Geotechnical Investigation Report - 1255 Fuller Avenue, Penetanguishene, Ontario

August 21, 2023

Prepared for:
1000239074 Ontario Inc

Cambium Reference: 16599-001

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1.0 Introduction

Cambium Inc. (Cambium) was retained by 1000239074 Ontario Inc (Client) to complete a geotechnical investigation in support of the proposed residential development located at 1255 Fuller Avenue, Penetanguishene, ON (Site).

A geotechnical investigation was required to confirm subsurface conditions at the site and provide geotechnical parameters and recommendations for supporting the design and construction of the proposed residential development.

This report presents and summarizes the methodology and findings of the geotechnical investigation conducted by Cambium at the Site. The report provides geotechnical recommendations for relevant issues pertaining to the proposed development based on the results of the investigation.

As part of the scope of works, Cambium was also retained to carry out a hydrogeological assessment concurrently with the geotechnical investigation. The hydrogeological assessment is provided under a separate cover.

1.1 Reviewed Documents

The following project documents were received and reviewed during the drafting of this report:

[1] Morgan Planning & Development – Orillia, Ontario
Concept Plan ‘D’; 12555 Fuller Ave, Town of Penetanguishene, County of Simcoe; File No. 1187; August 25, 2022.

[2] Innovative Planning Solutions – Barrie, Ontario
Draft Plan of Subdivision; Topographic Plan of Survey of Part Lot B1, Registered Plan No. 69 (Geographic Township of Tay) Town of Penetanguishene, County of Simcoe; File: 23 – 1314; August 1, 2023

[3] C.T. Strongman Surveying Ltd. – Orillia, Ontario
Topographic Plan of Part Lot B1, Registered Plan No. 69 (Geographic Township of Tay) Town of Penetanguishene, County of Simcoe; File No. D-4271; August 17, 2022.

1.2 Standards and Guidelines

Applicable standards, guidelines and other normative documents utilized in preparing geotechnical engineering recommendations for this report are provided below.

[4] Canadian Foundation Engineering Manual – 4th Edition; Canadian Geotechnical Society; 2006

2.0 Site and Project Description

2.1 Site Description

The total area of the Subject Property is approximately 3.86 hectares (9.53 acres). The property is irregularly shaped and generally bounded to the west by Fuller Avenue, to the north by Sandy Bay Road, and to the south and east by residential development. The site is currently partially developed with one residential dwelling along Fuller Avenue, with the remainder of the property being undeveloped and predominantly covered by trees, brush, and other vegetation. Based on [3] the majority of the site is relatively flat with a gentle downward grade from the northwest corner (238.5 m above sea level (mASL)) to the southeast corner (233.5 mASL) of the property, a steeper slope is noted in the southwest corner of the property where the grades range between 236 mASL and 229.5 mASL sloping downwards towards the southern boundary of the property.

A site location plan is appended as Figure 1 of this report.

2.2 Project Description

The proposed development [2] consists of 31 single detached lots, 33 townhouse units, a storm water management pond, with associated asphalt driveways, landscape areas, walkways, on-grade surface level parking and associated utility services. In addition, it is assumed basements will be proposed for all the residential lots.

3.0 Methodology

The geotechnical investigation was conducted at the Site by Cambium on November 24 and 25, 2022. Prior to the investigation, the client created an access route through the vegetated/treed area so a drill rig could access agreed borehole locations.

3.1 Borehole Investigation

A total of six boreholes, numbered BH101-22 to BH106-22, were advanced into the subsurface at predetermined locations throughout the proposed development. The boreholes were terminated at depths ranging between 6.3 to 6.55 m below ground surface (mbgs).

Boreholes BH101-22, BH102-22, and BH105-22 were each outfitted with a monitoring well following completion of drilling, to allow for subsequent groundwater level monitoring and hydrogeological field testing at the Site.

Borehole drilling and sampling were completed using a track-mounted drill rig operating under the supervision of a Cambium geotechnical analyst. The boreholes were advanced to the sampling depths by means of continuous flight hollow stem augers with 50 mm O.D. split spoon samplers.

Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess the consistency of cohesive soils and relative density of non-cohesive materials. Soil samples were collected at approximately 0.75 m intervals in the upper 3.0 m and at 1.5 m intervals below that depth.

The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, laboratory testing, and storage. Borehole logs are provided in Appendix A.

3.2 Site Survey

The elevations and coordinates for all borehole and monitoring well locations were obtained during a subsequent Site survey conducted by Cambium on December 8, 2022. The elevations were surveyed utilizing a benchmark with a known geodetic elevation provided to Cambium by the Client (double nails in a hydro pole along Fuller Avenue, located just north of the existing residential dwelling with a geodetic elevation of 230.36 mASL as per topographic survey provided by the Client [3].

A Site Plan including the borehole locations is appended as Figure 2 of this report.

3.3 Physical Laboratory Testing

Physical laboratory testing, including five grain size analyses (LS-702, 705) were completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Natural moisture content testing (LS-701) was completed on all retrieved soil samples. Results of the grain size testing are presented in Appendix B and are discussed in Section 4.0.

4.0 Subsurface Conditions

The stratigraphy encountered in the boreholes are indicated on the attached borehole logs in Appendix A. It is noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations. The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change. In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (drilling speed, shaking/grinding of the augers, etc.).

In general, the subsurface conditions consist of surficial topsoil underlain by cohesionless native deposits generally consisting of silty sand glacial till containing varying amounts of gravel and clay. Practical refusal was encountered within each of the boreholes due to the density of the native glacial till deposits.

4.1 Regional Geology

Ontario Geological Survey (OGS) geological mapping indicates that the quaternary geology within the vicinity of the site is characterized as Pleistocene Glaciolacustrine deposits generally characterized by sand, gravelly sand and gravel soils. Review of surficial geological mapping shows the site lies within a glacial till deposit characterized by stone poor sandy silt to silty sand soil matrix.

4.2 Topsoil

A layer of organic topsoil was encountered at the surface of each of the boreholes advanced at the Site. The encountered topsoil ranged in thickness from 100 mm to 150 mm and was black in colour.

The topsoil was moist at the time of the investigation with natural moisture contents ranging from 20.3% to 35.0% based on laboratory testing. Assessments of organic matter content or other topsoil quality tests were beyond the scope of this study.

4.3 Native Sand Materials

A deposit of cohesionless native sand soils were encountered beneath surficial topsoil within borehole BH101-22, extending to a depth of 3.0 mbgs. The native sand deposit was gravelly in composition and contains traces of silt and clay.

SPT N values recorded within the cohesionless native sand deposit varied from 4 to 35 blows, indicating a very loose to dense relative density.

Natural moisture contents of the cohesionless native sand deposit ranged from 5.3% and 10.6% based on laboratory testing.

Particle size distribution analyses were completed on one sample collected from the native sand materials. The testing results are provided in Appendix B and are summarized in Table 1.

Table 1 Particle Size Distribution Analysis – Upper Native Sand Deposit

Borehole	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH101-22 SS3	1.5 – 2.1	Gravelly Sand some Silt trace Clay	23	61	15	1	5.3

4.4 Glacial Till Materials

A deposit of native cohesionless native glacial till soils was encountered beneath the upper native sand deposit within borehole BH101-22, and beneath the surficial topsoil in each of the remaining boreholes. The glacial till deposit generally consisted of a silty sand matrix containing varying amounts of gravel and clay. The glacial till soils extended to the borehole termination depths from 6.3 mbgs to 6.55 mbgs.

SPT N values recorded within the native glacial till deposit ranged from 4 to 100 blows, indicating loose to very dense relative density. The deposit was generally compact to very dense, with the loose portions of the deposit being encountered within the upper weathered

portion of the deposit, extending to a depth of approximately 0.8 mbgs within each of the boreholes advanced at the site, except BH101-22.

Natural moisture contents within the deposit generally ranged between 4.8% and 15.2% based on laboratory testing.

Particle size distribution analysis was completed on five samples collected from the glacial till materials. The testing results are provided in Appendix B and are summarized in Table 2.

Table 2 Particle Size Distribution Analysis – Glacial Till

Borehole	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH102-22 SS5	3 – 3.7	Sand and Silt trace Clay trace Gravel	1	57	36	6	7.1
BH103-22 SS4	2.3 – 2.9	Silty Sand trace Clay trace Gravel	3	59	34	4	7.9
BH104-22 SS3	1.5 – 2.1	Silty Sand trace Clay trace Gravel	3	57	34	6	8.1
BH106-22 SS4	2.3 – 2.9	Silt and Sand trace Clay trace Gravel	1	43	52	4	10.4

4.5 Bedrock

Each of the boreholes advanced throughout the site were terminated due to practical refusal within the generally compact to very dense native silty sand glacial till soils close to the proposed termination depths for the study. The boreholes were terminated at depths from 6.3 mbgs to 6.55 mbgs. Borehole termination observations are summarized in Table 3.

