to 8.5 m
Provided with a steel monument casing



Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-109

FIGURE NO.: 9

PROJECT DESCRIPTION: Proposed Residential Development

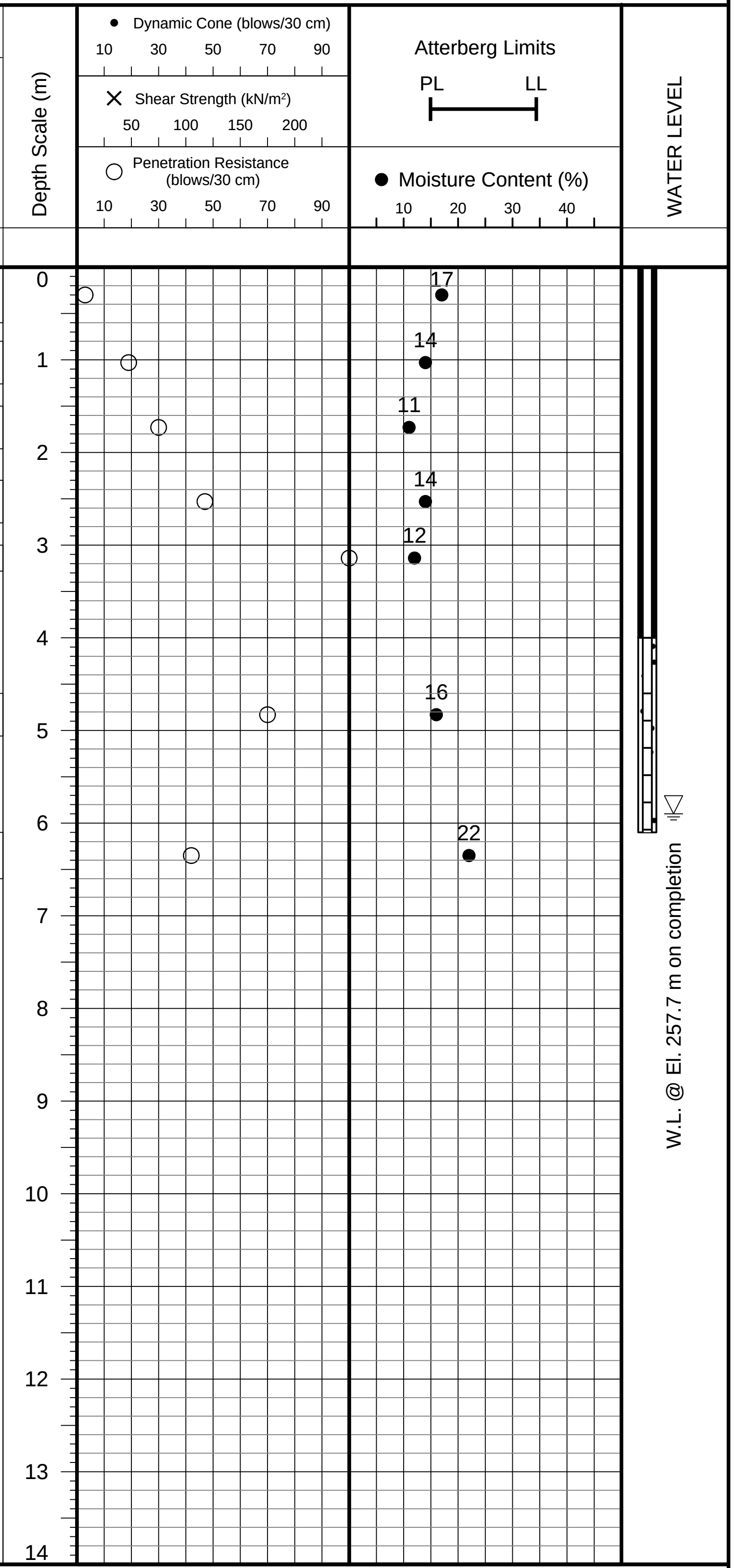
METHOD OF BORING: Hollow Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 13, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	N-Value
263.6	Ground Surface			
0.0	**38 cm TOPSOIL**	1	DO	3
	Brown, soft to very stiff **SILTY CLAY TILL** some sand to sandy, a trace of gravel occ. sand and silt seams and layers weathered	2	DO	19
		3	DO	30
261.5 2.1	Brown, dense to very dense **SANDY SILT TILL** a trace of clay occ. sand and silt seams and layers silt	4	DO	47
		5	DO	50/13
259.6 4.0	Dense to very dense, very moist to wet **SILTY FINE SAND/SANDY SILT** a trace of clay	6	DO	70
	brown grey	7	DO	42
257.0 6.6	**END OF BOREHOLE**			

Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen
Sand backfill from 4.0 to 6.1 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing



W.L. @ El. 257.7 m on completion

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-110

FIGURE NO.: 10

PROJECT DESCRIPTION: Proposed Residential Development

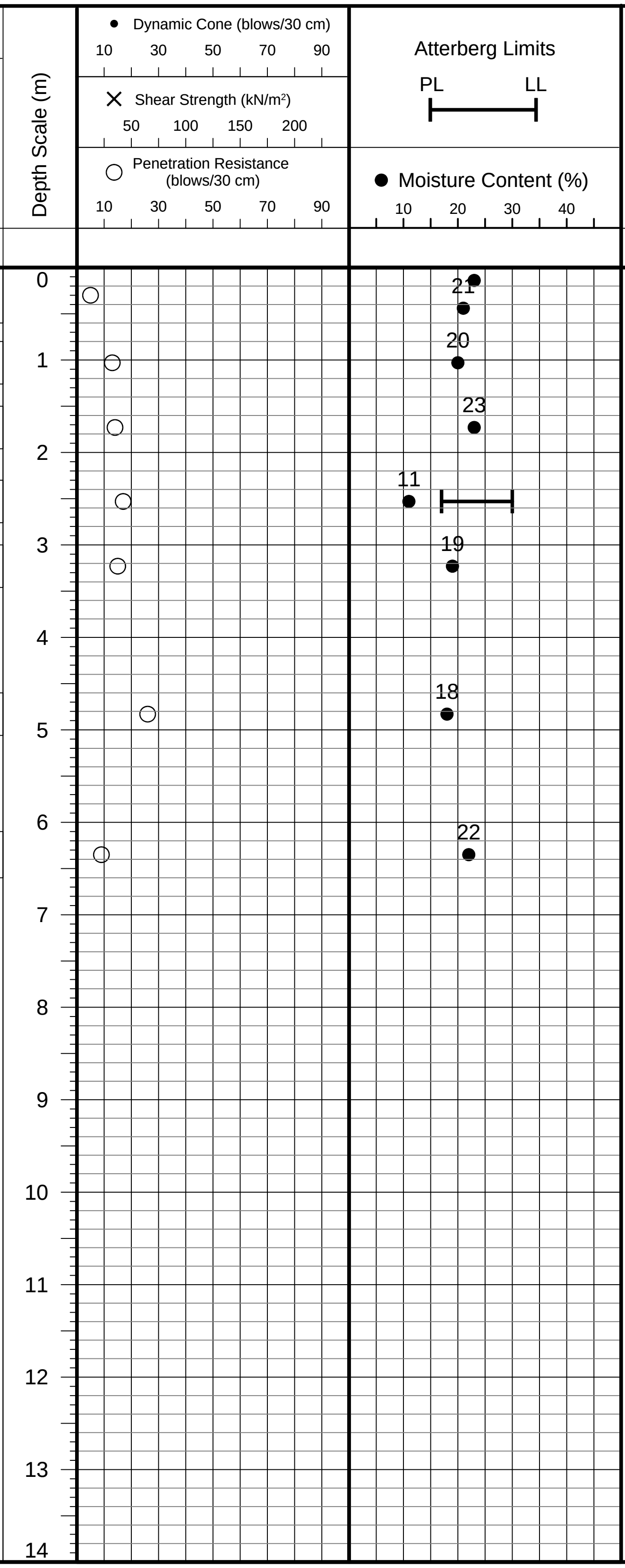
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 12, 2023

El. (m) Depth (m)	SOIL DESCRIPTION
263.6	Ground Surface
0.0	**28 cm TOPSOIL**
	Brown, loose to compact **SILT** weathered some sand to sandy occ. clay lenses
261.8 1.8	Grey, very stiff **SILTY CLAY TILL** sandy, a trace of gravel
260.7 2.9	Grey, very stiff **SILTY CLAY** occ. gravel
259.6 4.0	Grey, loose to compact, wet **SILTY FINE SAND/SANDY SILT** occ. silt layers
257.0 6.6	**END OF BOREHOLE**

SAMPLES		
Number	Type	N-Value
1A	DO	5
1B		
2	DO	13
3	DO	14
4	DO	17
5	DO	15
6	DO	26
7	DO	9



WATER LEVEL: Dry on completion

Soil Engineers Ltd.

