Geotechnical Investigation -725 Lake Road, Bowmanville, Ontario

February 27, 2025

Prepared for:
Jass Gill

Cambium Reference: 19211-001

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1.0 Introduction

Cambium Inc. (Cambium) was retained by Jass Gill (the "Client") to complete a geotechnical investigation in support of the design of the proposed industrial development to be located at 725 Lake Road, Bowmanville (the "Site") as shown on the Site Location Plan, Figure 1 attached. The terms of reference for the geotechnical consulting services were included in Cambium's proposal No. 19211-P, dated December 5, 2023. Authorization to proceed with the investigation was received from the Client on December 6, 2023.

The original geotechnical investigation was completed on the Site by Cambium in 2022 and the results were provided in a report titled, "Geotechnical Investigation Report – 725 Lake Road, Bowmanville, Ontario," dated July 21, 2022, Report No. 15360-001. It is understood that no changes have been made to the Site since the previous investigation. The factual results of the previous investigation are used to prepare this geotechnical report for the proposed slab-on-grade buildings at the Site.

The purpose of the field work and testing was to obtain information on the general subsurface soil and groundwater conditions at the site by means of a limited number of boreholes and laboratory tests. Based on an interpretation of the data available for this site, this report provides engineering comments, recommendations, and parameters for the geotechnical design aspects of the project, including selected construction considerations which could influence design decisions. It should be noted that this report addresses only the geotechnical (physical) aspects of the subsurface conditions at the site. The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, are beyond the terms of reference for this report and are not addressed herein. A hydrogeological report will be submitted separately.

This report provides the results of the geotechnical exploration and testing and should be read in conjunction with the *"Standard Limitations"* in Section 7.0 which forms an integral part of this document. The reader's attention is specifically drawn to this information, as it is essential for

the proper use and interpretation of this report. The data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within eighteen months of the date of the report, Cambium should be given an opportunity to confirm that the recommendations in this report are still valid.

2.0 Site and Project Description

The Site is located at municipal address 725 Lake Road in Bowmanville, Ontario as shown on the Site Location Plan, Figure 1, and Borehole Location Plan, Figure 2, attached. At the time of study, the site was vacant and lightly vegetated with shrubs and grasses.

The Site which is about 1.4 hectares (3.5 acres), is bordered on the east and south by vacant and agricultural properties, on the west by an industrial building and on the north by Lake Road. Based on the Site plan dated February 2024, drawing No. SP-1 provided by the Client, the area on the Site where the building is proposed is gently sloping downwards towards the west with elevations ranging from approximately 99 to 96 metres above sea level (masl).

At the time of preparing this report the information available indicated that the Site will be developed with two single storey slab-on-grade industrial buildings, each approximately 2,200 m^2 in size. The finished floor elevation (FFE) of the proposed buildings was not provided. The remainder of the site will be used for access roads and parking.

3.0 Methodology

3.1 Borehole Investigation

The geotechnical field investigation was conducted on June 9, 2022, during which time five boreholes, designated as BH101-22 to BH105-22, were advanced into the subsurface at predetermined locations throughout the Site. A summary of the geotechnical drilling program is presented below in Table 1. The approximate borehole locations are shown on the Borehole Location Plan, Figure 2, attached. The results of the subsurface investigation are presented on the Log of Borehole sheets in Appendix A and the results of geotechnical laboratory testing in Appendix B.

Table 1 Drilling Program

Borehole ID	Ground Surface Elevation (masl)	Borehole Depth (m)	Finished Elevation (masl)	Notes
BH101-21	98.20	5.0	93.20	50 mm diameter monitoring well installed
BH102-22	97.62	5.0	92.62	-
BH103-22	99.15	5.0	94.15	-
BH104-22	96.48	5.0	91.48	50 mm diameter monitoring well installed
BH105-22	98.24	5.0	93.24	50 mm diameter monitoring well installed

Drilling and sampling were completed using a track-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight solid stem augers using conventional 38-millimetre (mm) internal diameter split spoon sampling equipment driven by an automatic hammer in accordance with the SPT procedures outlined in ASTM International standard D1586: “Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils”. 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 split-spoon samplers used in the investigation limit the maximum

particle size that can be sampled and tested to about 40 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension were not sampled and are not represented in the grain size distributions contained herein. The results of the field tests (i.e., SPT “N” -values) as presented on the Record of Borehole sheets and in subsequent sections of this report are the values measured directly in the field and are unfactored.

The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive soils. Soil samples were collected at approximately 0.75 m intervals up to a depth of 3.0 mbgs and at 1.5 m intervals thereafter.

Groundwater conditions were noted in the open boreholes during and upon completion of drilling and monitoring wells were installed in BH101-22, BH104-22 and BH105-22 following the completion of drilling to allow for subsequent groundwater measurements. The monitoring wells consisted of a 50-mm diameter PVC riser pipe, with a slotted screen sealed at a selected depth within the borehole. A sand filter pack surrounded the screen, and above the screen the borehole and annulus surrounding the riser pipe were backfilled to the surface with bentonite. All other boreholes were backfilled and sealed in accordance with Ontario Regulation (O.Reg.) 903, as amended, and the property was reinstated to pre-existing conditions.

The field work for this investigation was observed by members of Cambium’s technical staff, who located the boreholes in the field, arranged for the clearance of underground utilities, observed the borehole drilling, sampling and in situ testing operations, logged the boreholes as well as examined and took custody of the recovered soil samples. The samples were identified in the field, placed in appropriate containers, labelled, and transported to our geotechnical laboratory for further visual examination by the project engineer and for laboratory testing.

Index and classification tests, consisting of water content determinations and gradation analyses, were carried out on selected soil samples and the results are presented in Appendix B and also on the Log of Borehole sheets in Appendix A.