Table 3 Borehole Elevations & Termination Depths

Borehole	Ground Elevation (mASL)	Termination Depth (mbgs)	Termination Elevation (mASL)
BH101-22	232.53	6.35	226.18
BH102-22	233.92	6.55	227.37
BH103-22	236.56	6.30	230.26
BH104-22	235.85	6.55	229.30
BH105-22	236.59	6.55	230.04
BH106-22	±234.5[1]	6.4	±228.1

[1] *Inferred from topographic survey, as borehole was unable to be surveyed due to dense tree cover.*

4.6 Groundwater

The soils were predominantly described as being dry to moist throughout the borehole investigation. Wet soils (based on visual observations during drilling works) were not observed within any of the boreholes advanced at the site.

Groundwater (free water) and caving (sloughing) was not noted within any of the boreholes advanced at the site following the completion of drilling. The groundwater level and caving observations in the boreholes are provided in Table 4 and are not representative of the stabilized groundwater conditions and as such, the groundwater table elevation may vary.

Table 4 Groundwater and Caving Observations During Drilling

Date	Borehole	Borehole Elevation (mASL)	Wet Soils Encountered During Drilling (mbgs)[1]	Water Level in Borehole upon Completion (mbgs) [1]	Elevation of Water in Borehole upon Completion (mASL) [2]	Caving Depth (mbgs)[1]
November 24 & 25, 2022	BH101-22	232.53	-	Dry	-	Open
	BH102-22	233.92	-	Dry	-	Open
	BH103-22	236.56	-	Dry	-	Open
	BH104-22	235.85	-	Dry	-	Open
	BH105-22	236.59	-	Dry	-	Open
	BH106-22	±234.5[3]	-	Dry	-	Open

[1] *metres below ground surface*

[2] *metres above sea level*

[3] *Inferred from topographic survey, as borehole was unable to be surveyed due to dense tree cover.*

A total of three monitoring wells were installed at the site in boreholes BH101-22, BH102-22 and BH105-22 to allow for subsequent groundwater level monitoring and hydraulic testing at the Site. The stabilized water level information obtained from the monitoring wells following the borehole investigation is summarized in Table 5.

Table 5 Groundwater Observations in the Monitoring Wells

Date	Borehole	Water Level Depth (mbgs)	Water Level Elevation (mASL)	Bottom of Well Elevation (mASL)
December 8, 2022	BH101-22	Dry	-	226.43
	BH102-22	Dry	-	227.82
	BH105-22	Dry	-	230.49
March 15, 2023	BH101-22	5.45	227.08	-
	BH102-22	Dry	-	
	BH105-22	6.02	230.57	
April 17, 2023	BH101-22	**2.56**	**229.97**	
	BH102-22	**5.58**	**228.35**	
	BH105-22	**5.92**	**230.67**	
May 17, 2023	BH101-22	2.93	229.60	
	BH102-22	5.61	228.32	
	BH105-22	5.96	230.63	
June 27, 2023	BH101-22	5.76	226.77	
	BH102-22	5.68	228.25	
	BH105-22	5.96	230.63	

***Bold** text denotes the high groundwater measurement during the monitoring events*

It should be noted that the encountered and measured groundwater levels reflect the groundwater conditions in the boreholes at the time of the borehole investigation and the subsequent monitoring events. Groundwater levels at the Site are anticipated to vary between and beyond the borehole locations and to fluctuate with seasonal variations in precipitation and snowmelt.

5.0 Geotechnical Considerations

This section of the report provides engineering information on, and recommendations for, the geotechnical design aspects of the project based on our interpretation of the borehole information, the laboratory test data and our understanding of the project requirements. The information in this portion of the report is provided for planning and design purposes for the guidance of the design engineers and architects. Where comments are made on construction, they are provided only to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the Site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own independent interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing, and the like. Cambium will not assume any responsibility for construction-related decisions made by contractors on the basis of this report.

5.1 Site Preparation

Existing topsoil and organic material, any loose reworked/disturbed native materials and any deleterious material (i.e., imported fill material, construction debris, fibrous material, asphalt, brick fragments, etc.) encountered should be excavated and removed beneath proposed development areas prior to construction. Additionally, this material should be excavated and removed to a minimum distance of 3 m around the building footprint. Any topsoil and materials with significant quantities of organics and deleterious materials are not appropriate for use as fill.

The exposed subgrade should be proof-rolled and inspected by a qualified geotechnical engineer prior to placement of any engineered fill or foundations. Any loose/soft soils identified at the time of the proof-rolling that are unable to uniformly be compacted should be sub-excavated and removed.

The excavations created through the removal of these materials should be backfilled with approved engineered fill consistent with the recommendations provided below.

The near surface soils can be very unstable if wet or saturated. Such conditions are common in the spring and late fall. Under these conditions, temporary use of granular fill, and possible separating/reinforcing geotextiles, may be required to prevent severe rutting on construction access routes.

5.2 Frost Penetration

Based on climate data and design charts, the maximum frost penetration depth below the surface at the Site is estimated at 1.6 mbgs. Exterior footings for the proposed structures should be situated at or below this depth for frost penetration or should be appropriately protected. Any services should be located below this depth or be appropriately insulated.

5.3 Excavations

At the time of preparing this report it is assumed that the proposed structures will be built with shallow basements.

In the areas of the Site where unsupported excavations to the required depths are deemed feasible, the excavations must be carried out in accordance with the latest edition of OHSA and Ontario Regulation 213/91 (as amended). For practical purposes, the loose to very dense native overburden soils at the Site above the groundwater table and within continually dewatered depths can be considered Type 3 soils and may have unsupported side slopes no steeper than 1H:1V in these areas.

Soils below the groundwater table should be treated as Type 4 soils and therefore excavation unsupported side slopes should be decreased to 3H:1V in these areas.

Excavation slopes should be protected during construction from precipitation, runoff, or snow/ice melt and should be inspected regularly for signs of instability.

If localized instability is noted during excavation or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions or the excavation sidewalls must be fully supported (shored).

Stockpiles of excavated materials should be kept at least at the same distance as the excavation depth from the top edge of the excavation to prevent slope instability. Care should also be taken to avoid overloading of any existing adjacent underground services/structures by stockpiles.

5.4 Groundwater Control and Dewatering

During the groundwater monitoring event conducted on December 8, 2022, all of the monitoring wells were measured as dry (i.e., no groundwater encountered), with the bottom of the wells ranging in elevation between 230.49 mASL and 226.43 mASL. Groundwater was encountered at various depths/elevations during monitoring events between March and June 2023, with the result summarized in Table 5.

The groundwater level measured at the Site represents a momentary observation, therefore, it could reasonably be expected that the groundwater table will be higher than measured at other times of the year, and it is recommended to conduct excavation and foundation works during drier times of the year to avoid groundwater-related issues and to save costs related to dewatering efforts.

In general, excavations may encounter some groundwater inflow into the excavation due to zones of perched water across the site, however this seepage should be manageable using filtered sumps and pumps. Depending on the grading, depth, size, and staging of the excavations, a Permit to Take Water (PTTW) or registry with the Environmental Activity and Sector Registry (EASR) of the Ministry of the Environment, Conservation and Parks (MECP) may potentially be required, however is deemed unlikely based on the initial conceptual design.

Where the excavations for site services such as sewers or watermain are expected to extend below the water table***,*** provisions will be required to maintain sufficiently dry excavations to permit safe working conditions. In this context, the groundwater level should be drawn down to at least 1 m below the base of the excavation, prior to the excavations reaching the base level, to reduce the potential for loosening of the excavation base due to seepage pressures. Further, care should be taken to direct surface water away from the open excavations. Whilst

unlikely based on the groundwater monitoring events, excavations extending below the groundwater table through, or in, saturated non-cohesive deposits will require the use of positive dewatering in the form of perimeter trenching with filtered sumps and pumps, and/or well points.

Water takings in excess of 50 m^3/day are regulated by the MECP. Certain takings of groundwater and storm water for construction site dewatering purposes with a combined total less than 400 m^3/day qualify for self-registration on the MECP's EASR replaces the need to obtain a PTTW and a Section 53 approval. A Category 3 PTTW is required where the proposed water taking is greater than 400 m^3/day.

The dewatering system is the Contractor's responsibility and the rate and volume required for dewatering is dependent on the construction methods and staging chosen by the contractor. Further, the contractor will be responsible for obtaining any required discharge approvals.

5.5 Foundation Design

At the time of preparing this report it is assumed that the dwellings and townhomes will be constructed with shallow basements. Cambium should be contacted to review the final grading plan and may provide changes to our foundation recommendations should the structures be constructed as slab on grade.