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-111

FIGURE NO.: 11

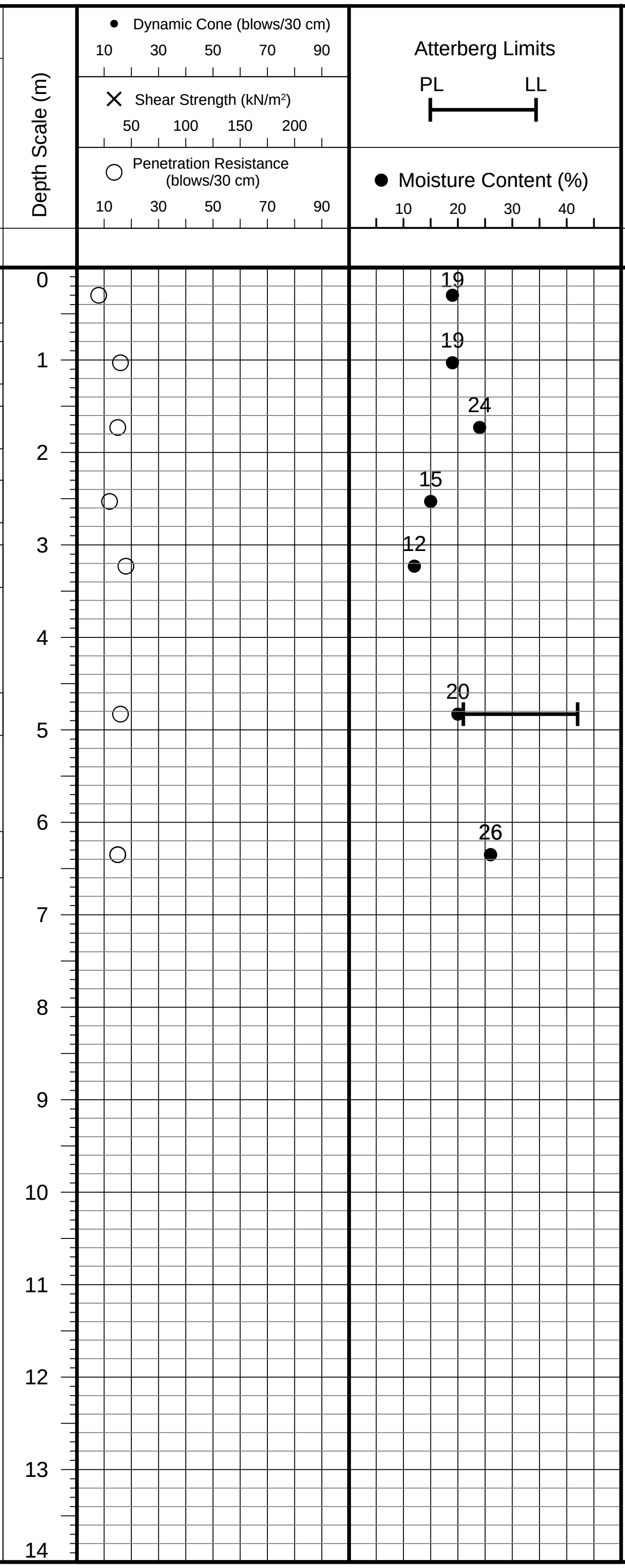
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 13, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
263.7	Ground Surface			
0.0	**33 cm TOPSOIL**	1	DO	8
	Brown, loose to compact **SANDY SILT** a trace of clay weathered	2	DO	16
262.3 1.4	Compact **SILT** a trace of clay, occ. sand seams brown grey	3	DO	15
261.6 2.1	Grey, stiff to very stiff **SILTY CLAY TILL** sandy, a trace of gravel occ. sand seams and layers	4	DO	12
		5	DO	18
259.7 4.0	Grey, very stiff **SILTY CLAY** a trace of sand, occ. gravel occ. sand and silt seams	6	DO	16
		7	DO	15
257.1 6.6	**END OF BOREHOLE**			



WATER LEVEL

Dry on completion

JOB NO.: 2310-S041

LOG OF BOREHOLE: SV-112

FIGURE NO.: 12

PROJECT DESCRIPTION: Proposed Residential Development

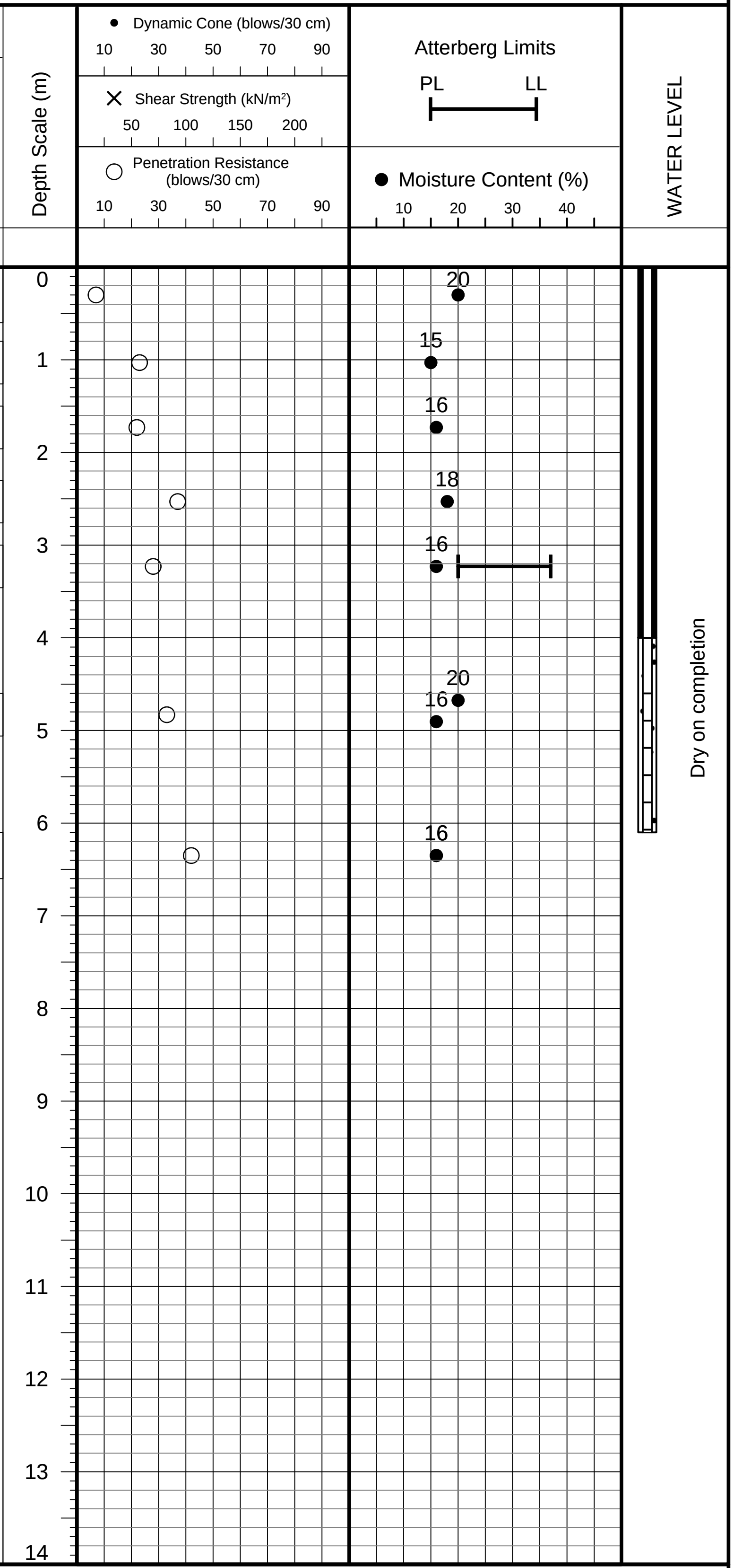
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

DRILLING DATE: October 13, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
262.9	Ground Surface			
0.0	**25 cm TOPSOIL**	1	DO	7
	Firm to hard weathered	2	DO	23
	SILTY CLAY TILL	3	DO	22
	some sand to sandy, a trace of gravel occ. sand and silt seams and layers	4	DO	37
		5	DO	28
	varved silt and clay structure	6A 6B	DO	33
257.3 5.6	Brown, dense, moist **SILTY FINE SAND/SANDY SILT** a trace of clay	7	DO	42
256.3 6.6	**END OF BOREHOLE**			

Installed 50-mm Ø PVC monitoring well to
6.1 m, completed with 1.5 m screen
Sand backfill from 4.0 to 6.1 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing

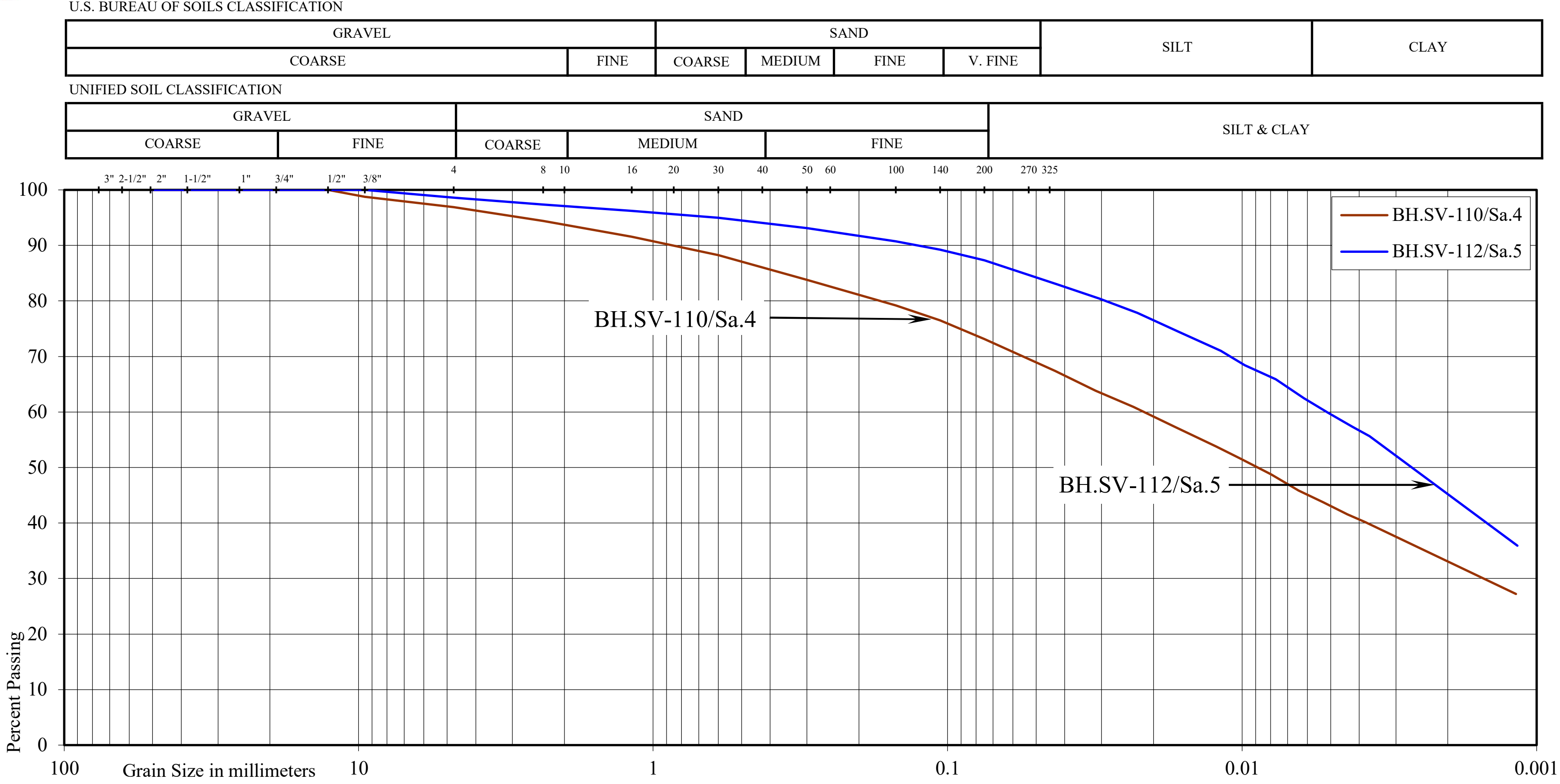


Soil Engineers Ltd.