The locations of the boreholes were surveyed using a Topcon RTK unit, and the elevations were inferred from a topographic survey provided by the Client and should be considered accurate to within 0.1 m. It should be noted that the ground surface elevations at the boreholes

are referenced for describing the soil stratigraphy only and should not be used or relied upon for site grading or any other purposes.

Site soil and groundwater conditions are described, and geotechnical recommendations are discussed in the following sections of this report.

3.2 Physical Laboratory Testing

Physical laboratory testing, including three particle size distribution analysis (LS-702, 705), were completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Moisture content testing was completed on all soil samples. Testing results are presented in Appendix B and are discussed in Section 4.0.

4.0 Site Geology and Stratigraphy

4.1 Regional Geology

The surficial geology aspects of the general site area were reviewed from the following publications:

- Chapman, L.J., and Putnam, D.F., 2007, “The Physiography of Southern Ontario”; 4th Edition, Ontario Geological Survey; and
- The Ontario Geological Survey. 2003. Surficial Geology of Southern Ontario.

Physiographic mapping in the area according to the above-noted reference indicates that the site lies within the physiographic region of southern Ontario known as the Iroquois Plain. The Iroquois Plain region covers the border of the lake shore extending from the City of Trenton in the east to the City of St. Catharines in the southwest. The Iroquois Plain refers to an area of lowlands that border the present-day Lake Ontario which was formed within the basin of Glacial Lake Iroquois which was a larger and higher version of Lake Ontario. Lake Iroquois sediments consist both of granular soils (silt and sand) and finer-grained silt and clay soils. The overburden within the Iroquois Plain in the vicinity of the study area is underlain by shale, limestone, dolomite and sandstone bedrock of the Whitby Bay Formation. Surface and groundwater flow is predominantly to the south toward Lake Ontario.

The surficial geology mapping indicates that the northern section of the Site lies within a region of stone-poor sandy silt to silty sand-textured till.

The subsurface conditions encountered during the investigation were generally consistent with the physiographic and surficial geological mapping.

4.2 Subsurface Conditions

The detailed soil profiles encountered in the boreholes are shown on the attached borehole logs in Appendix B. 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 on 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 (such as drilling speed and shaking/grinding of the augers).

Based on the results of the borehole investigation, subsurface conditions at the Site generally consist of topsoil overlying a sand and silt till material. Localized deposits of clay and silt were observed in some borehole locations between the topsoil and the sand and silt till layer.

Assessments of organic matter content or other topsoil quality tests were beyond the scope of this study.

The subsurface soil and groundwater conditions encountered in the boreholes drilled at the site are described in the following sections.

Please note that:

- Depths given in the table describing the subsurface conditions are measured from ground surface; and
- The SPT “N”-values given are blows for 0.3 m of penetration unless otherwise indicated.

A summary of the soil conditions encountered at the site is presented below in Table 2.

Table 2 Summary of Soil Properties

Stratigraphy	Depth (mbgs)		Elevation (masl)		SPT "N" Values	Relative Density / Consistency	Approximate Water Content (%)	Notes
	From	To	From	To				
Topsoil	0	750 mm	96.5 to 99.2	95.7 to 98.4	-	-	-	Encountered at all borehole locations.
Silt and Sand to Sandy Silt Till	0.7 to 2.3	5.0*	95.0 to 98.5	91.5* to 94.2*	9 to 67	Loose to very dense but generally compact to very dense	5 to 14	Encountered at all borehole locations.
Clay and Silt	0.7	1.5 to 2.3	95.7 to 97.5	95.0 to 95.9	12 to 23	Stiff to very stiff	14 to 21	Encountered at borehole locations BH101-22 and BH104-22
*borehole termination depth.								

Please note:

- The predominant soil type is the silt and sand and sandy silt till deposits, and on average the till material had a very dense relative density.
- The clay and silt deposits were generally encountered as localized deposits near the surface.

The results of the particle size distribution tests are presented in Table 3 and Table 4 with details provided in Appendix B.

Table 3 Particle Size Distribution Analysis – Sand and Silt Till

Borehole	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH103-22 SS5	3.0 – 3.5	Sand and Silt	13	38	37	12	6.7
BH105-22 SS4	2.3 – 2.7	Silt and Sand	10	38	40	12	7.6

Table 4 Particle Size Distribution Analysis – Clay and Silt

Borehole	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH101-22 SS2	0.8 – 1.2	Clay and Silt	0	8	41	51	20.8

4.3 Groundwater Conditions

Groundwater level measurements for the current investigation were collected at the Site on June 20, 2022, December 15, 2023. Monthly groundwater level measurements have been to be taken starting October 2024 and scheduled to run until June 2025. The groundwater level was measured at each well with an electronic water level tape, which was cleaned between well locations. Table 5, below, summarizes the groundwater level measurements collected to date.

Table 5 Groundwater Level Measurements

Borehole ID	Measurement Date	Groundwater Level Depth (mbgs)	Groundwater Elevation masl
BH101-22	June 20, 2022	1.01	97.19
	December 15, 2023	2.70	95.50
	October 17, 2024	2.89	95.31
	November 14, 2024	2.74	95.46
	December 19, 2024	1.96	96.24
	January 13, 2025	0.98	97.22
	February 11, 2025	1.26	96.94
BH104-22	June 20, 2022	1.36	95.12
	December 15, 2023	4.52	91.96
	October 17, 2024	-*	-
	November 14, 2024	4.22	92.26
	December 19, 2024	4.32	92.16
	January 13, 2025	3.94	92.54
	February 11, 2025	2.87	93.61
BH105-22	June 20, 2022	1.10	97.14
	December 15, 2023	Dry	-
	October 17, 2024	4.40	93.84
	November 14, 2024	4.41	93.83
	December 19, 2024	4.12	94.12
	January 13, 2025	1.35	96.89
	February 11, 2025	1.87	96.37

**Groundwater level measurement not taken due to issue with monument well*

The measured groundwater levels reflect the groundwater conditions in the boreholes at the time of the field work as indicated in the table above. Groundwater levels at the site are anticipated to vary between and beyond the borehole locations and to fluctuate on a seasonal basis and in response to significant precipitation or snowmelt events.