5.5.1 Conventional Shallow Footings

From a geotechnical perspective, the proposed structures can be supported on standard strip and/or spread footings founded on the cohesionless native soils (silty sand glacial till soils, loose to very dense relative density). Table 6 gives allowable bearing capacities based on geotechnical principles outlined in [4] for shallow foundations bearing on native soils.

The provided values are applicable for strip foundations with a minimum width of 0.5 m and for spread foundations with minimum dimensions of 1 m x 1 m. It is noted that the density of native glacial till is generally consistent with depth, with a compact zone noted in borehole BH101-22 at a depth of 3 to 3.6 mbgs, as such, footings should be constructed within the elevation ranges provided in Table 6. In addition, consideration should be given to constructing

footings at shallower depths and either importing fill or providing appropriate insulation around the foundation elements for frost protection.

Table 6 Bearing Capacities for Shallow Foundations on Native Soils

Borehole	Soil Description	Depth (mbgs)	Elevation (mASL)	Maximum Geotechnical Reaction SLS (kPa)	Maximum Geotechnical Reaction ULS (kPa)
BH101-22	Glacial Till	1.5 – 4.5		150	200
		Below 4.5		200	265
BH102-22	Glacial Till	Below 0.8	249.0 – 244.8	200	265
BH103-22	Glacial Till	Below 0.8	245.9 - 244.3	200	265
BH104-22	Glacial Till	0.8 – 6.1	248.6 – 244.0	150	200
		Below 6.1		200	265
BH105-22	Glacial Till	Below 0.8	244.8 – 243.0	200	265
BH106-22	Glacial Till	Below 0.8	247.3 – 244.4	200	265
Note: assumes all foundations provided with at least 1.6 m of adjacent earth cover.					

Alternatively, in areas where the proposed founding levels are above the level of competent native soil, or where sub excavation is required, footings can bear directly on a pad of engineered fill constructed per the recommendations in Section 5.6. From a preliminary perspective, footings placed on approved engineered fill and appropriately protected from frost may be designed for an allowable bearing capacity of 150 kPa at SLS and 200 kPa at ULS. Cambium should be retained to review the final grading plan, as the preliminary engineered fill bearing capacity values will change depending on engineered fill thickness, material and the native subgrade soil the engineered fill pad is constructed on.

Settlement potential at the above-noted SLS loadings is less than 25 mm and differential settlement should be less than 20 mm. The quality of the subgrade should be inspected by Cambium during construction, prior to constructing the footings, to confirm bearing capacity estimates.

5.5.2 Floor Slabs

To create a stable working surface, to distribute loadings, and for drainage purposes, an allowance should be made to provide at least 200 mm of OPSS 1010 Granular A compacted to

98% of Standard Proctor Maximum Dry Density (SPMDD) beneath all floor slabs. It is recommended that all floor slabs are situated at least 500 mm above the seasonal high groundwater elevation.

If any interior areas are not to be continuously heated throughout the winter there is potential for damage to the floor slab due to frost action depending upon the composition of the subgrade soils. The floor slab within any area expected to be exposed to freezing temperatures should be adequately insulated to prevent frost penetration within the subgrade.

Any basement floor slabs should be underlain by a 300 mm thick layer of 19 mm diameter crushed clear stone wrapped in a geotextile (Terrafix 270R or equivalent) and hydraulically connected to perimeter subdrains.

The clear stone material should be nominally compacted to a dense state.

5.6 Subdrainage

The exterior grade around any buildings should be sloped from the walls to direct surface runoff away from the building. To deal with seasonal perched water and/or the water table, perimeter subdrains consisting of geotextile wrapped perforated pipe subdrains set in a trench of clear stone and connected to a sump or other frost-free positive outlet are recommended.

Subsurface walls should be adequately damp proofed above the water table and waterproofed below the water table.

5.7 Backfill and Compaction

All existing vegetation, topsoil, organic and non-organic fills, and any loose soils shall be removed down to a competent base. Backfill areas must be approved by a qualified geotechnical engineer prior to placement of any new fill, to ensure the suitability of subgrade conditions.

The cohesionless native silty sand glacial till soils encountered at the Site are generally contains a significant content of fine-grained soils (typically ±40%) and may not be appropriate

for use as fill below any proposed grading and/or parking and driving areas, and subsequent materials testing will be required during construction to confirm acceptance.

Some moisture content adjustments of fill material may be required prior to placement and compaction, depending upon seasonal conditions. Geotechnical inspections and testing of engineered fill are required to confirm acceptable quality.

Foundation wall and any buried utility backfill material should consist of free-draining imported granular material. Typically, backfill should be placed in maximum 300 mm thick lifts and should be compacted to a minimum of 98% of SPMDD. Backfill adjacent to the structural elements (i.e., foundation walls) should be compacted to 95% of SPMDD taking care not to damage the adjacent structures. The backfill material in the upper 300 mm below the pavement subgrade elevation should be compacted to 100% of SPMDD in all areas.

5.7.1 Engineered Fill

Where the existing fill is treated as an engineered fill to support structural elements such as foundations and/or floor slabs the following is recommended for the construction of engineered fill:

I. Remove any and all existing vegetation, surficial topsoil / organics, organic fills or fills and any loose/disturbed soils to a competent subgrade for a suitable envelope.

II. The area of the engineered fill should extend horizontally 1 m beyond the outside edge of the foundations then extend downward at an imaginary 1H:1V slope to the competent approved native soil. The exposed edges of the engineered fill should be sloped at a maximum of 3H:1V to avoid weakening of the engineered fill edges due to slope movement. If fill is required adjacent to sloped banks (i.e., slope steeper than 3H:1V), the fill shall be placed in stepped planes to avoid a plane weakness.

III. The subgrade or base of the engineered fill area must be approved by Cambium prior to placement of any new fill, to ensure that suitability of subgrade condition.

IV. Place approved OPSS 1010 SSM or Granular B Type I material at a moisture content at or near optimum moisture in suitable maximum 200 mm thick lifts,

compacted to 100% of SPMDD. If native soils from the site are not used as engineered fill, imported material for engineered fill should consist of clean, non-organic soils, free of chemical contamination or deleterious material. Any frost penetration into the fill material must be removed prior to placement of subsequent lifts of fill and reviewed by Cambium.

V. The engineered fill should be placed at least 600 mm above the elevation of the proposed underside of footing.

VI. Due to the potential negative effects of differential settlement between the engineered fill and the native soils, in any block where footings are to be placed partly on engineered fill and partly on native soils, reinforcing steel bars should be included and placed within the footings and the top of the foundation walls. All tie reinforcing steel bars should be included and placed within the top of the foundation walls. All tie reinforcing steel bars should have at least 600 mm of overlap. The actual steel reinforcement design should be confirmed / designed by the project structural engineer.

VII. Full time testing and inspection of the engineered fill will be required for it to be used as a founding material, as outlined in Section 4.2.2.2 of the Ontario Building Code.

5.8 Lateral Earth Pressure

Lateral earth pressure coefficients (K) are shown in Table 7. It is assumed that potential lateral loads will result from cohesionless, frictional materials, such as granular backfill and the encountered native silty sand glacial till soils.

Table 7 Lateral Earth Pressure Coefficients

Stratum/Parameter	γ [kN/m^3]	Φ [°]	c [kN/m^2]	K_o [-]	K_a [-]	K_p [-]
Silty Sand Glacial Till loose to very dense	21	33.0	0	0.46	0.29	3.39
Engineered Fill (per recommendations provided above)	20.5	32.5	0	0.46	0.30	3.32

Where: γ = bulk unit weight of soil (kN/m^3)

γ' = submerged (effective) unit weight of soil (kN/m^3)

φ = internal angle of friction (degrees)

c = soil cohesion (kN/m^2)

K_a = Rankine active earth pressure coefficient (dimensionless)

K_o = Rankine at-rest earth pressure coefficient (dimensionless)

K_p = Rankine passive earth pressure coefficient (dimensionless)

The coefficients provided in Table 6 assume that the surface of the granular backfill is horizontal against any proposed retaining wall, and the wall is vertical and smooth. Cambium should be contacted to provide updated lateral earth pressure coefficients should the assumptions differ to those noted.

5.9 Seismic Site Classification

The Ontario Building Code (OBC) specifies that the structures should be designed to withstand forces due to earthquakes. For the purpose of earthquake design, geotechnical information shall be used to determine the “Site Class”.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the OBC (2012). The classification is based on the determination of the average shear wave velocity in the top 30 m of the Site stratigraphy, where shear wave velocity (V_s) measurements have been taken. Alternatively, the classification is estimated

based on rational analysis of undrained shear strength (S_u) or penetration resistances (N_{60} values).

Based on the explored soil properties and in accordance with Table 4.1.8.4.A, it is recommended that Site Class “D” (stiff soil) be applied for structural design at the Site.