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Street, Town of Caledon

Borehole No:	SV-110	SV-112
Sample No:	4	5
Depth (m):	2.5	3.2
Elevation (m):	261.1	259.7

	SV-	SV-
BH./Sa.	110/4	112/5
Liquid Limit (%) =	30	37
Plastic Limit (%) =	17	20
Plasticity Index (%) =	13	17
Moisture Content (%) =	11	16
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY TILL

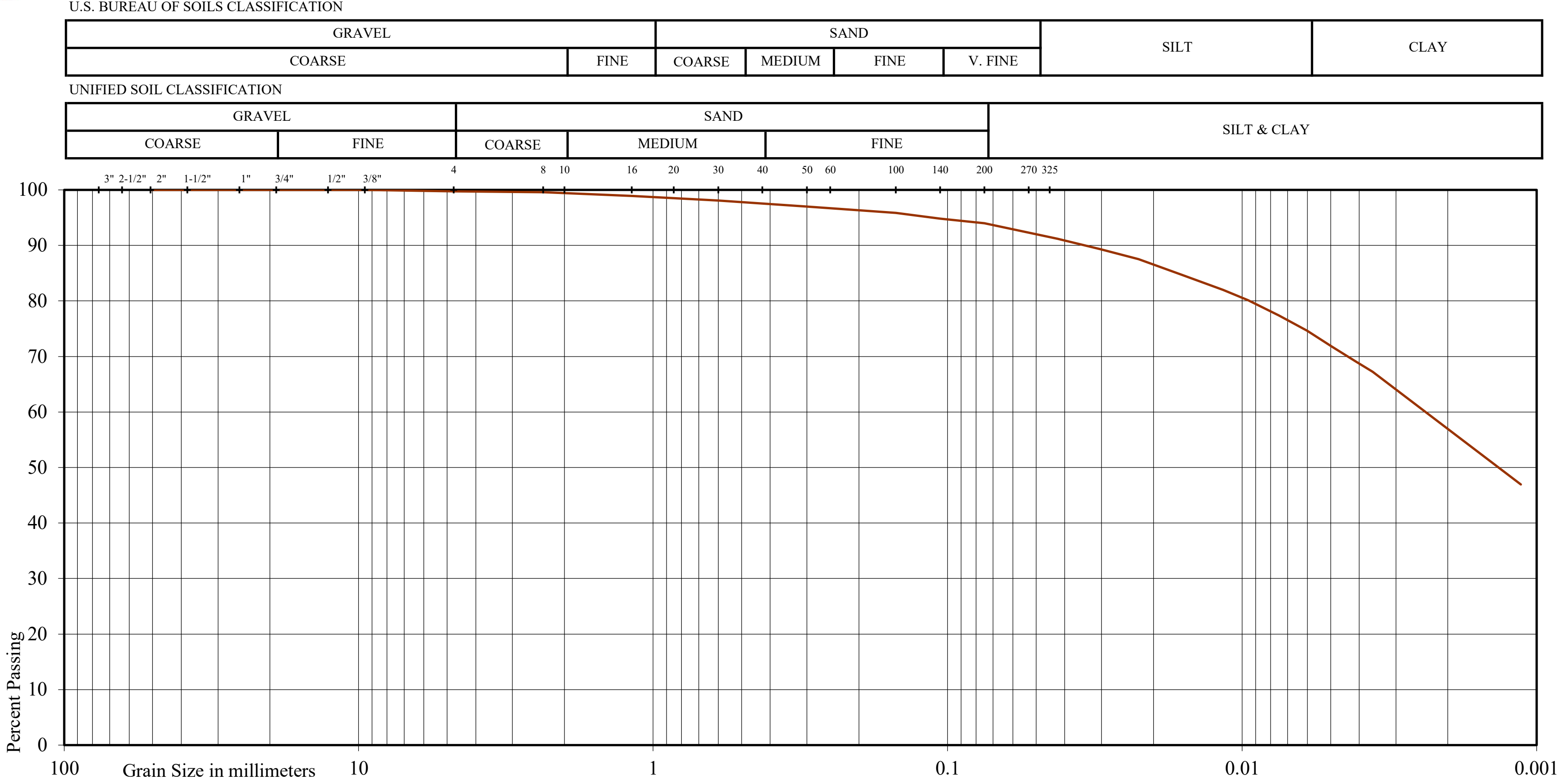
some sand to sandy, a trace of gravel

Figure: 13

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

SV-

Location: Southwest of Old School Road and Hurontario Street, Town of Caledon

BH./Sa. 111/6

Liquid Limit (%) = 42

Borehole No: SV-111

Plastic Limit (%) = 21

Sample No: 6

Plasticity Index (%) = 21

Depth (m): 4.8

Moisture Content (%) = 20

Elevation (m): 258.9

Estimated Permeability (cm./sec.) = 10^{-7}

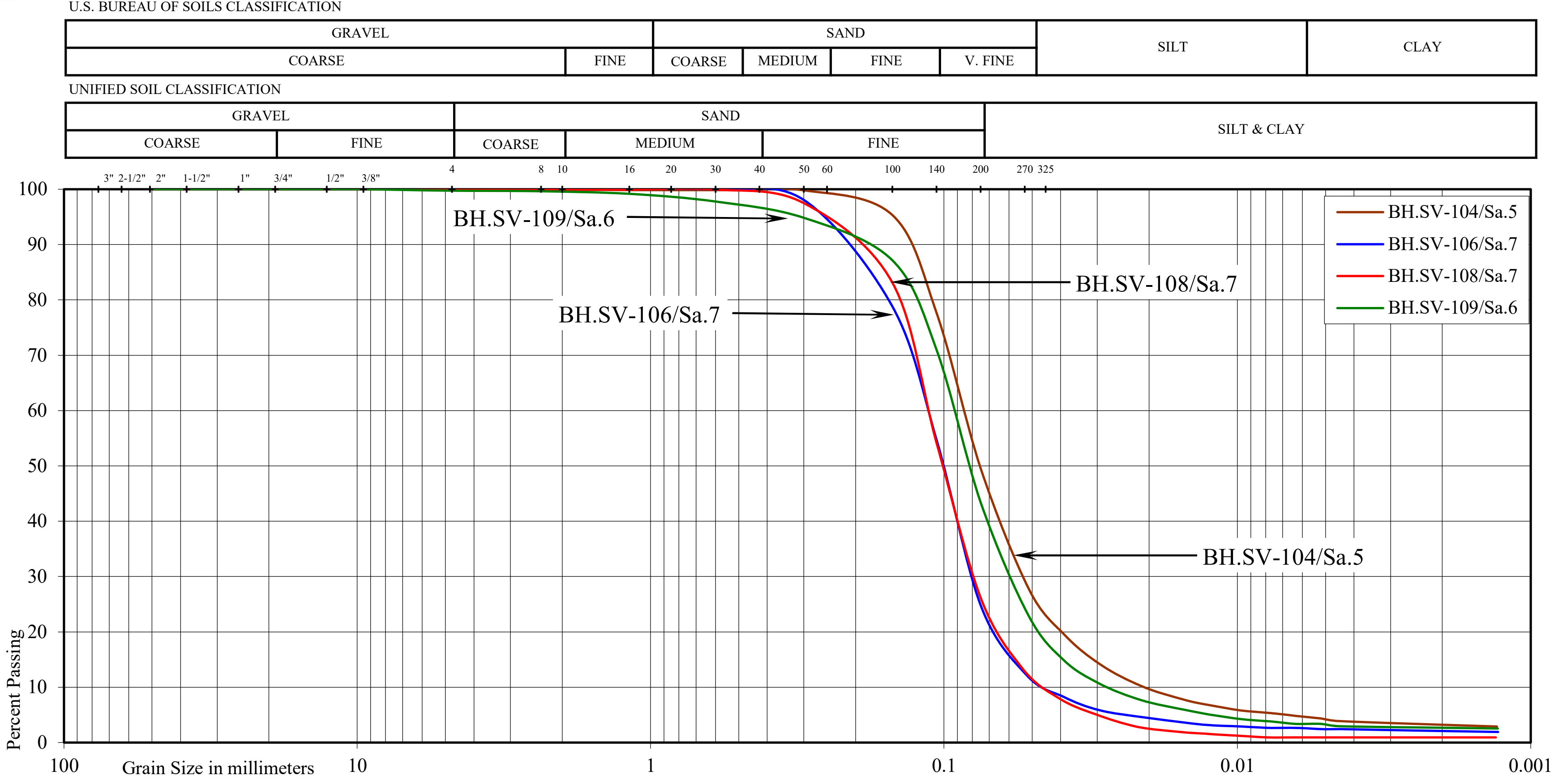
Classification of Sample [& Group Symbol]: SILTY CLAY
a trace of sand

Figure: 14

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Street, Town of Caledon

Borehole No:	SV-104	SV-106	SV-108	SV-109
Sample No:	5	7	7	6
Depth (m):	3.2	6.3	6.3	4.8
Elevation (m):	260.9	258.6	258.0	258.8

	SV-	SV-	SV-	SV-
BH./Sa.	104/5	106/7	108/7	109/6
Liquid Limit (%) =	-	-	-	-
Plastic Limit (%) =	-	-	-	-
Plasticity Index (%) =	-	-	-	-
Moisture Content (%) =	14	19	25	16
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-3}	10^{-3}	10^{-3}