5.0 Geotechnical Considerations

This section of the report provides engineering information and recommendations for the geotechnical design aspects of the project based on our interpretation of the borehole information, the laboratory test data and on our understanding of the project requirements. The following recommendations are provided to assist designers. It is possible that subsurface conditions beyond the borehole locations may vary from those observed. Recommendations should not be construed as providing instructions to contractors, who should form their own opinions about site conditions. 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 interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like. If significant variations are found before or during construction, Cambium should be contacted so that we can reassess our findings, if necessary.

Cambium will not assume any responsibility for construction-related decisions made by contractors on the basis of this report.

5.1 General Site Preparation

All fill, organics and deleterious material should be removed from below the development areas prior to construction. For site grading, in areas of cut or fill where the proof roll and/or inspection has identified unsuitable subgrade conditions, whether loose, too soft or too wet, the poorly performing material is to be removed and replaced with an approved material and compacted as directed by the Geotechnical Engineer.

5.1.1 Engineered Fill

Materials for the use of engineered fill, if required, must be approved by Cambium prior to placement. When the fill is treated as an engineered fill to support structural elements or pavement, general guidelines for the placement and preparation are presented below:

- Remove any and all existing vegetation, organic fills or fills and any loose soils to a competent subgrade for a suitable envelope.
- 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. The exposed subgrade should be proof-rolled and inspected by a qualified geotechnical engineer prior to placement of any granular fill to confirm that the exposed soils are native, undisturbed, and competent, and have been adequately cleaned of ponded water and all disturbed, loosened, softened, organic and other deleterious material. Any loose/soft soils identified at the time of 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 area of the engineered fill should extend horizontally 1 m beyond the outside edge of the foundations then extend downward at an imaginary 1 horizontal to 1 vertical (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.
- Cambium suggests the engineered fill should be approved OPSS 1010 SSM or Granular B Type I material. Excavated material from site, may be used as engineered fill provided it does not contain organic matter or have deleterious content and subject to approval by Cambium. Please note that the sandy silt to silt deposits are problematic for use as engineered fill and are frost susceptible. In addition, the cohesive silty clay to clayey are not generally suitable for use as engineered fill.
- The engineered fill should be placed at a moisture content at or near optimum moisture in maximum 200 mm thick lifts and compacted to minimum 100% of standard Proctor maximum dry density (SPMDD). Any frost penetration into the fill material must be removed prior to placement of subsequent lifts of fill or reviewed by Cambium.

- The engineered fill should be placed at least 600 mm above the elevation of the proposed underside of footing.
- Due to the potential negative effects of differential settlement between the engineered fill and the native soils, it is generally not recommended that individual footings be supported on both engineered fill and on native soils. In addition, differential settlement may occur between different footings if some of the footings are on native soils, and some are on engineered fill.
- Full time testing and inspection will be required for all excavation, backfilling and compaction operations.

5.2 Foundation Design

The recommendations given below are preliminary and for planning purposes only. These recommendations should be reviewed once the final development plans are available.

Based on the results of this investigation, the proposed structures on Site may be founded on conventional shallow spread and/or continuous strip footings bearing in the native, undisturbed soils as described in Table 6 below:

Table 6 Anticipated Founding Soils for Shallow Foundations

Borehole ID	Minimum Footing Base Depth Below Existing Ground Surface (m)	Maximum Footing Base Elevation (m)	Anticipated Founding Materials
BH101-22	1.2	97.0	Very Stiff Clay and Silt
BH102-22	1.2	96.4	Compact Sany Silt Till
BH103-22	1.2	98.0	Dense Sand and Silt Till
BH104-22	1.4	95.1	Compact Silt and Sand Till
BH105-22	1.2	97.0	Compact Silt and Sand Till
1 Or frost depth whichever is deeper.			

The spread/strip footings bearing at the depths/elevations provided above may be designed using the factored geotechnical resistance at Ultimate Limit States (ULS) and the geotechnical reaction at Serviceability Limit States (SLS), for 25 mm of total settlement and 19 mm of differential settlement, provided below in Table Table 7.

Table 7 Founding Level and Bearing Capacity

Spread or Strip Footing Dimensions	Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Reaction at SLS (for 25 mm of settlement) kPa
0.5 m Strip footing	200	175
1.0 m Strip footing		
1 m x 1 m Spread	250	225
2 m x 2 m Spread		

Footings founded on granular engineered fill may be designed using a factored geotechnical resistance at ultimate limit states (ULS) of 200 kPa and a geotechnical reaction at serviceability limit states (SLS) of 125 kPa (for a total settlement of 25 m). These bearing resistances are for strip footings 0.45 m to 1.0 m wide and spread footings varying from 1 m x 1 m to 2 m x 2 m in size.

As the actual soil bearing resistances are related to the actual footing sizes and founding depths, the foundation recommendations must be reviewed by Cambium once the building details are finalized.

All fill, old foundations, other structures organics, and any deleterious materials should be stripped/removed from the proposed development area.