Consideration could be given to carrying out shear wave velocity testing (Multichannel Analysis of Surface Waves, “MASW”) to evaluate whether an improved seismic site class can be obtained. Further details regarding shear wave velocity testing could be provided upon request.

5.10 Site Servicing

Trench excavations should follow general guidelines of Sections 5.3 and 5.4.

Bedding and cover material for any services should consist of OPSS 1010 Granular A or B Type II, placed in accordance with the Town of Penetanguishene standards. The bedding and cover material shall be placed in maximum 150 mm thick lifts and should be compacted to at least 98% of SPMDD. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to at least 98% of SPMDD.

5.11 Pavement Design

The performance of the pavement is dependent upon proper subgrade preparation. All topsoil and organic materials should be removed down to native material and backfilled with approved engineered fill, compacted to at least 98% of SPMDD. The subgrade should be compacted, proof rolled and inspected by a Geotechnical Engineer. Any areas where rutting or appreciable deflection is noted should be sub-excavated and replaced with suitable fill. The fill should be compacted to at least 98% of SPMDD.

The recommended minimum pavement structure design has been provided in Table 8 based upon review of the site soil and groundwater conditions and review of the Town of Penetanguishene engineering standards.

Table 8 Minimum Pavement Structure

Pavement Layer	Compaction Requirements	Urban Residential (mm)	Urban Arterial (mm)
Surface Course Asphalt	92% - 96.5% MRD (OPSS 310)	40 mm HL3 or SP12.5	40 mm HL3 or SP12.5
Binder Course Asphalt	92% - 96.5% MRD (OPSS 310)	50 mm HL8 or SP19.0	90 mm HL8 or SP19.0
Granular Base	100% SPMDD (ASTM-D698)	150 mm Granular A	150 mm Granular A
Granular Subbase	100% SPMDD (ASTM-D698)	300 mm Granular B	300 mm Granular B

Material and thickness substitutions must be approved by the Design Engineer. The thickness of the subbase layer could be increased at the discretion of the Engineer, to accommodate site conditions at the time of construction, including soft or weak subgrade soil replacement.

Compaction of the subgrade should be verified by the Engineer prior to placing the granular fill. Granular layers should be placed in 200 mm maximum loose lifts and compacted to at least 100% of SPMDD. The granular materials specified should conform to OPSS standards, as confirmed by appropriate materials testing. Asphalt materials should be rolled and compacted as per OPSS 310.

The final asphalt surface should be sloped at a minimum of 2% to shed runoff. Abutting pavements should be sawcut to provide clean vertical joints with new pavement areas.

6.0 Report Limitations

6.1 Design Review and Inspections

Cambium should be contacted to review and approve design drawings, prior to tendering or commencing construction, to ensure that all pertinent geotechnical-related factors have been addressed. It is important that onsite geotechnical supervision be provided at this site for excavation and backfill procedures, deleterious soil removal, subgrade inspections and compaction testing.

6.2 Changes in Site and Project Scope

This geotechnical engineering report is intended for planning and design purposes only.

Subsurface conditions can be altered by the passage of sufficient time, natural occurrences, and human intervention. In particular, consideration should be given to contractual responsibilities as they relate to control of groundwater seepage, disturbance of soils, and frost protection.

The design parameters provided, and the engineering advice offered in this report are intended for use by the owner and its retained design consultants. If there are changes to the project scope and development features, these interpretations made of the subsurface information, for geotechnical design parameters, advice, and comments relating to constructability issues and quality control may not be complete for the project. Cambium should be retained to conduct further review to interpret the implications of such changes with respect to this report.

7.0 Closing

We trust that the information contained in this report meets your current requirements. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (705) 719-0700.

Respectfully submitted,

CAMBIUM INC.

Rob Gethin, P.Eng.
Group Manager – Geotechnical

RLG/jb

8.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer, and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

Reliance on Materials and Information

The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze, or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect, or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work or reports.

Facts, conditions, information, and circumstances may vary with time and locations and Cambium's work is based on a review of such matters as they existed at the particular time and location indicated in its reports. No assurance is made by Cambium that the facts, conditions, information, circumstances, or any underlying assumptions made by Cambium in connection with the work performed will not change after the work is completed and a report is submitted. If any such changes occur or additional information is obtained, Cambium should be advised and requested to consider if the changes or additional information affect its findings or results.

When preparing reports, Cambium considers applicable legislation, regulations, governmental guidelines, and policies to the extent they are within its knowledge, but Cambium is not qualified to advise with respect to legal matters. The presentation of information regarding applicable legislation, regulations, governmental guidelines, and policies is for information only and is not intended to and should not be interpreted as constituting a legal opinion concerning the work completed or conditions outlined in a report. All legal matters should be reviewed and considered by an appropriately qualified legal practitioner.

Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

Reliance

Cambium's services, work and reports may be relied on by the client and its corporate directors and officers, employees, and professional advisors. Cambium is not responsible for the use of its work or reports by any other party, or for the reliance on, or for any decision which is made by any party using the services or work performed by or a report prepared by Cambium without Cambium's express written consent. Any party that relies on services or work performed by Cambium or a report prepared by Cambium without Cambium's express written consent, does so at its own risk. No report of Cambium may be disclosed or referred to in any public document without Cambium's express prior written consent. Cambium specifically disclaims any liability or responsibility to any such party for any loss, damage, expense, fine, penalty or other such thing which may arise or result from the use of any information, recommendation or other matter arising from the services, work or reports provided by Cambium.

Limitation of Liability

Potential liability to the client arising out of the report is limited to the amount of Cambium's professional liability insurance coverage. Cambium shall only be liable for direct damages to the extent caused by Cambium's negligence and/or breach of contract. Cambium shall not be liable for consequential damages.

Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.

Appended Figures

GEOTECHNICAL INVESTIGATION

1000239074 ONTARIO INC
1255 Fuller Avenue,
Penetanguishene, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Watercourse
- Water Area
- Provincial Park
- Wooded Area
- Built Up Area

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

194 Sophia Street
Peterborough, Ontario, K9H 1E5
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SITE LOCATION MAP

Project No.: 16599-001		Date: December 2022	
		Rev.:	
Scale: 1:100,000		Projection: NAD 1983 UTM Zone 17N	
Created by: DBB	Checked by: RG	Figure:	1

O:\GIS\MXDs\16500-16599\16599-001 1000239074 Ont Inc - Angelo Lavino - GEO & HydroG - 1255 Fuller Ave, Penetanguishene\2022-11-29 FIG 1- Site Location Map.mxd

GEOTECHNICAL INVESTIGATION

1000239074 ONTARIO INC
1255 Fuller Avenue,
Penetanguishene, Ontario

LEGEND

- Borehole
- Monitoring Well
- Site (approximate)

Notes:
- Site plan overlay created by Innovative Planning Solutions, File no. 23-1314, dated August 1, 2023.
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for

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BOREHOLE LOCATION PLAN

Project No.:	16599-001	Date:	January 2023
		Rev.:	August 2023
Scale:	1:1,750	Projection:	NAD 1983 UTM Zone 17N
Created by:	DBB	Checked by:	SK
Figure:	2		

O:\GIS\MXDs\16500-16599\16599-001 1000239074 Ont Inc - Angelo Lavinio - GEO & HydroG - 1255 Fuller Ave, Penetanguishene\2023-08-21 FIG 2- Borehole Location Plan.mxd

Appendix A

Borehole Logs

Client:	1000239074 Ontario Inc.	**Project Name:**	1255 Fuller Avenue, Penetanguishene, ON	**Log of Borehole:**	BH101-22
Contractor:	Walker Drilling	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Location:	1255 Fuller Avenue	**Elevation:**	232.53 mASL	**Date Completed:**	Nov 24, 2022
Project No.:	16599-001	**UTM:**	17T **N:** 4960515 **E:** 585286		

SUBSURFACE PROFILE				SAMPLE							
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. +, rem V. ⊕) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
232.5	0		**TOPSOIL:** TOPSOIL (~150mm thick) — Elevation 232.38 / Depth 0.15	1A	SS			20.3%		Cap	
232	0.5		**(SW) gravelly SAND:** some silt, trace, clay; brown; non-cohesive, moist, loose	1B	SS	60	4	10.6%	4		
231.5	1		- compact	2	SS	70	11	9.6%	11	Bentonite Plug	
231	1.5									Riser	
				3	SS	70	27	5.3%	27		
230.5	2										
230	2.5		- dense	4	SS	80	35	9.5%	35		
229.5	3		Elevation 229.48 / Depth 3.05								
			(SM) SILTY SAND: trace to some gravel; brown; non-cohesive, moist, compact to very dense	5	SS	80	11	9.8%	11		
229	3.5										
228.5	4									Sand Pack	
228	4.5		- very dense	6	SS	80	57	9.9%	57	PVC Screen	
227.5	5										
227	5.5										
226.5	6										
				7	SS	70	73	6.6%	73	Cap	No groundwater encountered during monitoring event on December 8, 2022
			Elevation 226.18 / Depth 6.35								
226	6.5		Borehole Terminated @ 6.4m Due to Practical Refusal								
225.6											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS3	23	61	15	1