Classification of Sample [& Group Symbol]: SILTY FINE SAND

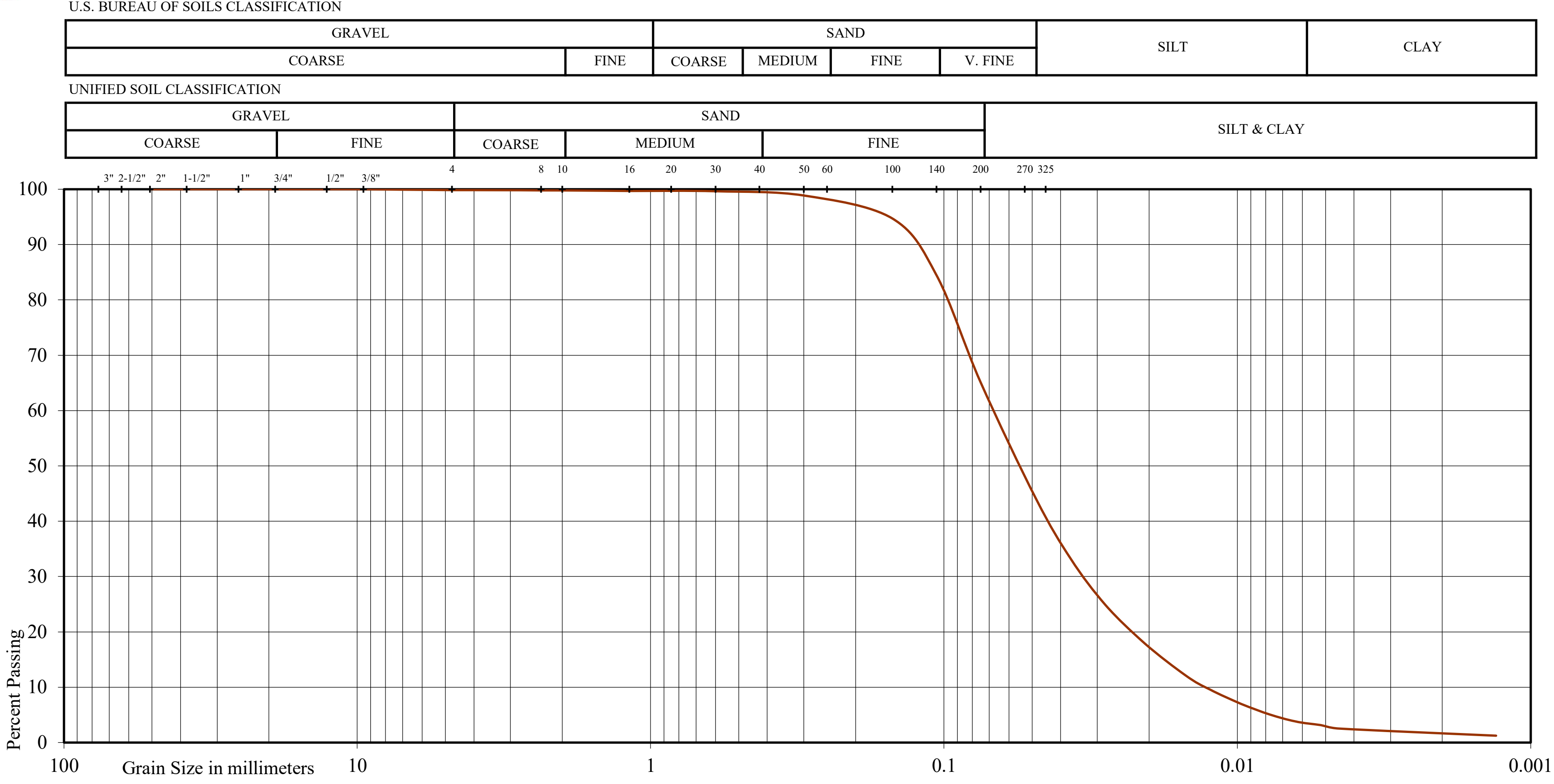
a trace of clay

Figure: 15

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

SV-

Location: Southwest of Old School Road and Hurontario Street, Town of Caledon

BH./Sa. 102/5

Liquid Limit (%) = -

Borehole No: SV-102

Plastic Limit (%) = -

Sample No: 5

Plasticity Index (%) = -

Depth (m): 3.2

Moisture Content (%) = 20

Elevation (m): 261.4

Estimated Permeability (cm./sec.) = 10^{-4}

Classification of Sample [& Group Symbol]: SANDY SILT

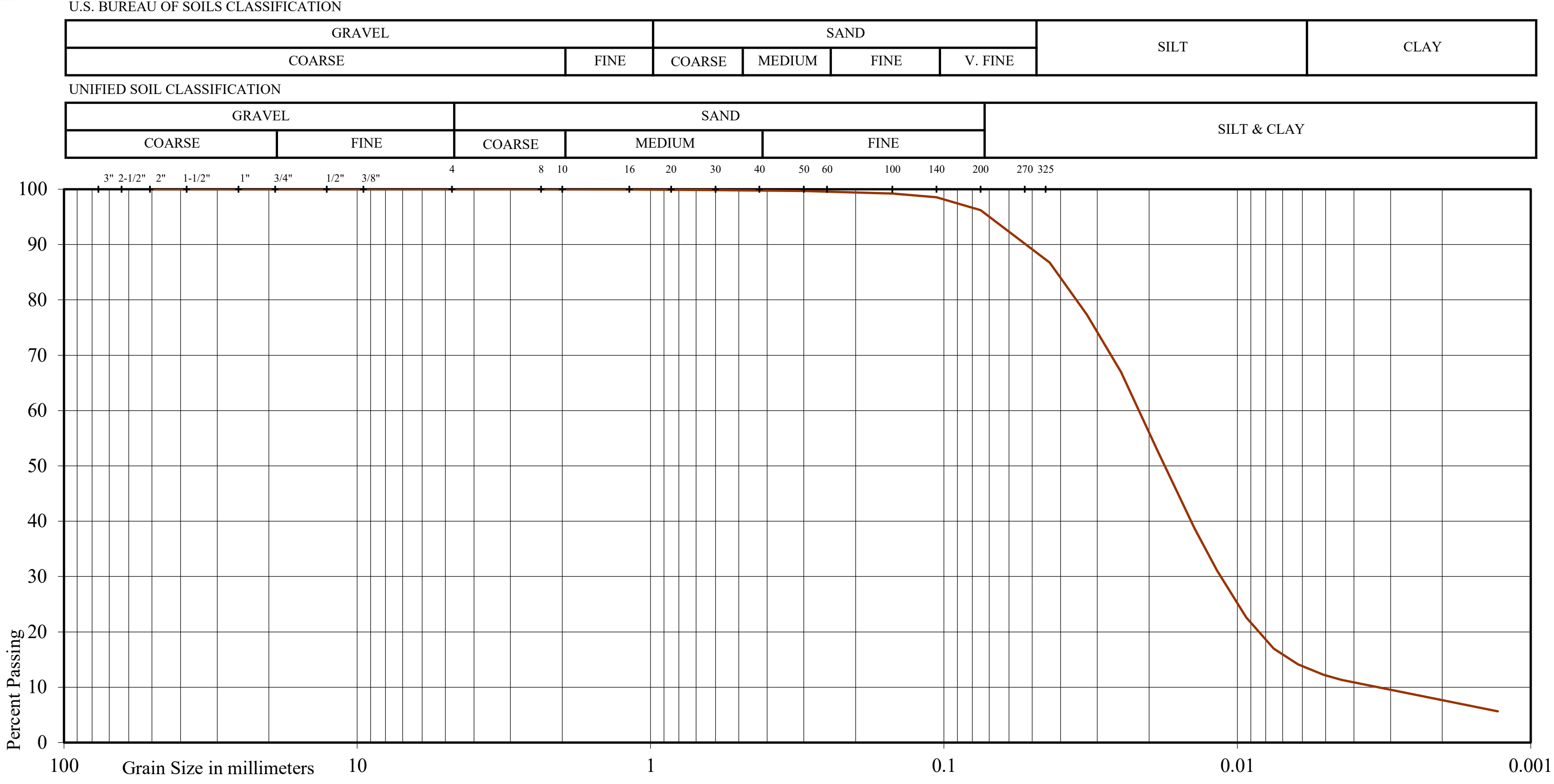
a trace of clay

Figure: 16

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

SV-

Location: Southwest of Old School Road and Hurontario Street, Town of Caledon

BH./Sa.107/9A

Liquid Limit (%) = -

Borehole No: SV-107

Plastic Limit (%) = -

Sample No: 9A

Plasticity Index (%) = -

Depth (m): 9.2

Moisture Content (%) = 21

Elevation (m): 255.9

Estimated Permeability (cm./sec.) = 10^{-5}

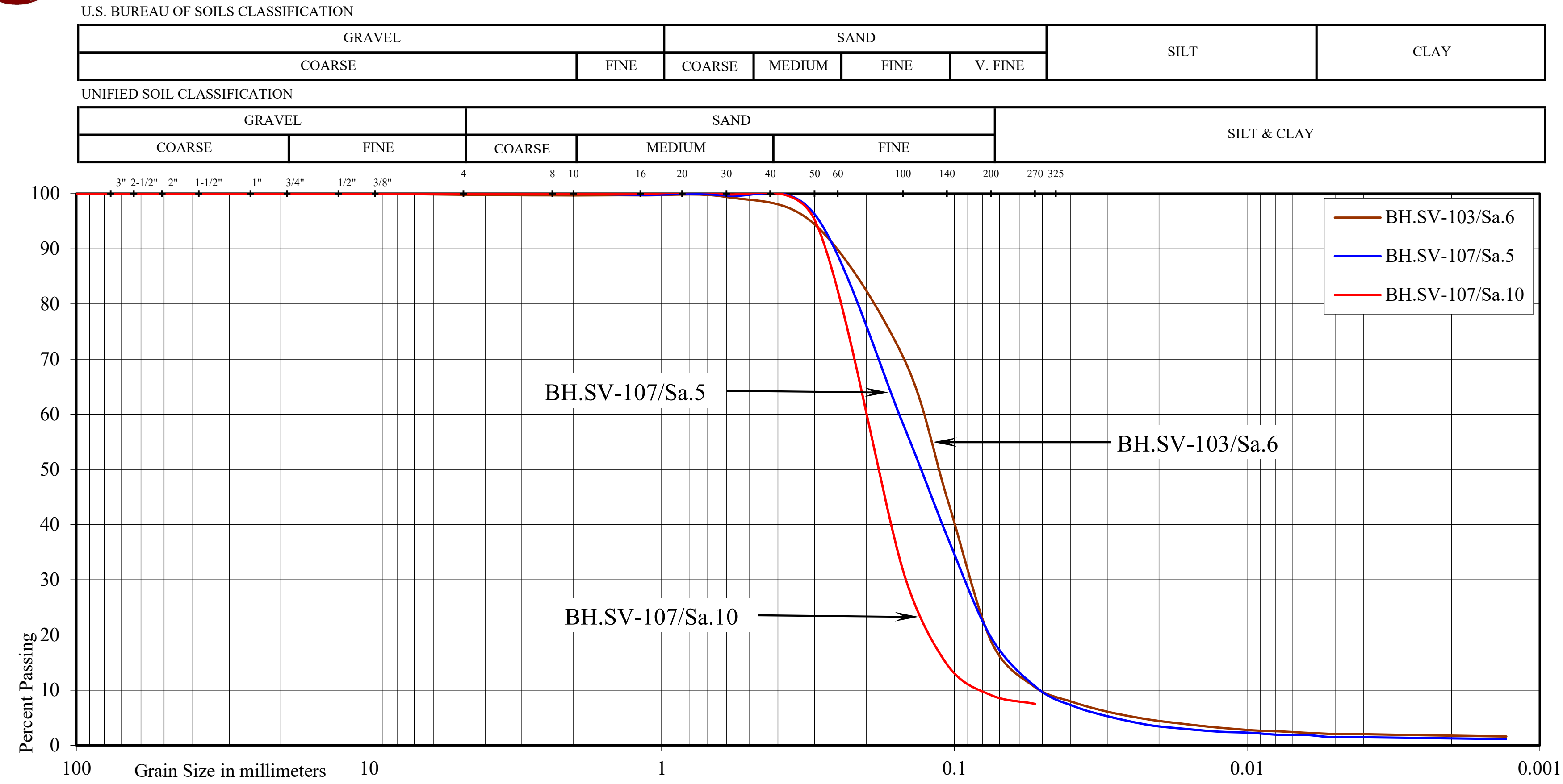
Classification of Sample [& Group Symbol]:	SILT traces of fine sand and clay