If stepped spread footings are constructed at different founding levels, the difference in elevation between individual footings should not be greater than one half the clear distance between the footings (2H:1V or gentler). Should this not be possible, Cambium should be consulted to provide field inspection to ensure that the footings exceeding the above requirement are stable and the bearing and lateral support for the upper footing is not compromised. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevations of the upper footings can be adjusted accordingly. Stepped strip footings, if required, should be constructed in accordance with the latest edition of the Ontario Building Code (2015 OBC), Section 9.15.3.9.

Our foundation recommendations are subject to a key assumption that no former excavation, former or existing underground utility or structure is located within or intercepts the zone of influence of the proposed footings. The zone of influence of the proposed footings can be defined as any line drawn from the underside edge of the footing down and away at a slope of 1H:1V. Complete removal of fill and any existing or remaining foundations from previous structures or any underground utilities, if present, or lowering the founding elevation (if appropriate) may be required subject to the inspection by Cambium during the time of construction.

The founding materials are susceptible to disturbance by construction activities especially during wet weather and care should be taken to preserve the integrity of the materials as bearing strata. Prior to placing concrete for the footings, the foundation excavations must be inspected by Cambium to confirm that the footings are located in a native, undisturbed and competent bearing stratum which has been cleaned of ponded water and loosened or softened material. If the concrete for the footings on the native soil cannot be placed immediately after excavation and inspection (i.e., within 24 hours of excavation and inspection), it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum. The bearing soil and fresh concrete must be protected from freezing during cold weather construction.

All exterior footings and footings in unheated areas should be provided with at least 1.2 m of earth cover after final grading or a thermally equivalent thickness of insulation, in order to address the potential for damage due to frost action.

5.3 Slab-on-Grade

It is anticipated that the floor slab can be designed as a concrete slab-on-grade. The soils at the subgrade level after removal of the topsoil will generally consist of compact silt and sand to silty sand or stiff to very stiff clay and silt. If any loose native deposits are encountered at the subgrade level, the loose material may be compacted in place if the layer is not more than 0.5 m thick or sub-excavated and recompacted as engineered fill.

The exposed subgrade should be proof rolled in conjunction with an inspection by Cambium. Remedial work should be carried out on any loose, softened, disturbed, wet or poorly performing zones as directed by Cambium. Any low areas may then be brought up to within at least 200 mm of the underside of the floor slabs, as required, using OPSS Granular B, Type I material or other approved material, placed in maximum 200 mm loose lifts and uniformly compacted to at least 100% of SPMDD.

The final lift of granular fill beneath floor slabs should consist of a minimum thickness of 200 mm of free draining OPSS Granular A material, uniformly compacted. Any filling operations should be inspected and tested by Cambium. Additional Granular A material may be needed to provide adequate pipe bedding and cover, depending on the requirements for an under-slab drainage system.

The floor slabs should be structurally separate from the foundation walls and columns. Sawcut control joints should be provided at regular intervals and along column lines to minimize shrinkage cracking and to allow for any differential settlement of the floor slabs.

5.3.1 Slab on Grade Design Parameters

The deflections and the resulting forces and bending moments in the slab to be used in its structural design could be determined by structural analysis using a Wetergaard's modulus of subgrade reaction, K_v, for the subgrade. However, the modulus of subgrade reaction is not a fundamental soil property, and its value depends, in part, on the size and shape of the slab. For the analysis of the contact stress distribution beneath a slab, its value would depend on the size of the areas over which increased/concentrated contact stresses are anticipated; the size of these areas is in turn related to the value the modulus of subgrade reaction. Accordingly, the analysis of the slab should involve an iterative analysis between the determination of the contact stress distribution by the structural engineer and the geotechnical determination of the modulus of subgrade reaction value, until these two are consistent with each other. For initial analyses, the moduli of subgrade reaction appropriate for slab on grade design on the soils at the site are as follows:

- Engineered Fill (granular fill (SSM)): 20 MPa/m

It is recommended that these values are confirmed during construction with plate load testing.

5.4 Temporary Excavations and Support

It is anticipated that excavations for the construction of the foundations and site services will extend through the surficial topsoil and into the compact to very dense non-cohesive deposits or stiff to very stiff silt and clay deposits. The inverts of the proposed site services are not known at the time of preparing this report. Once the actual depths and inverts are finalized, the following comments and recommendations should be reviewed and revised, as necessary.

Based on the results of this investigation, the founding soils for the services below frost depth are likely to consist of compact to dense non-cohesive deposits or stiff to very stiff cohesive deposits which are generally considered to be suitable for supporting the site services, provided the integrity of the base can be maintained during construction.

Temporary excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA) and Ontario Health and Safety Regulations for Construction Projects (O. Reg 213). It is anticipated that temporary excavations above the groundwater table level in the soils at this site can provisionally be classified as Type 3 soils with unsupported side slopes no steeper than 1H:1V. For Type 3 soils, the slope should be from the base of the excavation. If excavations will extend below the measured groundwater elevations, adequate dewatering will be required to achieve a Type 3 soil classification. Please note that if the excavation extends below the groundwater table without adequate dewatering, the soil at the face of the excavation would be classified as Type 4 and a maximum side slope inclination of 3H:1V would be required for OHSA compliance. Where the side slopes consist of more than one soil type, the soil shall be classified as the type with the highest number among the types present. The soil type classifications indicated above are provisional and are subject to change based on field observations of the actual conditions at the time of exposure.

However, depending upon the construction procedures adopted by the contractor, actual groundwater seepage conditions, the success of the contractor’s groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing/shoring of the slopes may be required. Care should be taken to direct surface runoff away from the open

excavations. 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 underground services/structures by stockpiles.

The subsoils (especially the cohesive deposits) are generally susceptible to disturbance due to construction activities, ponded water, potential groundwater seepage and heavy precipitation.