1m = 26 units

Logged By: WA **Input By:** WA

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Client: 1000239074 Ontario Inc. **Project Name:** 1255 Fuller Avenue, Penetanguishene, ON **Log of Borehole:** BH102-22

Contractor: Walker Drilling **Method:** Track Mounted Hollow Stem Auger Page: 1 of 1

Location: 1255 Fuller Avenue **Elevation:** 233.92 mASL **Date Completed:** Nov 24, 2022

Project No.: 16599-001 **UTM:** 17T **N:** 4960568 **E:** 585389

SUBSURFACE PROFILE				SAMPLE							
Elevation (m) / Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. / rem V.) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
233.9 / 0		**TOPSOIL:** TOPSOIL (~100mm thick)	233.82 / 0.1	1A	SS			28.8%		Cap	
233.4 / 0.5		**(SM) SILTY SAND:** trace organic matter; brown; non-cohesive, moist, loose	233.16 / 0.76	1B	SS	50	5	13.4%	5		
232.9 / 1		**(SM) SILTY SAND:** trace to some gravel, trace clay ; brown; non-cohesive, moist, compact		2	SS	80	20	9.0%	20	Bentonite Plug	
232.4 / 1.5		- very dense		3	SS	80	88	8.3%	88	Riser	
231.9 / 2				4	SS	80	56	4.8%	56		
231.4 / 2.5											
230.9 / 3		- grey at a depth of about 3.1mbgs		5	SS	80	50	7.1%	50		
230.4 / 3.5											
229.9 / 4										Sand Pack	
229.4 / 4.5										PVC Screen	
228.9 / 5				6	SS	70	89	6.8%	89		
228.4 / 5.5											
227.9 / 6											
227.4 / 6.5		- some gravel	227.37	7	SS	80	96	6.1%	96	Cap	No groundwater encountered during monitoring event on December 8, 2022
227		Borehole Terminated @ 6.6m Due to Practical Refusal	6.55								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS5	1	57	36	6

1m = 26 units

Logged By: WA **Input By:** WA

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Client:	1000239074 Ontario Inc.	**Project Name:**	1255 Fuller Avenue, Penetanguishene, ON	**Log of Borehole:**	BH103-22
Contractor:	Walker Drilling	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Location:	1255 Fuller Avenue	**Elevation:**	236.56 mASL	**Date Completed:**	Nov 25, 2022
Project No.:	16599-001	**UTM:**	17T **N:** 4960584 **E:** 585270		

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. / rem V.) (20 40 60 80)	SPT (N) (20 40 60 80)	Well Installation	Log Notes
236.6	0	**TOPSOIL:** TOPSOIL (~125mm thick)	236.43 / 0.13	1A	SS			22.2%				
236.1	0.5	**(SM) SILTY SAND:** trace organic matter; brown; non-cohesive, moist, loose	235.8 / 0.76	1B	SS	50	5	8.5%		5		
235.6	1	**(SM) SILTY SAND:** trace gravel, trace clay; brown; non-cohesive, moist, dense		2	SS	60	32	5.4%		32		
235.1	1.5	- compact		3	SS	70	28	8.4%		28		
234.6	2											
234.1	2.5	- very dense		4	SS	80	88	7.9%		88		
233.6	3											
233.1	3.5			5	SS	80	82	7.5%		82		
232.6	4											
232.1	4.5											
231.6	5			6	SS	80	76	10.9%		76		
231.1	5.5											
230.6	6			7	SS	80	50	8.0%		50		Borehole noted as open and dry upon completion
230.1	6.5	Borehole Terminated @ 6.3m Due to Practical Refusal	230.26 / 6.3									
229.6												

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS4	3	59	34	4

1m = 26 units

Logged By: WA **Input By:** WA

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Client: 1000239074 Ontario Inc. **Project Name:** 1255 Fuller Avenue, Penetanguishene, ON **Log of Borehole:** BH104-22

Contractor: Walker Drilling **Method:** Track Mounted Solid Stem Auger Page: 1 of 1

Location: 1255 Fuller Avenue **Elevation:** 235.85 mASL **Date Completed:** November 25, 2022

Project No.: 16599-001 **UTM:** 17T **N:** 4960604 **E:** 585206

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. / rem V.) (20 40 60 80)	SPT (N) (20 40 60 80)	Well Installation	Log Notes
235.8	0	**TOPSOIL:** TOPSOIL (~125mm thick)	235.72 / 0.13	1A	SS			27.4%				
235.4	0.5	**(SM) SILTY SAND:** some clay, trace organic matter; brown, moist, loose	235.09 / 0.76	1B	SS	40	4	13.4%		4		
234.8	1	**(SM) SILTY SAND:** trace gravel, trace clay; brown, non-cohesive, moist, compact		2	SS	60	17	9.7%		17		
234.4	1.5			3	SS	70	29	7.9%		29		
233.8	2											
233.4	2.5	- some gravel		4	SS	80	27	7.8%		27		
232.8	3											
232.4	3.5	- moist to wet		5	SS	80	11	11.0%		11		
231.8	4											
231.4	4.5											
230.8	5	- brown to grey		6	SS	90	15	9.7%		15		
230.4	5.5											
229.8	6											
229.4	6.5	- very dense	229.3	7	SS	90	100	8.0%			100	Borehole noted as open and dry upon completion
228.9		Borehole Terminated @ 6.6m Due to Practical Refusal	6.55									

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS3	3	57	34	6

1m = 26 units

Logged By: WA **Input By:** WA

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Client:	1000239074 Ontario Inc.	**Project Name:**	1255 Fuller Avenue, Penetanguishene, ON	**Log of Borehole:**	BH105-22
Contractor:	Walker Drilling	**Method:**	Track Mounted Solid Stem Auger	Page:	1 of 1
Location:	1255 Fuller Avenue	**Elevation:**	236.59 mASL	**Date Completed:**	Nov 25, 2022
Project No.:	16599-001	**UTM:**	17T **N:** 4960691 **E:** 585256		

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. / rem V.) (20 40 60 80)	SPT (N) (20 40 60 80)	Well Installation	Log Notes
236.6	0	**TOPSOIL:** TOPSOIL (~125mm thick)	236.46 / 0.13	1A	SS			35.0%			Cap	
236.1	0.5	**(SM) SILTY SAND:** trace clay, trace organic matter; brown, non-cohesive, moist, loose	235.83 / 0.76	1B	SS	60	5	11.9%	5			
235.6	1	**(SM) SILTY SAND:** trace gravel; brown, non-cohesive, moist, dense		2	SS	80	49	5.4%		49	Bentonite Plug	
235.1	1.5	- some gravel, brown to grey, compact		3	SS	80	28	8.6%		28	Riser	
234.6	2											
234.1	2.5	- very dense		4	SS	70	56	6.4%		56		
233.6	3	- grey		5	SS	70	50	6.2%		50		
233.1	3.5											
232.6	4										Sand Pack	
232.1	4.5	- decreased gravel content		6	SS	80	58	5.3%		58	PVC Screen	
231.6	5											
231.1	5.5											
230.6	6											
230.1	6.5		230.04	7	SS	80	64	11.7%		64	Cap	No groundwater encountered during monitoring event on December 8, 2022
229.6		Borehole Terminated @ 6.6m Due to Practical Refusal	6.55									

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 26 units

Logged By: WA **Input By:** WA

Client:	1000239074 Ontario Inc.	**Project Name:**	1255 Fuller Avenue, Penetanguishene, ON	**Log of Borehole:**	BH106-22
Contractor:	Walker Drilling	**Method:**	Track Mounted Solid Stem Auger	Page:	1 of 1
Location:	1255 Fuller Avenue	**Elevation:**	234.5 mASL	**Date Completed:**	Nov 25, 2022
Project No.:	16599-001	**UTM:**	17T **N:** 4960723 **E:** 585322		