Figure: 17

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

Location: Southwest of Old School Road and Hurontario Street, Town of Caledon

	SV-	SV-	SV-
BH./Sa.	103/6	107/5	107/10
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	21	6	22
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-3}	10^{-2}

Borehole No:	SV-103	SV-107	SV-107
Sample No:	6	5	10
Depth (m):	4.8	3.2	10.9
Elevation (m):	259.3	261.9	254.2

Classification of Sample [& Group Symbol]: FINE SAND

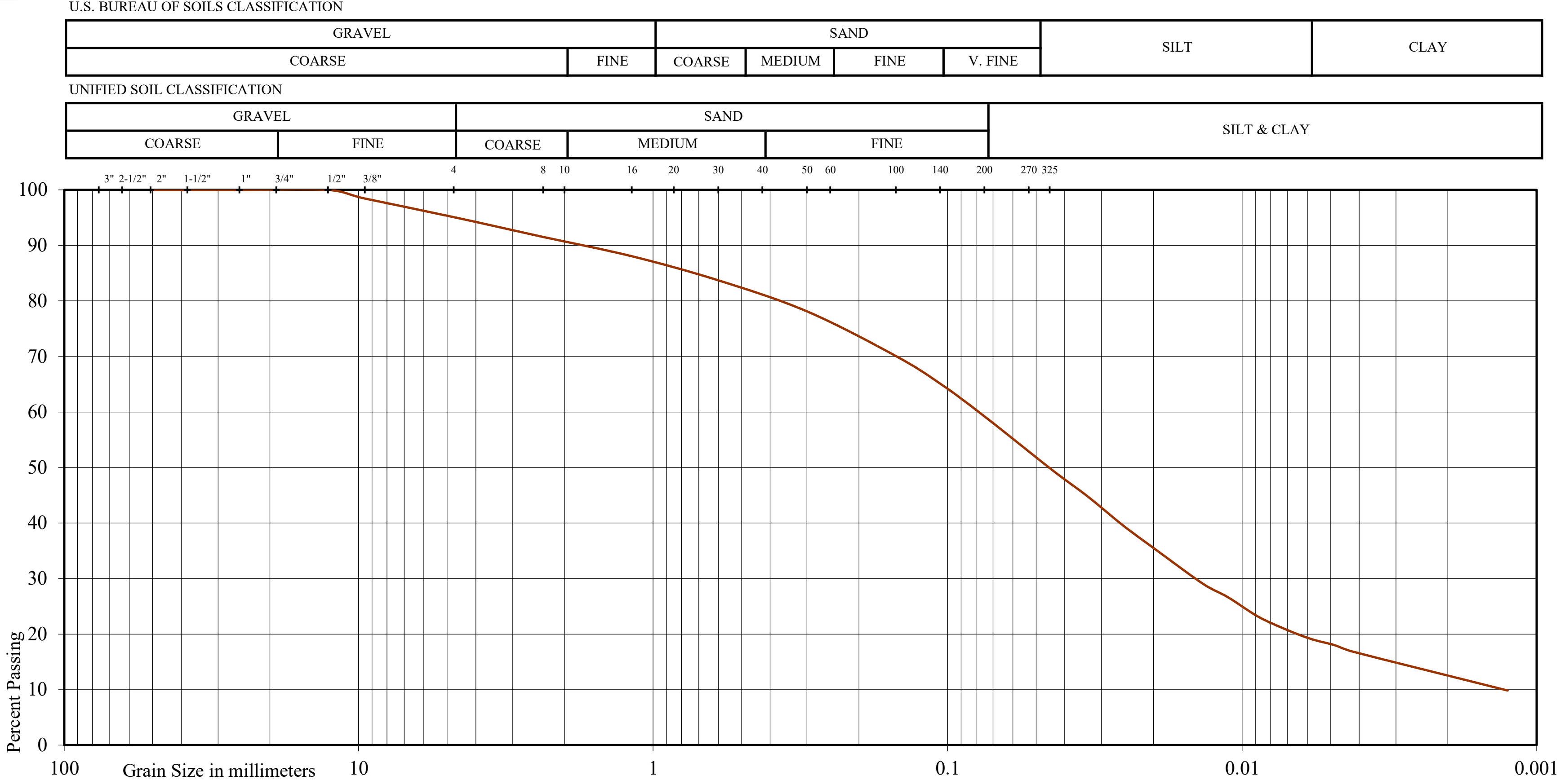
a trace to some silt, a trace of clay

Figure: 18

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S041



Project: Proposed Residential Development

SV-

Location: Southwest of Old School Road and Hurontario Street, Town of Caledon

BH./Sa. 106/10

Liquid Limit (%) = -

Borehole No: SV-106

Plastic Limit (%) = -

Sample No: 10

Plasticity Index (%) = -

Depth (m): 10.8

Moisture Content (%) = 9

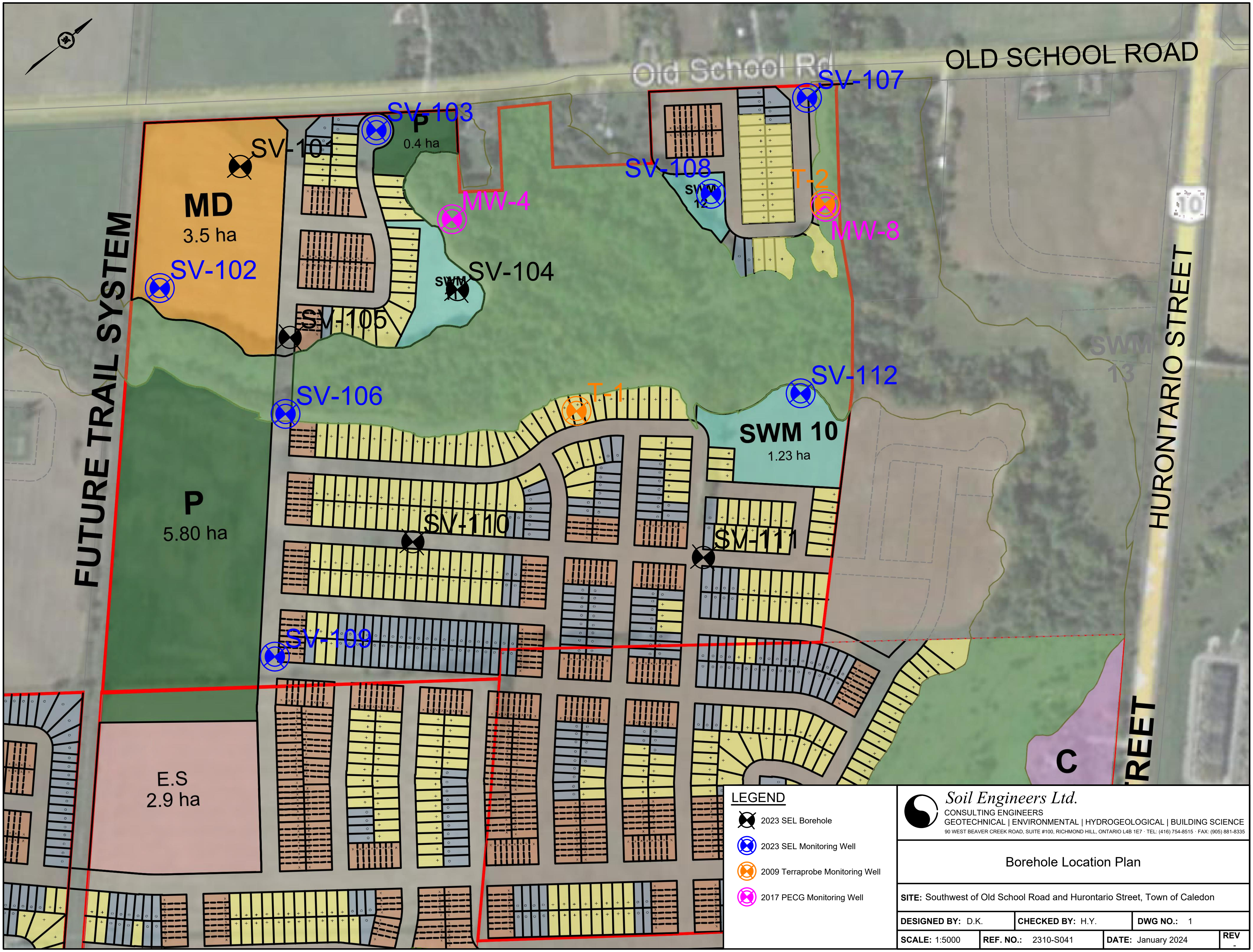
Elevation (m): 254.1

Estimated Permeability (cm./sec.) = 10^{-6}

Figure: 19

Classification of Sample [& Group Symbol]: SANDY SILT TILL

some clay, a trace of gravel



LEGEND

- ☒ 2023 SEL Borehole
- ☒ 2023 SEL Monitoring Well
- ☒ 2009 Terraprobe Monitoring Well
- ☒ 2017 PECG Monitoring Well