5.5 Temporary Groundwater Control

The groundwater level in the monitoring wells was observed to range from about 1.0 mbgs to 4.5 mbgs and one monitoring well was dry on the one occasion when measurements were taken.

Where the excavations for the foundations or site services 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. A hydrogeological assessment report is being submitted separately.

It is anticipated that the majority of dewatering activities for the foundations or site services in the glacial till or clay and silt deposits can be completed using properly constructed and filtered sumps located within the excavations.

Water takings in excess of 50 m^3/day are regulated by the (Ministry of the Environment, Conservation and Parks (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 Environmental Activity and Sector Registry ("EASR"). Registry on the 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.

5.6 Backfill and Compaction

Excavated non-organic fill and native non-cohesive soils from the Site may be appropriate for use as fill below grading and parking areas, provided that the actual or adjusted moisture content at the time of construction is within a range that permits compaction to required densities. Some moisture content adjustments may be required depending on seasonal conditions. It is not recommended that the cohesive materials containing significant fine particles be reused as backfill, and consideration may be given to using these soils in landscaping area only.

5.6.1 Foundation Wall Backfill

To avoid frost adhesion and possible heaving, all foundation walls are to be backfilled with non-frost susceptible granular material such as imported material meeting OPSS Granular B Type I or II. The existing earth fill material may be used as backfill material if required.

All material containing organics should not be used as backfill against the foundation walls.

Where backfill will support areas of hard surfacing (pavements, walkways, etc.) the backfill should be placed in maximum 200 mm thick lifts and compacted to at least 95% of SPMDD. Light, walk behind compaction equipment should be used in proximity to foundation walls.

5.7 Permanent Drainage

The groundwater level measurement taken in the monitoring wells ranges from about 1.0 mbgs to 4.5 mbgs. Based on the information provided, the buildings on site will be slab-on-grade structures, however no FFE has been provided at the time of writing this report. Based on the groundwater elevations, it is anticipated that an exterior perimeter drainage system would not be required. If the finished floor level is above the finished grade, an underfloor drainage system may not be required.

The extent of drainage measures such as a composite synthetic drainage system or equivalent, under slab drainage and sump system should be assessed during the final design stages and Cambium can provide geotechnical input as required.

The exterior grade around any buildings should be sloped from the walls to direct surface runoff away from the building.

If an underfloor drainage system connected to sumps is required, it should be provided to collect seepage and to limit pore water pressure build-up on the underside of the floor slab. The subfloor drainage system may consist of a network of robust sub-drain pipes conveying collected groundwater to a sump or sumps from which the groundwater can be pumped to a municipal storm sewer. The drainage system would consist of interconnected perforated drainpipes (bedded on, and within, free draining granular soils wrapped in geotextile fabric) installed around the perimeter of the building and within the building footprint.

5.8 Seismic Site Classification

For the purpose of seismic design, geotechnical information is used to determine the “Site Class”. The average properties in the top 30 m (below the lowest founding level) are to be considered. The site classification recommendation is based on the available information as well as our interpretation of conditions below the boreholes and our knowledge of the soil conditions in the area. In accordance with Table 4.1.8.4.A of the OBC (2012), it is recommended that Site Class “D” (stiff soil) be applied for structural design at the Site.

The seismic site class designation could possibly be improved following additional deeper borehole information. Multichannel Analysis of Surface Waves (MASW) testing could also be considered to reassess the seismic site class.

5.9 Site Servicing

Trench excavations should follow general guidelines of Section 5.4 and 5.5.

The bedding for the site servicing pipes should be compatible with the type and class of pipe, the surrounding subsoil and anticipated loading conditions and should be designed in

accordance with Municipality of Clarington Guidelines. Bedding and cover material for any services should consist of OPSS 1010 Granular A or B Type II, placed in accordance with the Municipality of Clarington standards. The bedding and cover material shall be placed in maximum 300 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.

Clear stone bedding material should not be used in any case for pipe bedding or to stabilize the base since fine particles from the native deposits could potentially migrate into the voids in the clear stone and cause loss of pipe support and settlement.

5.10 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 developed for two traffic loading scenarios, light duty and heavy duty. The heavy-duty design is appropriate for areas where heavy trucks and maintenance vehicles are anticipated to drive while the light duty design is appropriate for areas where no heavy traffic is anticipated. The recommended minimum pavement structure is provided in Table 8.

Table 8 Pavement Structure

Pavement Layer	Compaction Requirements	Light Duty	Heavy Duty
Surface Course Asphalt	OPSS 310	40 mm HL3	40 mm HL3
Binder Course Asphalt	OPSS 310	50 mm HL8	90 mm HL8 (2 lifts)
Granular Base	100% SPMDD	150 mm Granular A	150 mm Granular A
Granular Subbase	98% SPMDD	300 mm Granular B Type 1	400 mm Granular B Type 1

Material and thickness substitutions must be approved by the Design Engineer. Compaction of the subgrade should be verified by the Engineer prior to placing the granular base. Granular layers should be placed in 150 mm maximum loose lifts and compacted to specified density. The granular materials should conform to OPSS standards, as confirmed by appropriate materials testing.

Subdrains are recommended beneath the pavement structure, connecting to the storm sewer or an alternative frost-free outlet as outlined above, to extend the lifespan of the structure.

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.

5.11 Design Review and Inspections

Cambium should be provided the opportunity to review the design drawings, prior to next stage tendering and construction, to ensure that all pertinent geotechnical-related factors have been addressed.

During construction, a sufficient degree of foundation inspections, subgrade inspections, and an adequate number of in situ density tests and materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes, and to monitor conformance to the pertinent project specifications. Concrete testing should be carried out on both the plastic material in the field and of set cylinder samples in a CSA certified laboratory.