SUBSURFACE PROFILE				SAMPLE							
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture 25 50 75	Shear Strength Cu, kPa (nat V. +, rem V. ⊕) 20 40 60 80 / SPT (N) 20 40 60 80	Well Installation	Log Notes
234.5	0		**TOPSOIL:** TOPSOIL (~125mm thick) — Elevation 234.37	1A	SS			30.2%			
			(SM) SILTY SAND: trace clay, trace organic matter; brown, moist, loose — 0.13	1B	SS	50	5	15.2%	5		Borehole elevation is approximate, and inferred from topographic survey due to dense tree cover within the site not allowing for accurate measurement following completion of investigations
234	0.5		Elevation 233.74 / Depth 0.76								
233.5	1		**(SM) SILTY SAND:** trace clay, trace gravel; brown, non-cohesive, moist, compact	2	SS	70	28	7.9%	28		
233	1.5			3	SS	70	28	9.8%	28		
232.5	2										
232	2.5		- brown to grey	4	SS	80	19	10.4%	19		
231.5	3										
231	3.5		- decreased gravel content, grey	5	SS	90	29	12.6%	29		
230.5	4										
230	4.5		- very dense	6	SS	80	83	12.6%	83		
229.5	5										
229	5.5										
228.5	6			7	SS	80	68	7.8%	68		Borehole noted as open and dry upon completion
228	6.5		Elevation 228.1 / Depth 6.4 — Borehole Terminated @ 6.4m Due to Practical Refusal								
227.5											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS4	1	43	52	4

1m = 26 units

Logged By: WA **Input By:** WA

Peterborough, Barrie, Oshawa, Kingston, Ottawa

Appendix B

Physical Laboratory Testing Results

Grain Size Distribution Chart

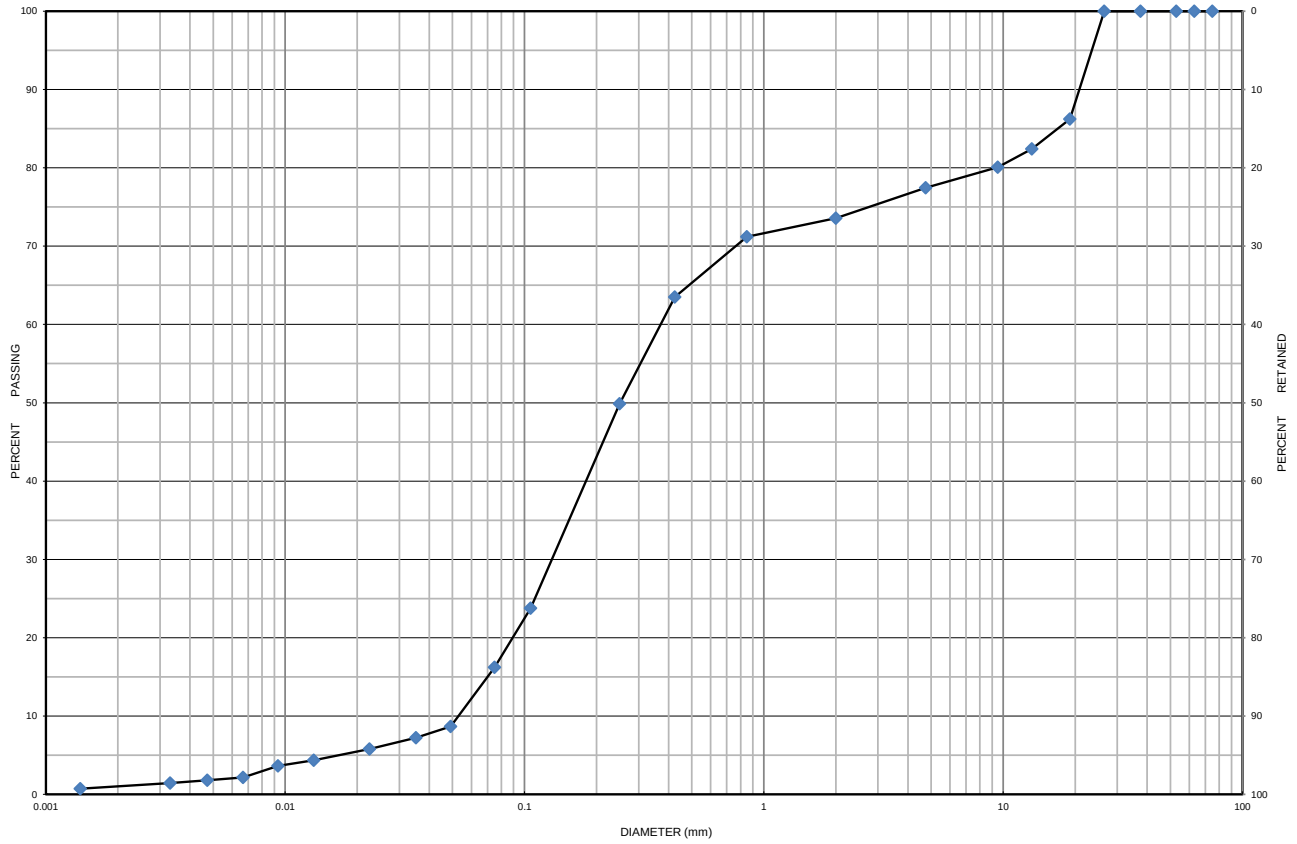
Project Number: *16599-001* **Client:** *1000239074 Ontario Inc. - Angelo Lavinio*

Project Name: *1255 Fuller Avenue Penetanguishene*

Sample Date: *November 24, 2022* **Sampled By:** *Waleed El-Taweel - Cambium Inc.*

Location: *BH 101-22 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-22-1831*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-22	SS 3	1.5 m to 2.1 m	23	61	15	1	5.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Gravelly Sand some Silt trace Clay	SM	0.360	0.140	0.054	6.67	1.01

Additional information available upon request

Issued By: _____ *Date Issued:* *December 19, 2022*

(Senior Project Manager)

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
194 Sophia St. | Peterborough | ON | K9H 1E5

Grain Size Distribution Chart

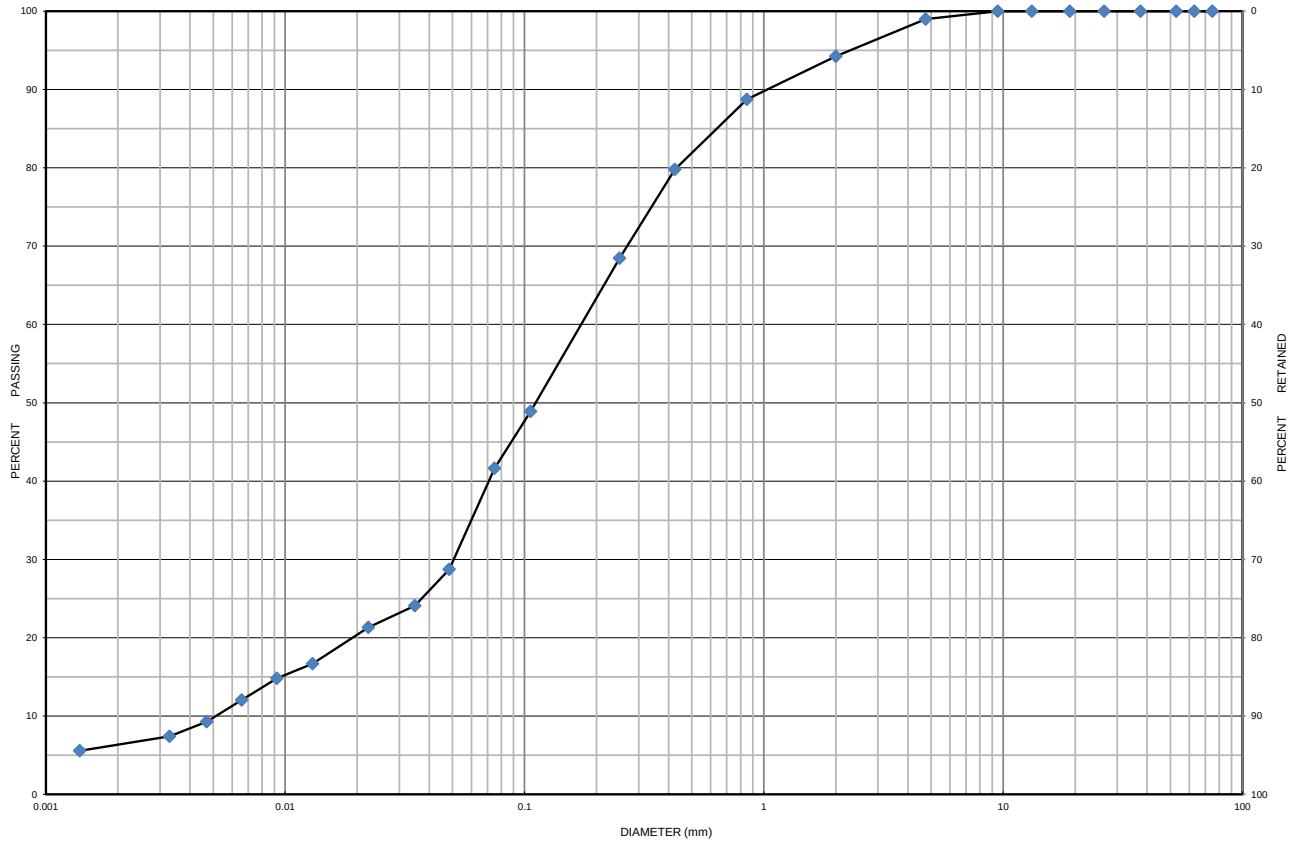
Project Number: *16599-001* **Client:** *1000239074 Ontario Inc. - Angelo Lavinio*