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90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

Borehole Location Plan

SITE: Southwest of Old School Road and Hurontario Street, Town of Caledon

DESIGNED BY: D.K. **CHECKED BY:** H.Y. **DWG NO.:** 1

SCALE: 1:5000 **REF. NO.:** 2310-S041 **DATE:** January 2024 **REV** -

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SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

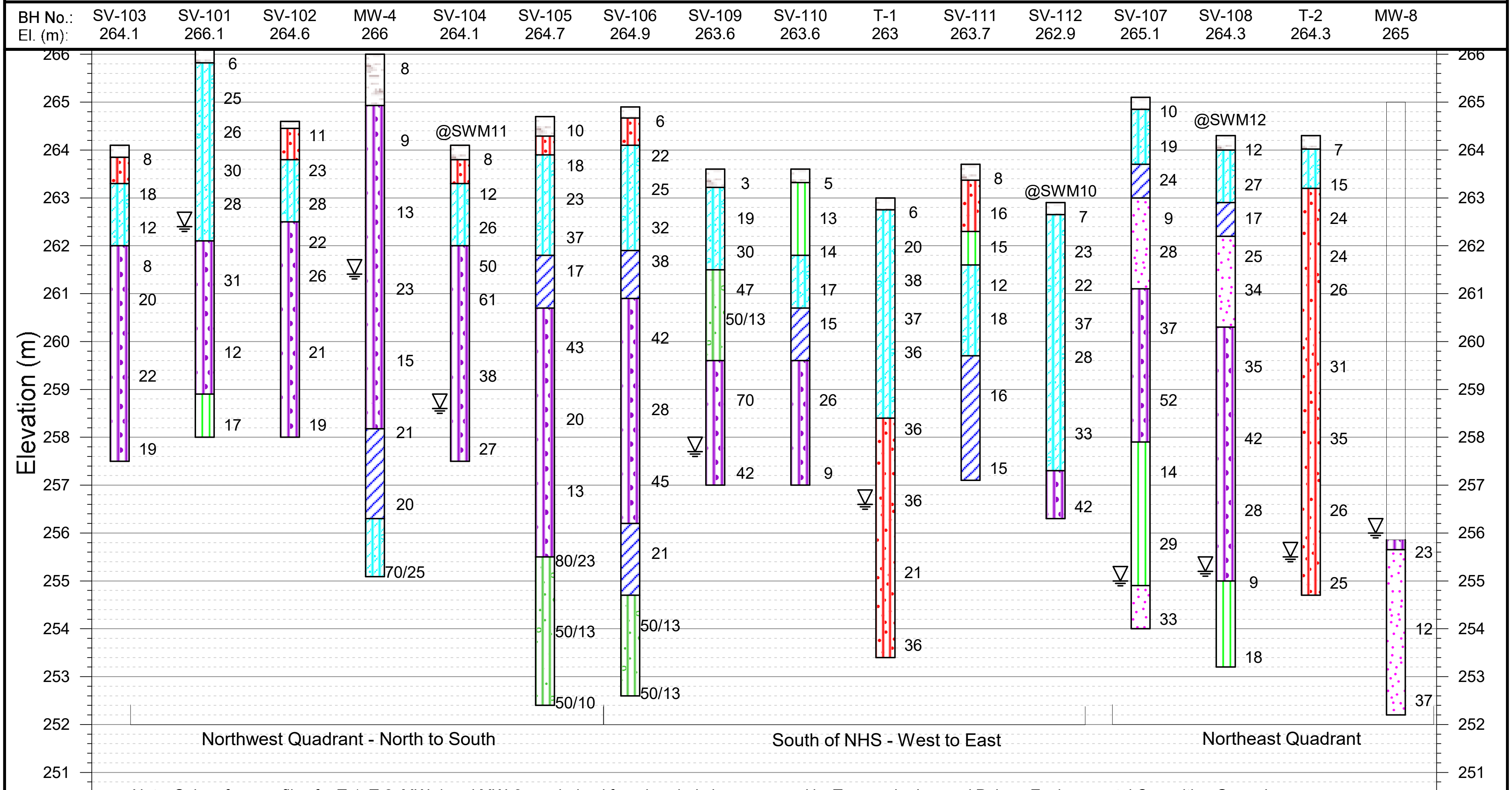
JOB NO.: 2310-S041
REPORT DATE: January 2024
PROJECT DESCRIPTION: Proposed Residential Development

PROJECT LOCATION: Southwest of Old School Road and Hurontario Street
Town of Caledon

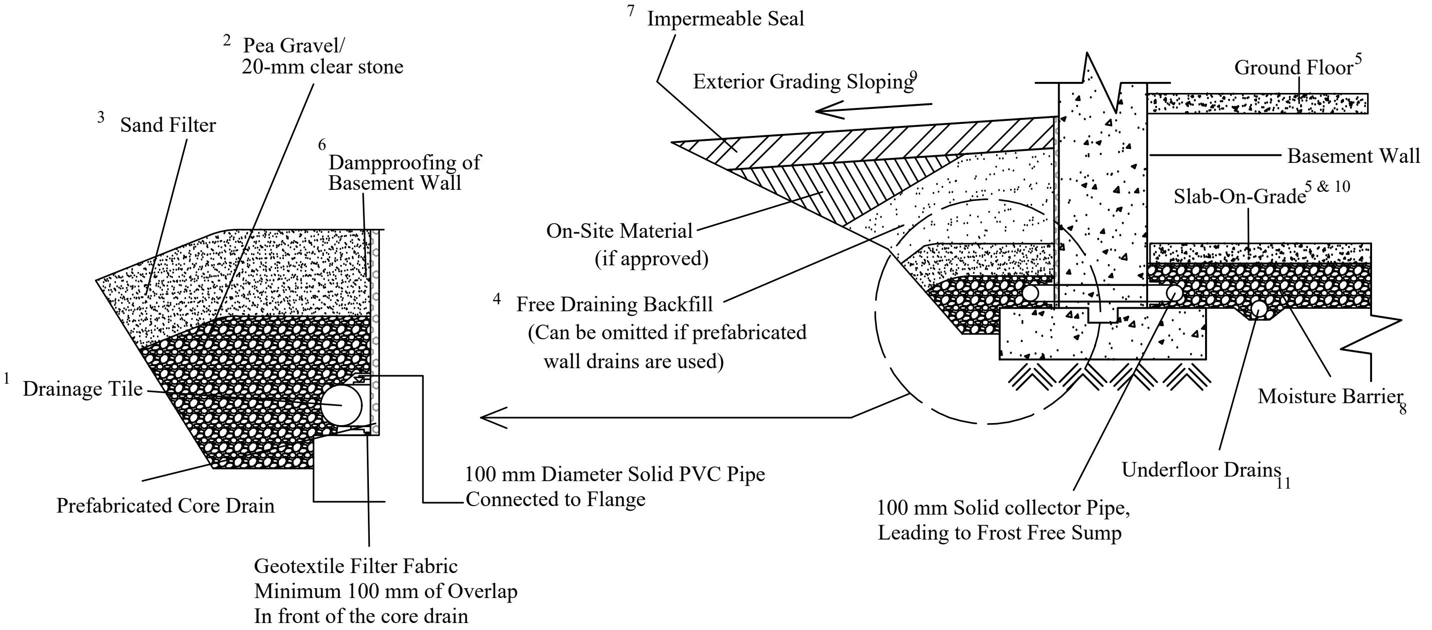
LEGEND

▨	TOPSOIL	▨	SAND AND SILT	▨	SANDY SILT TILL	▨	SILTY CLAY
▨	SAND	▨	SANDY SILT	▨	SILT	▨	SILTY CLAY TILL

∇ WATER LEVEL (END OF DRILLING)



Note: Subsurface profiles for T-1, T-2, MW-4 and MW-8 are derived from borehole logs prepared by Terraprobe Inc. and Palmer Environmental Consulting Group Inc.



NOTES:

1. **Drainage tile**: consists of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be at minimum of 150 mm (6") below underside of basement floor slab.

2. **Pea gravel**: at 150 mm (6") on the top and sides of drain. If drain is not placed on concrete footing, provide 100 mm (4") of pea gravel below drain. The pea gravel may be replaced by 19-mm clear stone provided that the drain is covered by a porous geotextile membrane of Terrafix 270R or equivalent.

3. **Filter material**: consists of C.S.A. fine concrete aggregate. A minimum of 300 mm (12") on the top and sides of gravel. This may be replaced by an approved porous geotextile membrane of Terrafix 270R or equivalent.

4. **Free-draining backfill**: OPSS Granular 'B' or equivalent, compacted to 95% to 98% (maximum) Standard Proctor dry density. Do not compact closer than 1.8 m (6') from wall with heavy equipment. This may be replaced by on-site material if prefabricated wall drains (Miradrain) extending from the finished grade to the bottom of the basement wall are used.

5. **Do not backfill** until the wall is supported by the basement floor slab and ground floor framing, or adequate bracing.

6. **Dampproofing** of the basement wall is required before backfilling

7. **Impermeable backfill seal** of compacted clay, clayey silt or equivalent. If the original soil in the vicinity is a free-draining sand, the seal may be omitted.

8. **Moisture barrier**: 19-mm CRL or compacted OPSS Granular 'A', or equivalent. The thickness of this layer should be 150 mm (6") minimum.

9. **Exterior Grade**: slope away from basement wall on all the sides of the building.

10. **Slab-On-Grade** should not be structurally connected to walls or foundations.

11. **Underfloor drains**[*] should be placed in parallel rows at 6 to 8 m (20'-25') centre, on 100 mm (4") of pea gravel with 150 mm (6") of pea gravel on top and sides. The spacing should be at least 300 mm (12") between the underside of the floor slab and the top of the pipe. The drains should be connected to positive sumps or outlets. Do not connect the underfloor drains to the perimeter drains.