Cambium should also be retained to complete testing and inspections during construction operations to examine and approve subgrade conditions, placement and compaction of fill materials.

6.0 Closing

Please note that this report is governed by the attached qualifications and limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned.

Cambium Inc.

DocuSigned by:
50177C868A8847D...

Kelly Lewis, P. Eng
Project Manager – Geotechnical

DocuSigned by:
34555F00ED064E9...

Zhaochang Luo, M.Eng., P.Eng.
Senior Project Manager – Team Lead

Signed by:

2025-02-27

KL/ZL

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7.0 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.

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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.

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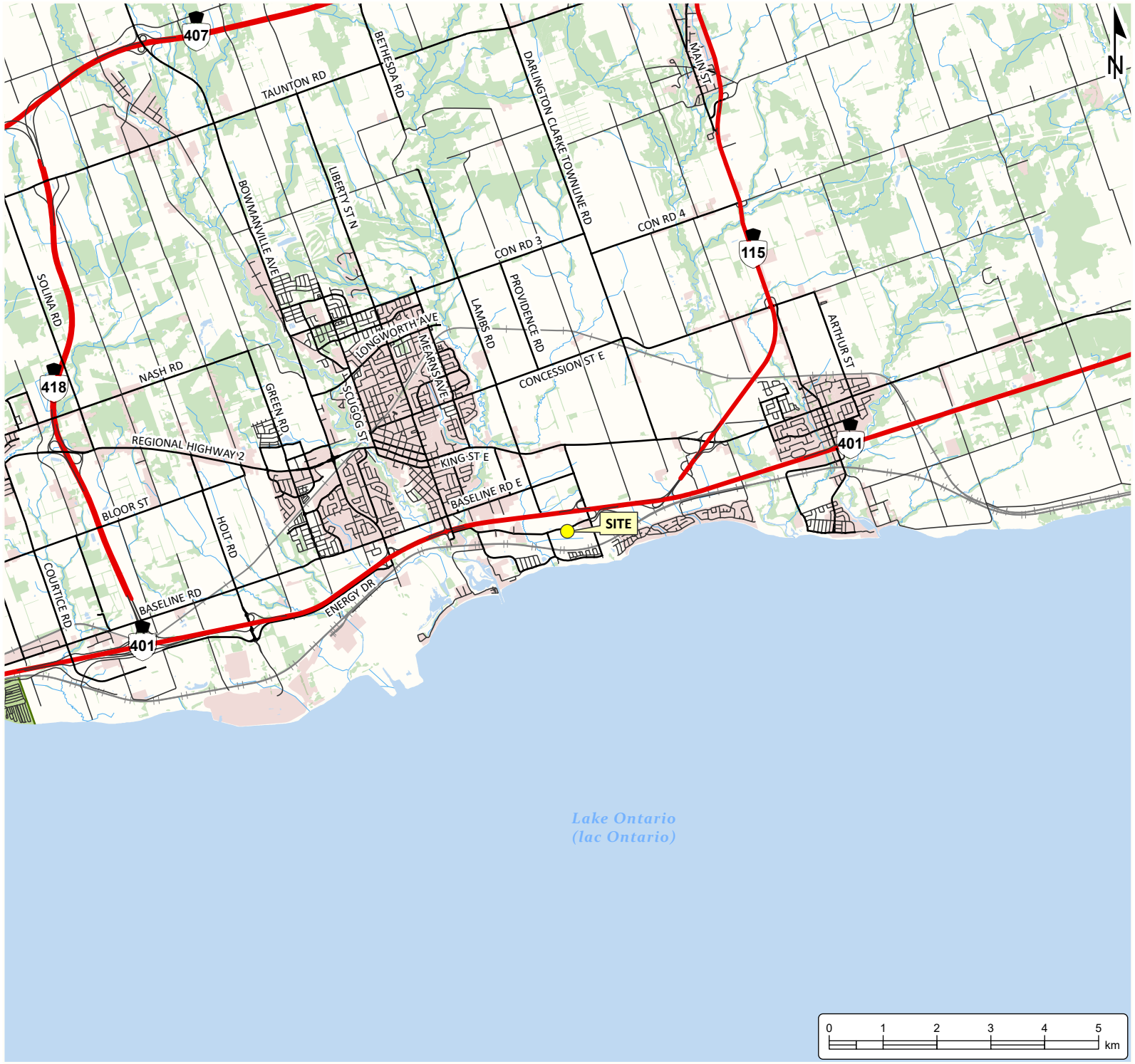
Appended Figures



GEOTECHNICAL INVESTIGATION

JASS GILL
725 Lake Road
Bowmanville, Ontario

LEGEND

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

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SITE LOCATION PLAN

Project No.: 19211-001		Date: April 2024	Rev.:
Scale: 1:100,000		Projection: NAD 1983 UTM Zone 17N	
Created by: LD	Checked by: SK	Figure: 1	

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GEOTECHNICAL INVESTIGATION

JASS GILL
725 Lake Road
Bowmanville, Ontario

LEGEND

- Benchmark
- Borehole
- Monitoring Well
- Site (approximate)

Notes:
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BOREHOLE LOCATION PLAN

Project No.: 19211-001		Date: April 2024	Rev.:
Scale: 1:1,000		Projection: NAD 1983 UTM Zone 17N	
Created by: LD	Checked by: SK	Figure: 2	

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Appendix A

Borehole Logs

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Log of Borehole: BH/MW101-22