Project Name: *1255 Fuller Avenue Penetanguishene*

Sample Date: *November 24, 2022* **Sampled By:** *Waleed El-Taweel - Cambium Inc.*

Location: *BH 102-22 SS 5* **Depth:** *3 m to 3.7 m* **Lab Sample No:** *S-22-1832*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-22	SS 5	3 m to 3.7 m	1	57	36	6	7.1

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt trace Clay trace Gravel	SM	0.1750	0.0500	0.0051	34.31	2.80

Additional information available upon request

Issued By: _____ *Date Issued:* *December 19, 2022*

(Senior Project Manager)

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Grain Size Distribution Chart

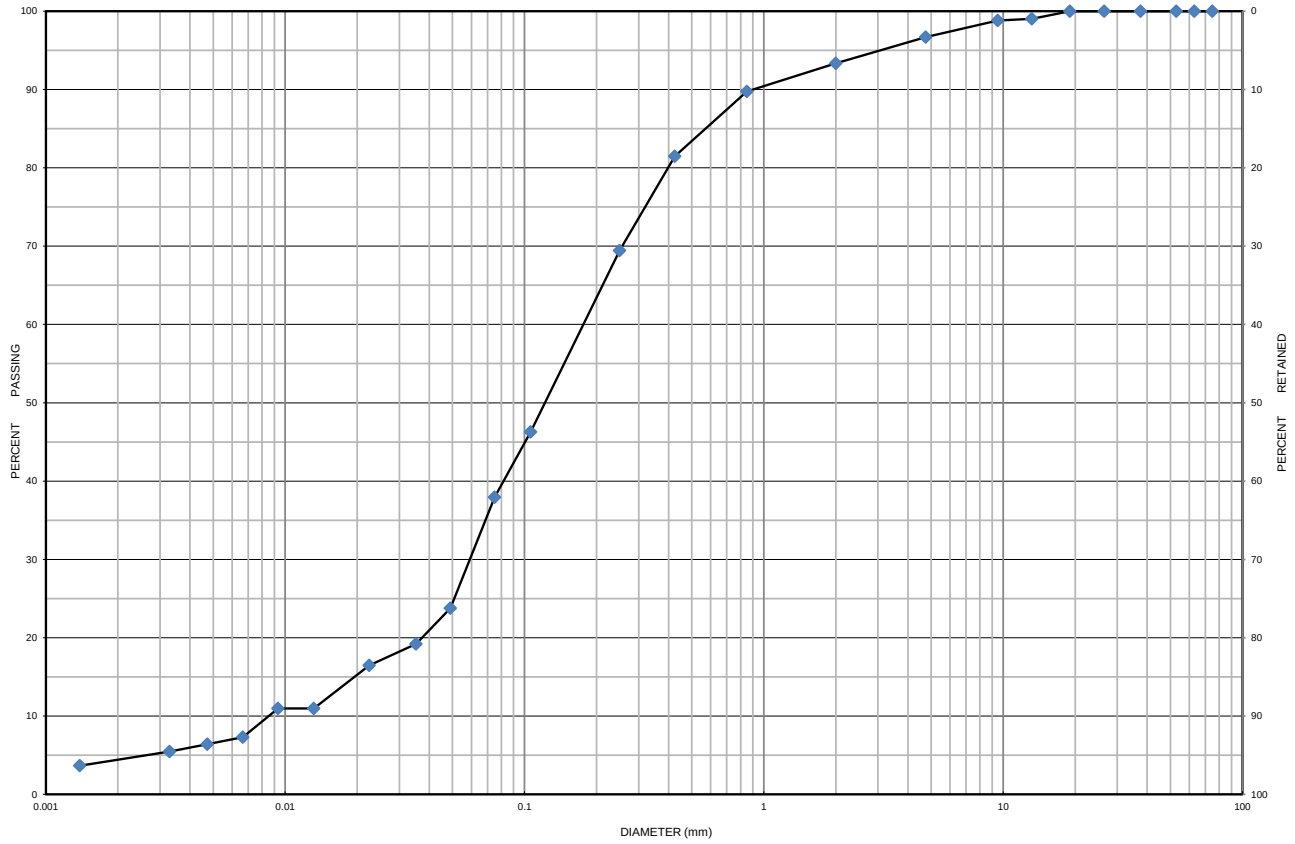
Project Number: *16599-001* **Client:** *1000239074 Ontario Inc. - Angelo Lavinio*

Project Name: *1255 Fuller Avenue Penetanguishene*

Sample Date: *November 24, 2022* **Sampled By:** *Waleed El-Taweel - Cambium Inc.*

Location: *BH 103-22 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-22-1835*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 103-22	SS 4	2.3 m to 2.9 m	3	59	34	4	7.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand trace Clay trace Gravel	SM	0.1800	0.0600	0.0086	20.93	2.33

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Grain Size Distribution Chart

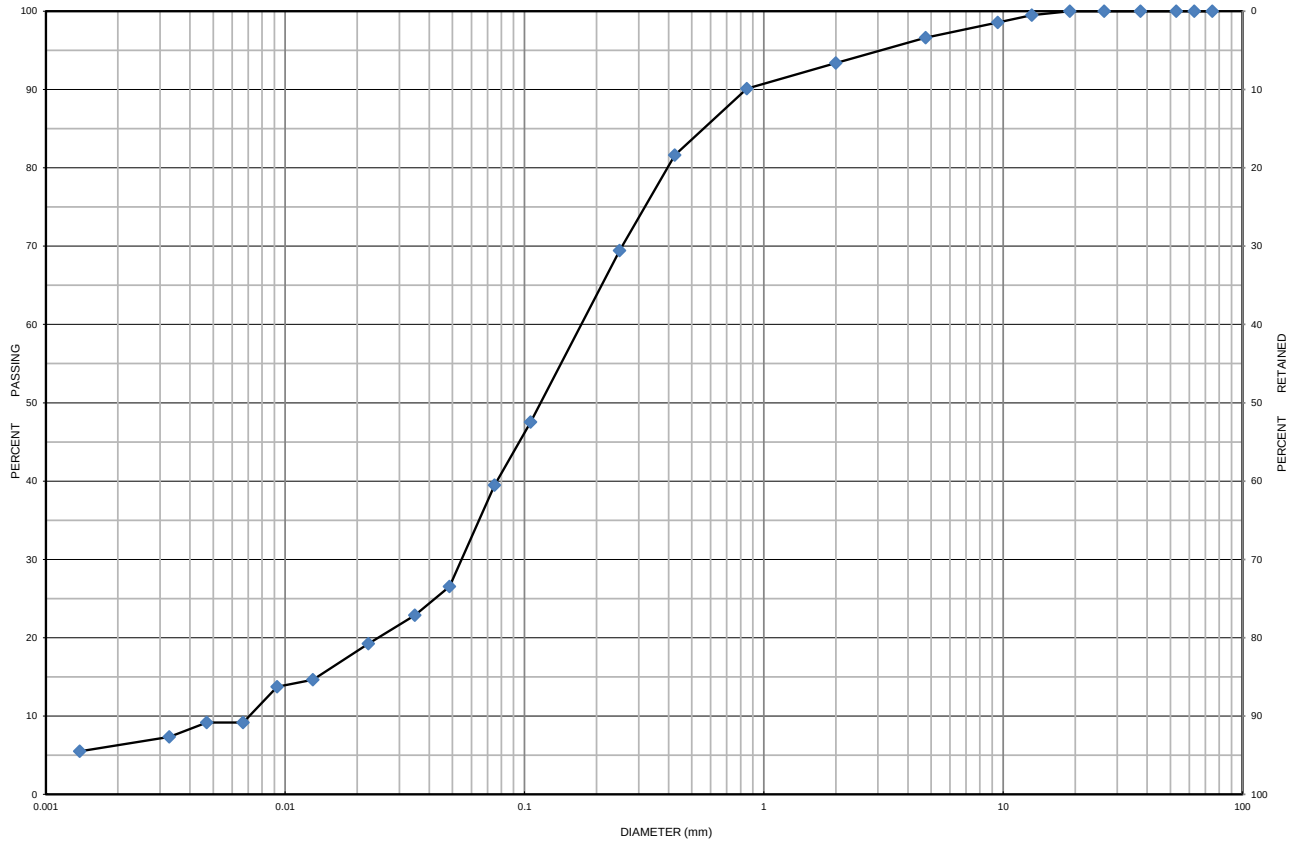
Project Number: *16599-001* **Client:** *1000239074 Ontario Inc. - Angelo Lavinio*