[*] Underfloor drains can be deleted where not required.

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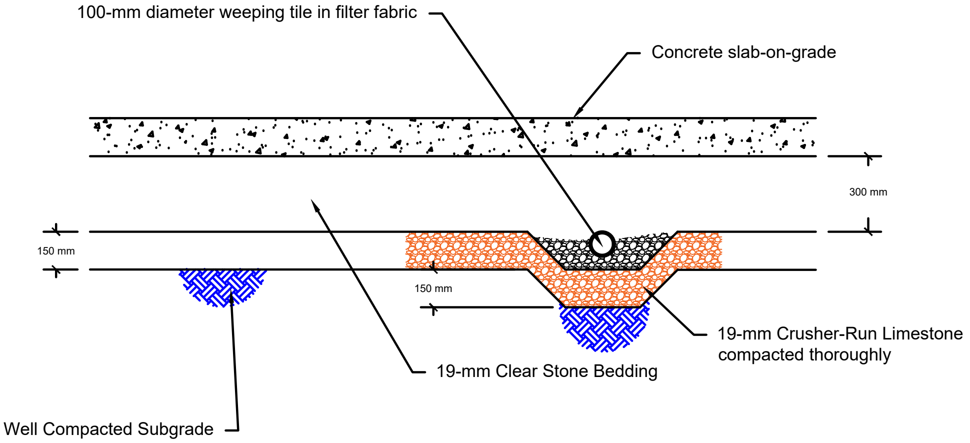
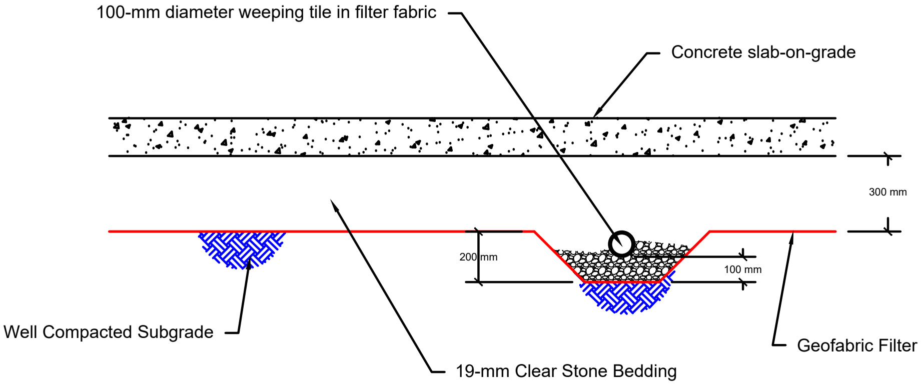
PERMANENT PERIMETER DRAINAGE SYSTEM
(FOR OPEN EXCAVATION)

SITE: SOUTHWEST OF OLD SCHOOL ROAD AND HURONTARIO STREET
TOWN OF CALEDON

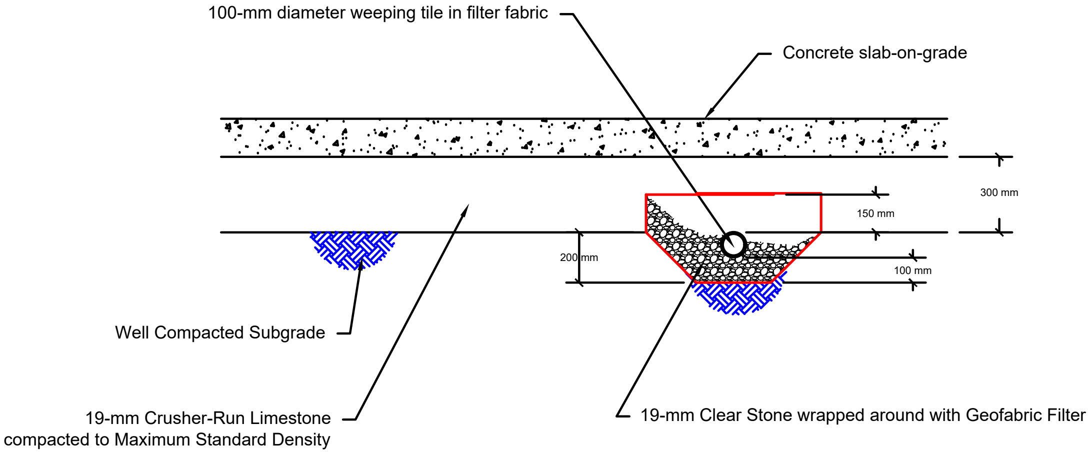
DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 3
SCALE: N.T.S.
REF. NO.: 2310-S041
DATE: JANUARY 2024
REV -



Option 'A'



Option 'B'



Option 'C'

Note:

1. Weepers should be placed in 6 m grids, draining in a positive gradient towards an outlet or a sump pit for removal by pumping.
2. A 10-mil polyethylene sheet should be specified between the gravel bedding and concrete slab.

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90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

DETAILS OF UNDERFLOOR WEEPERS

SITE: SOUTHWEST OF OLD SCHOOL ROAD AND HURONTARIO STREET
TOWN OF CALEDON

DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 4
SCALE: N.T.S.
REF. NO.: 2310-S041
DATE: JANUARY 2024
REV -

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90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX

BOREHOLE LOGS BY TERRAPROBE INC. AND PECG

REFERENCE NO. 2310-S041

Terraprobe

LOG OF BOREHOLE 1

PROJECT: Mayfield West

LOCATION: Caledon, Ontario

CLIENT: Philips Engineering Ltd.

DATE: February 12, 2009

EQUIPMENT: Bombardier/Hollow Stem Augers

ELEVATION DATUM: Geodetic

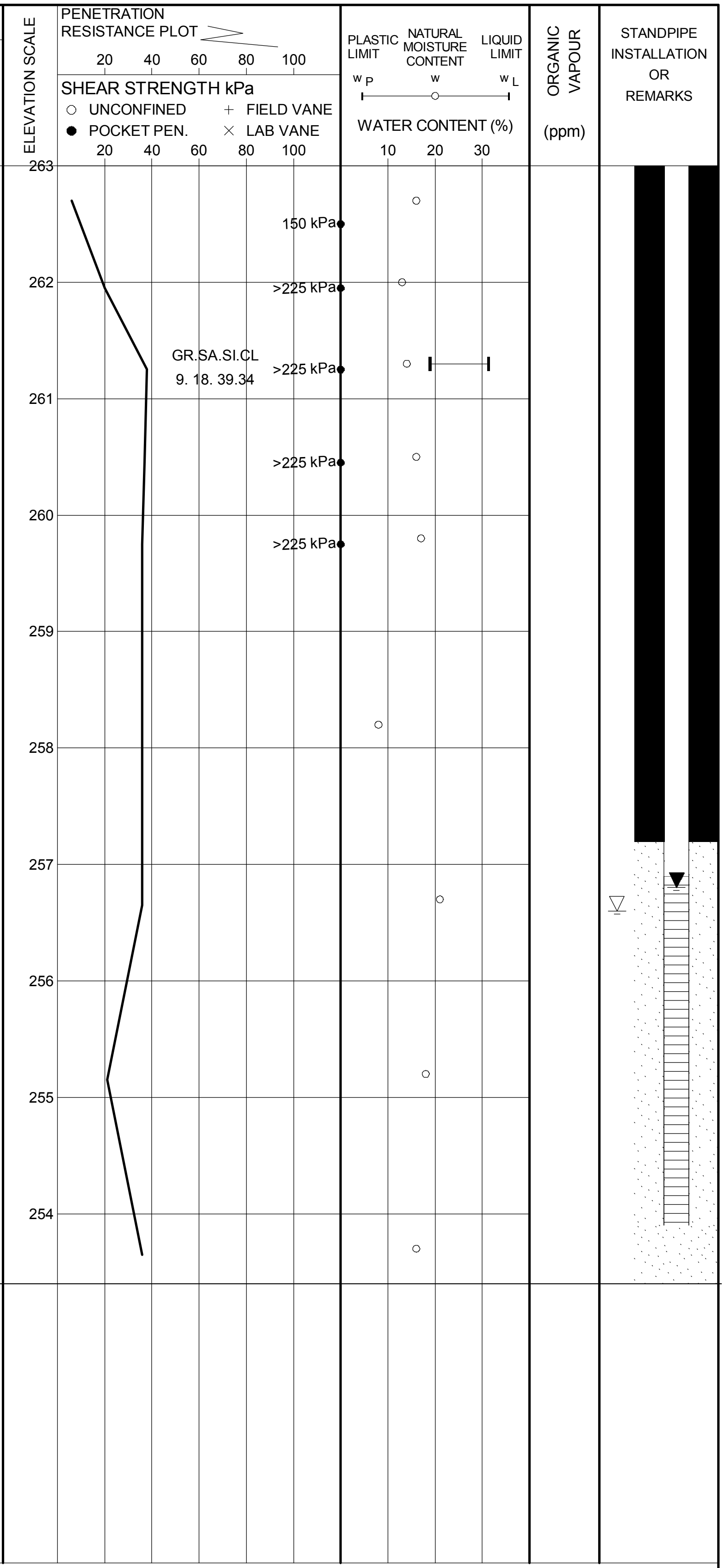
FILE: 1-08-3053

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
263.0 / 0.0	250mm TOPSOIL
262.8 / 0.3	Weathered, firm ---- CLAYEY SILT embedded sand and gravel, very stiff to hard, brown, moist (GLACIAL TILL) ---- sandy
258.4 / 4.6	SANDY SILT trace gravel, trace clay, compact to dense, brown, moist ---- wet ---- grey
253.4 / 9.6	End of Borehole

SAMPLES

NUMBER	TYPE	"N" VALUES
1	SS	6
2	SS	20
3	SS	38
4	SS	37
5	SS	36
6	SS	36
7	SS	36
8	SS	21
9	SS	36



NOTES:
Borehole was caving at 6.7m and unstabilized water level at 6.4m upon completion of drilling.
Water level in monitoring well at 6.2m (Elev. 256.8m) on April 23, 2009.

Terraprobe

LOG OF BOREHOLE 2

PROJECT: Mayfield West
LOCATION: Caledon, Ontario
CLIENT: Philips Engineering Ltd.