Client:	MTC	**Project Name:**	Geotechnical Investigation	**Project No.:**	19211-001
Contractor:	DrillTech Drilling Ltd	**Method:**	Solid Stem Auger	**Date Completed:**	June 9, 2022
Location:	725 Lake Road, Bowmanville	**UTM:**	17T 4863261 m N, 688856 m E	**Elevation:**	98.20 masl

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
99										Cap	
										Monument	
98	0		TOPSOIL: Dark brown silty topsoil, trace organics, moist	1	GS						
										Bentonite Plug	GSA SS2: 0% Gravel 8% Sand 41% Silt 51% Clay
										PVC Standpipe	Water level measured at 1.01 mbgs on June 20, 2022
97	1		CLAY AND SILT: Brown clay and silt, trace sand, DTPL, very stiff	2	SS	100	23				
				3	SS	100	22				
96	2		TILL: Light brown silt and sand till, some clay, trace gravel, moist, compact	4	SS	100	16				
										Sand Pack	
										PVC Screen	
95	3		-Grey	5	SS	100	21				
94	4		-Very dense	6	SS	100	64			Cap	Borehole open and dry upon completion
93	5		Borehole terminated at 5.0 mbgs in SILT AND SAND TILL								

Logged By: TA **Input By:** KL

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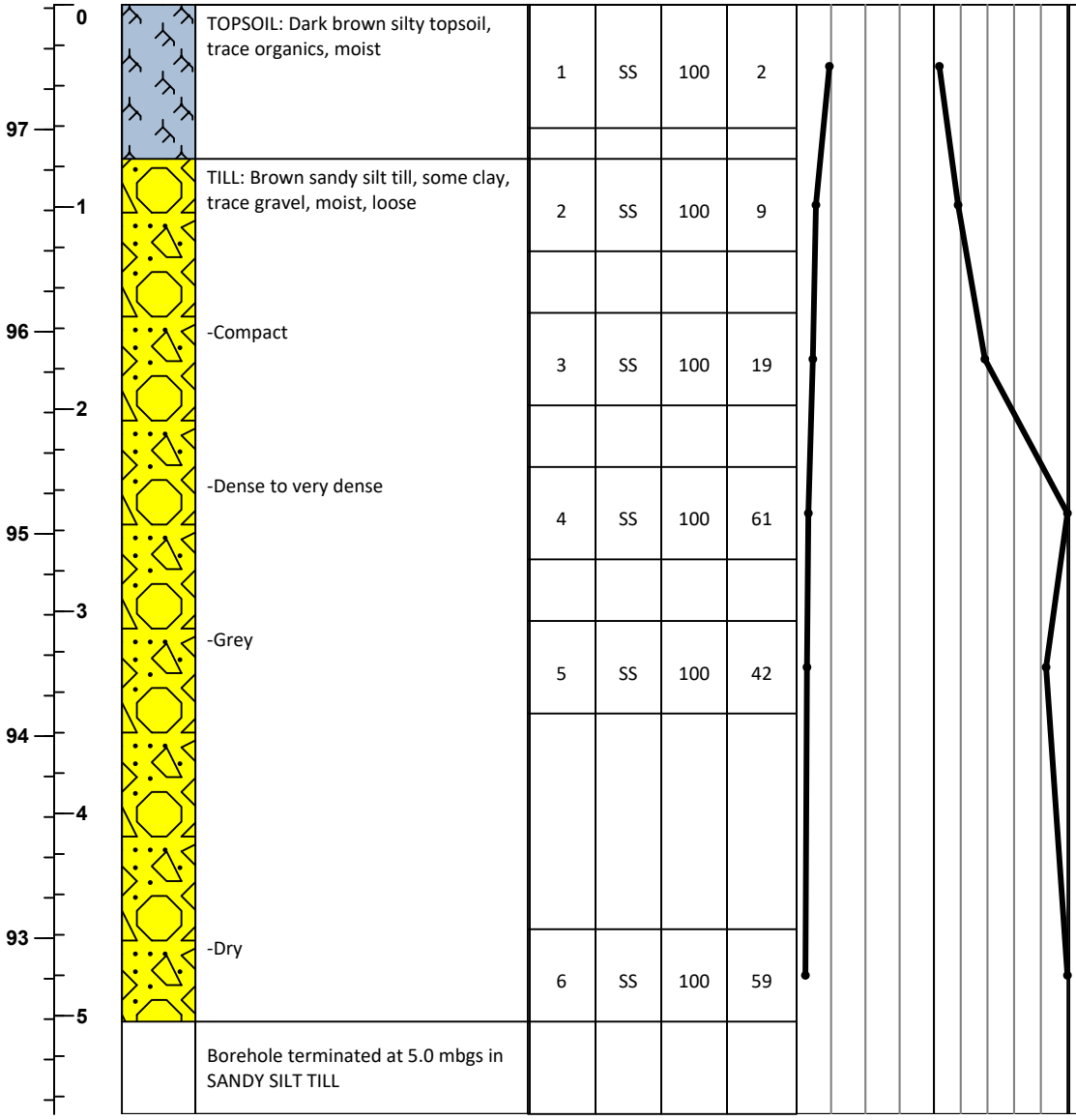
Log of Borehole: BH102-22

Client:	MTC	**Project Name:**	Geotechnical Investigation	**Project No.:**	19211-001
Contractor:	DrillTech Drilling Ltd	**Method:**	Solid Stem Auger	**Date Completed:**	June 9, 2022
Location:	725 Lake Road, Bowmanville	**UTM:**	17T 4863227 m N, 688839 m E	**Elevation:**	97.62 masl