Project Name: *1255 Fuller Avenue Penetanguishene*

Sample Date: *November 24, 2022* **Sampled By:** *Waleed El-Taweel - Cambium Inc.*

Location: *BH 104-22 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-22-1834*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 104-22	SS 3	1.5 m to 2.1 m	3	57	34	6	8.1

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand trace Clay trace Gravel	SM	0.175	0.055	0.007	25.00	2.47

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Grain Size Distribution Chart

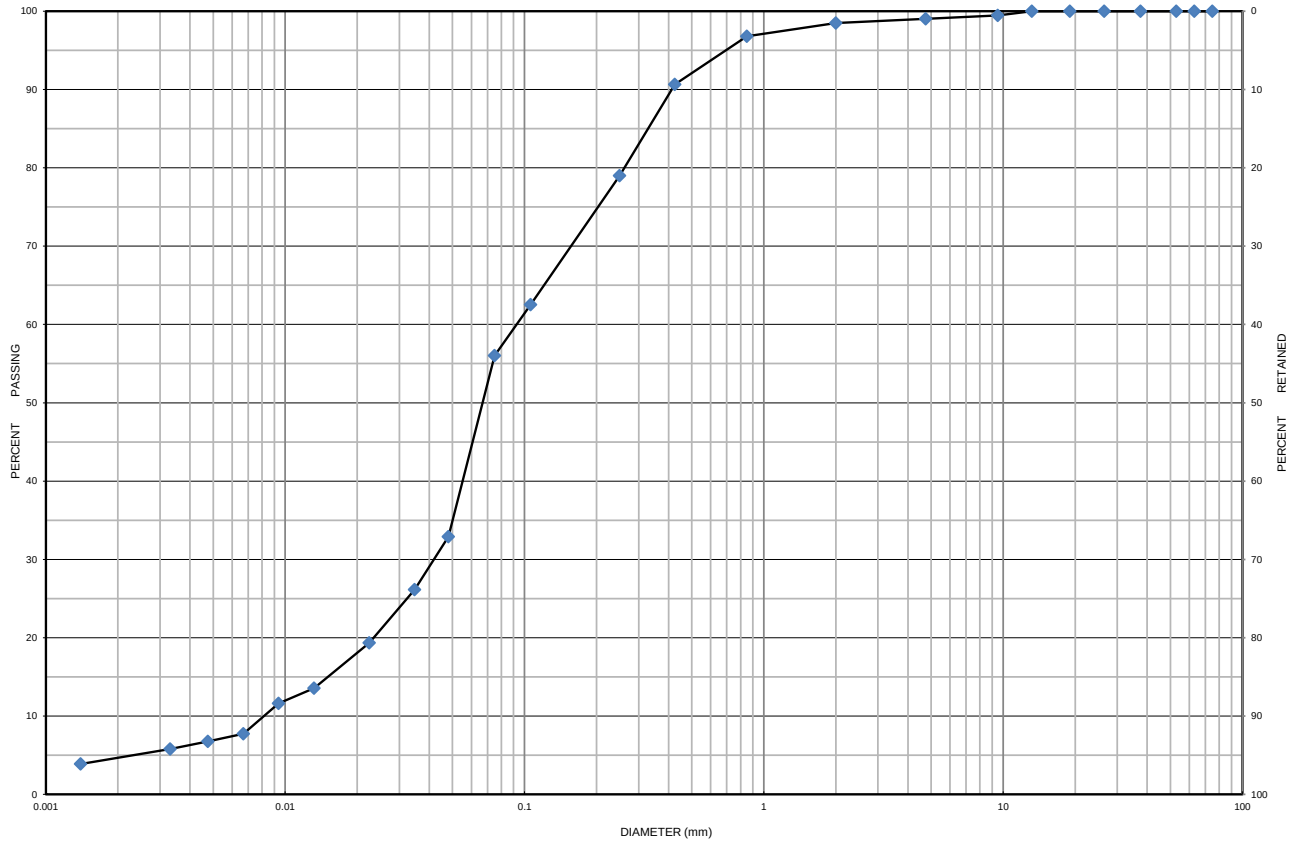
Project Number: *16599-001* **Client:** *1000239074 Ontario Inc. - Angelo Lavinio*

Project Name: *1255 Fuller Avenue Penetanguishene*

Sample Date: *November 24, 2022* **Sampled By:** *Waleed El-Taweel - Cambium Inc.*

Location: *BH 106-22 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-22-1833*

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 106-22	SS 4	2.3 m to 2.9 m	1	43	52	4	10.4

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt and Sand trace Clay trace Gravel	ML	0.0910	0.0430	0.0082	11.10	2.48

Additional information available upon request

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Moisture Content

Project Number: 16599-001
Project Name: 1255 Fuller Avenue Penetanguishene
Client: 1000239074 Ontario Inc. - Angelo Lavinio
Date Taken: 2022-11-24

Lab Number: S-22-1830
Date Tested: 2022-12-13
Tested By: D. Rock & K. Dickson

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
101	1A	0.00-0.15	38.0	20.3	NR,1
101	1B	0.15-0.61	8.8	10.6	
101	2	0.76-1.37	20.0	9.6	
101	2	0.76-1.37	37.8	9.7	
101	3	1.52-2.13	21.3	5.3	NR
101	4	2.29-2.90	22.6	9.5	
101	5	3.05-3.66	36.5	9.8	
101	6	4.57-5.18	31.6	9.9	
101	7	6.10-6.71	17.6	6.6	
102	1A	0.00-0.10	13.8	28.8	NR,1
102	1B	0.10-0.61	30.7	13.4	NR
102	2	0.76-1.37	21.8	9.0	
102	3	1.52-2.13	24.9	8.3	
102	4	2.29-2.90	9.8	4.8	
102	5	3.05-3.66	13.4	7.1	NR
102	6	4.57-5.18	14.4	6.8	
102	7	6.10-6.71	19.8	6.1	
103	1A	0.00-0.13	19.5	22.2	NR,1
103	1B	0.13-0.61	17.6	8.5	NR
103	2	0.76-1.37	10.1	5.4	
103	3	1.52-2.13	19.0	8.4	
103	4	2.29-2.90	52.2	7.9	NR
103	5	3.05-3.66	25.6	7.5	
103	5	4.57-5.18	38.3	10.9	
103	7	6.10-6.71	19.1	8.0	
104	1A	0.00-0.13	22.2	27.4	NR,1
104	1B	0.13-0.61	17.1	13.4	NR,1

1 – Contains organics
2 – Contains rubble
3 – Hydrocarbon Odour
4 – Unknown Chemical Odour
5 – Saturated – free water visible
6 – Very moist – near optimum moisture content
7 – Moist – below optimum moisture
8 – Dry – dry texture – powdery
9 – Very small – caution may not be representative
10 – Hold sample for gradation analysis

Moisture Content

Project Number: 16599-001
Project Name: 1255 Fuller Avenue Penetanguishene
Client: 1000239074 Ontario Inc. - Angelo Lavinio
Date Taken: 2022-11-24

Lab Number: S-22-1830
Date Tested: 2022-12-13
Tested By: D. Rock & K. Dickson

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
104	3	1.52-2.13	52.2	7.9	NR
104	4	2.29-2.90	24.8	7.8	
104	5	3.05-3.66	33.8	11.0	
104	6	4.57-5.18	27.5	9.7	
104	7	6.10-6.71	18.5	8.0	
105	1A	0.00-0.13	27.9	35.0	NR,1
105	1B	0.13-0.61	18.0	11.9	NR
105	2	0.76-1.37	11.2	5.4	
105	3	1.52-2.13	32.7	8.6	
105	4	2.29-2.90	22.8	6.4	NR
105	5	3.05-3.66	19.1	6.2	
105	6	4.57-5.18	10.6	5.3	
105	7	6.10-6.71	23.7	11.7	
106	1A	0.00-0.13	35.0	30.2	NR,1
106	1B	0.13-0.61	15.8	15.2	NR,1
106	2	0.76-1.37	15.8	7.9	
106	3	1.52-2.13	18.6	9.8	
106	4	2.29-2.90	71.4	10.4	NR
106	5	3.05-3.66	28.0	12.6	
106	6	4.57-5.18	35.4	12.6	
106	7	6.10-6.71	17.2	7.8	

1 – Contains organics
2 – Contains rubble
3 – Hydrocarbon Odour
4 – Unknown Chemical Odour
5 – Saturated – free water visible
6 – Very moist – near optimum moisture content
7 – Moist – below optimum moisture
8 – Dry – dry texture – powdery
9 – Very small – caution may not be representative
10 – Hold sample for gradation analysis