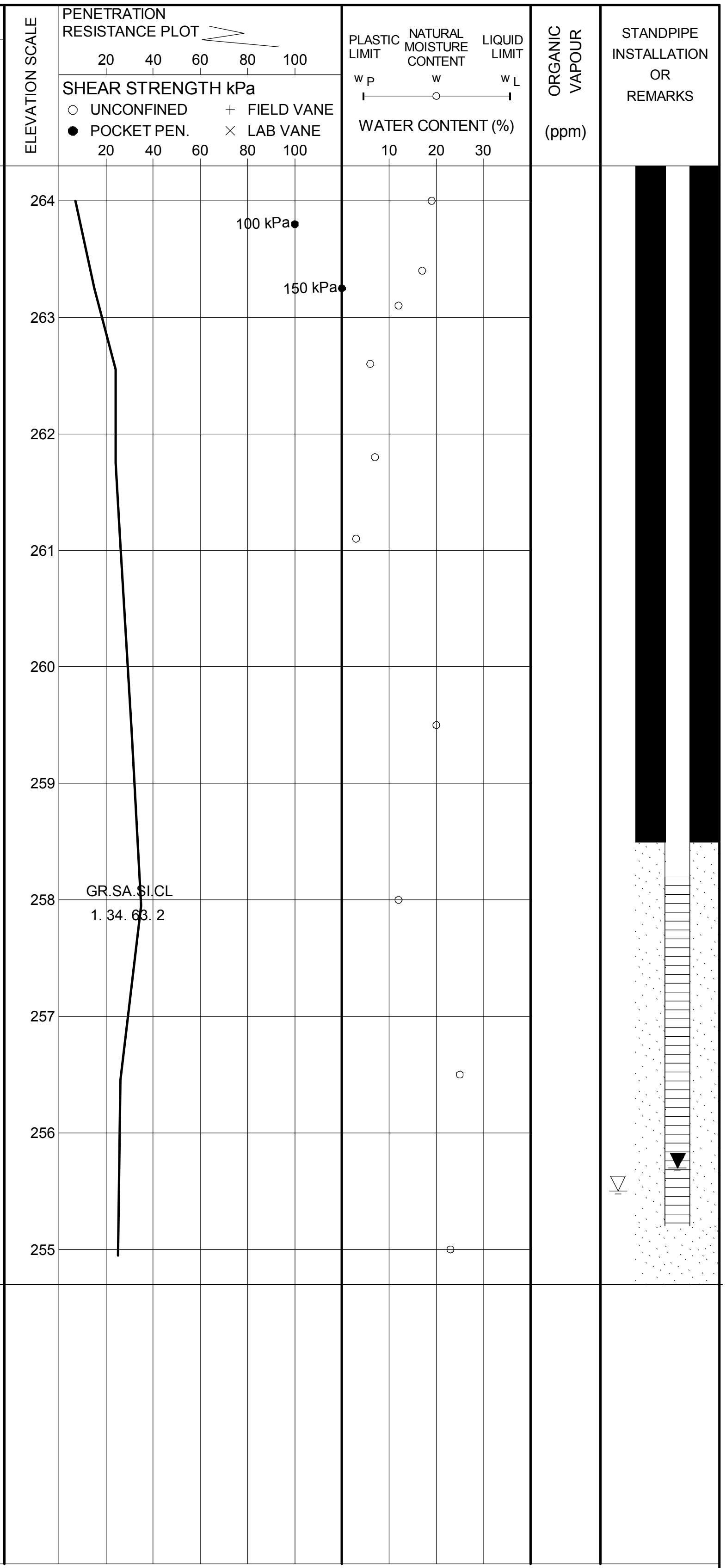
DATE: February 12, 2009
EQUIPMENT: Bombardier/Hollow Stem Augers
ELEVATION DATUM: Geodetic
FILE: 1-08-3053

SOIL PROFILE

ELEV DEPTH	DESCRIPTION
264.3	
0.0 264.0	280mm TOPSOIL
0.3	CLAYEY SILT embedded sand and gravel, stiff to very stiff, brown, moist (GLACIAL TILL)
263.2 1.1	SANDY SILT trace gravel, trace clay, compact to dense, brown, moist ---- wet
254.7 9.6	End of Borehole

SAMPLES

NUMBER	TYPE	"N" VALUES
1	SS	7
2	SS	15
3	SS	24
4	SS	24
5	SS	26
6	SS	31
7	SS	35
8	SS	26
9	SS	25



NOTES:
Borehole was caving at 8.8m and unstabilized water level at 8.8m upon completion of drilling.
Water level in monitoring well at 8.6m (Elev. 255.7m) on April 23, 2009.

BOREHOLE RECORD OF MW-4

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592076.8 E, 4844412.8 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 6.40 m - 7.92 m

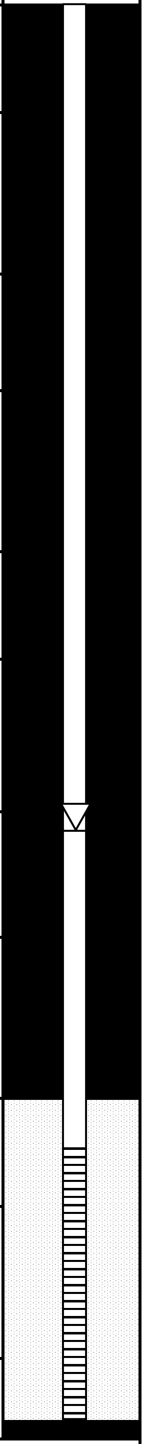
Depth (mbgs): 1, 2, 3, 4, 5, 6, 7, 8

0, 0.6, 0.75, 1.36, 1.52, 2.13, 2.28, 2.89, 3.04, 3.65, 4.57, 5.18, 6.09, 6.7, 7.62

Soil Profile			
Description	Strata	Elevation	Depth
Topsoil: clay and silt, organics, loose, moist, brown	▦	264.93	1.07
Fine and medium sand and silt, laminae, loose to medium density, moist to wet, light brown *6.25 m: Grey*	░	258.18	7.82
Clay, cohesive, very stiff, wet, grey	☰		

Samples		Sample Description	
Number	Type	Recovery (m)	N-Value
1	SS	0.330 / 0.609	8
2	SS	0.330 / 0.609	9
3	SS	0.508 / 0.609	13
4	SS	0.609 / 0.609	23
5	SS	0.609 / 0.609	15
6	SS	0.533 / 0.609	21

Piezometer Installation



Well Installation Details

Stick Up Height: 0.68 m	**W.L. upon Well Completion (D.):** 5.27 mbtoc, 4.59 mbgs
Ground Elevation: 266 masl	**W.L. upon Well Completion (S.):** N/A

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BOREHOLE RECORD OF MW-4

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592076.8 E, 4844412.8 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 6.40 m - 7.92 m

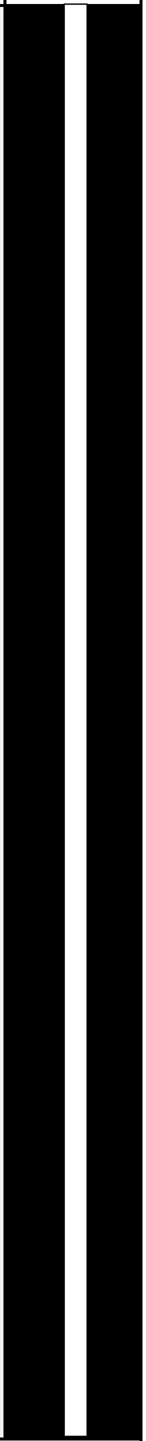
Depth (mbgs)	Soil Profile			Samples		Sample Description		Piezometer Installation
	Description	Strata	Elevation Depth	Number	Type	Recovery (m)	N-Value	
8.22 9 9.14 9.75	*Continued* Clay, cohesive, very stiff, wet, grey	▤	256.3	7	SS	0.533 / 0.609	20	■
10 10.66	Silty clay till, some gravel and cobbles, very dense, moist, red/brown	▩	9.7 255.09					■
11 11.27 12 12.19 12.8 13 13.71 14 14.32 15 15.24 15.84 16	END OF BOREHOLE AT 10.91 m		10.91	8	SS	0.254 / 0.254	70 / 0.25	

Well Installation Details

Stick Up Height: 0.68 m	**W.L. upon Well Completion (D.):** 5.27 mbtoc, 4.59 mbgs
Ground Elevation: 266 masl	**W.L. upon Well Completion (S.):** N/A

BOREHOLE RECORD OF MW-8

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592322.7 E, 4844726.5 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 9.75 m - 11.28 m

Depth (mbgs)	Soil Profile			Samples		Sample Description		Piezometer Installation
	Description	Strata	Elevation Depth	Number	Type	Recovery (m)	N-Value	
0 0.6 0.75 1 1.36 1.52 2 2.13 2.28 2.89 3 3.04 3.65 4 4.57 5 5.18 6 6.09 6.7 7 7.62 8	*Note: Straight drill to 9.14 m, no samples collected. See TerraProbe BH2 for stratigraphy.*							

Well Installation Details

Stick Up Height: 0.73 m	**W.L. upon Well Completion (D.):** 9.73 mbtoc, 9.00 mbgs
Ground Elevation: 265 masl	**W.L. upon Well Completion (S.):** N/A

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BOREHOLE RECORD OF MW-8

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 592322.7 E, 4844726.5 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 15, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 9.75 m - 11.28 m

Depth (mbgs)	Soil Profile			Samples		Sample Description		Piezometer Installation
	Description	Strata	Elevation Depth	Number	Type	Recovery (m)	N-Value	
8.22			255.86					
9.14	Fine sand and silt, medium dense, dry, brown		9.14	1	SS	0.609 / 0.609	23	
9.75	Fine to coarse sand, some silt, medium dense to dense, wet, grey							
10.66	*10.66 m: clay and silt, cohesive, medium soft, wet, grey*			2	SS	0.609 / 0.609	12	
11.27								
12.19	*12.34 m: gravel*			3	SS	0.609 / 0.609	37	
12.8			252.2					
	END OF BOREHOLE AT 12.80 m		12.8					
13.71								
14.32								
15.24								
15.84								

Depth scale: 9, 10, 11, 12, 13, 14, 15, 16

Well Installation Details

Stick Up Height: 0.73 m	**W.L. upon Well Completion (D.):** 9.73 mbtoc, 9.00 mbgs
Ground Elevation: 265 masl	**W.L. upon Well Completion (S.):** N/A