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
0 / 97		TOPSOIL: Dark brown silty topsoil, trace organics, moist	1	SS	100	2				
1 / 96		TILL: Brown sandy silt till, some clay, trace gravel, moist, loose	2	SS	100	9				
2 / 95		-Compact	3	SS	100	19				
3 / 94		-Dense to very dense	4	SS	100	61				
4 / 93		-Grey	5	SS	100	42				
5		-Dry	6	SS	100	59				Borehole open and dry upon completion
		Borehole terminated at 5.0 mbgs in SANDY SILT TILL								



Logged By: TA **Input By:** KL

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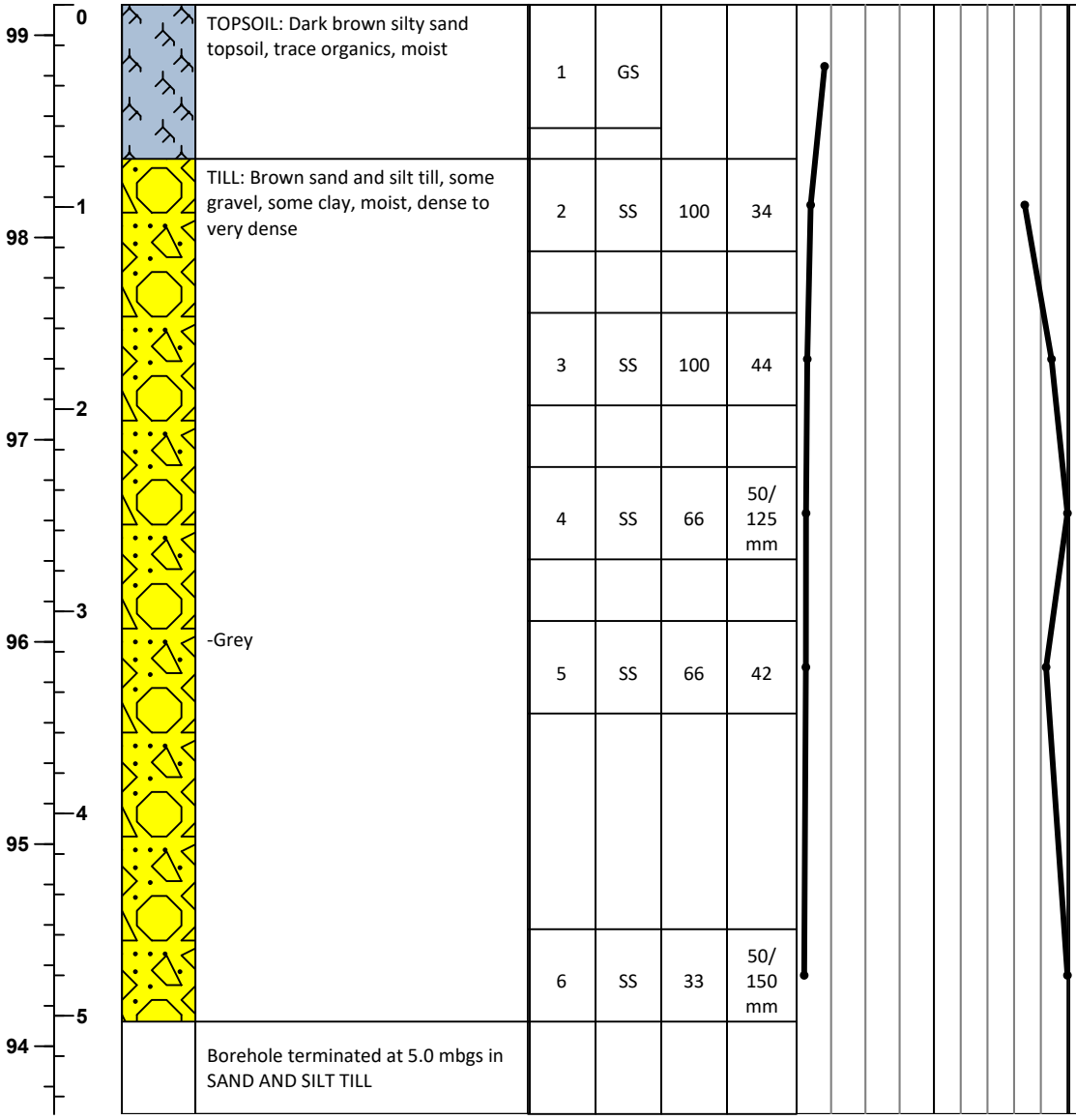
Log of Borehole: BH103-22

Client:	MTC	**Project Name:**	Geotechnical Investigation	**Project No.:**	19211-001
Contractor:	DrillTech Drilling Ltd	**Method:**	Solid Stem Auger	**Date Completed:**	June 9, 2022
Location:	725 Lake Road, Bowmanville	**UTM:**	17T 4863225 m N, 688897 m E	**Elevation:**	99.15 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
99 / 0		TOPSOIL: Dark brown silty sand topsoil, trace organics, moist	1	GS						
98 / 1		TILL: Brown sand and silt till, some gravel, some clay, moist, dense to very dense	2	SS	100	34				
			3	SS	100	44				
97 / 2			4	SS	66	50/ 125 mm				
96 / 3		-Grey	5	SS	66	42				GSA SS5: 13% Gravel 38% Sand 37% Silt 12% Clay
95 / 4			6	SS	33	50/ 150 mm				Borehole open and dry upon completion
94 / 5		Borehole terminated at 5.0 mbgs in SAND AND SILT TILL								



Logged By: TA **Input By:** KL

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Log of Borehole: BH/MW104-22

Client:	MTC	**Project Name:**	Geotechnical Investigation	**Project No.:**	19211-001
Contractor:	DrillTech Drilling Ltd	**Method:**	Solid Stem Auger	**Date Completed:**	June 9, 2022
Location:	725 Lake Road, Bowmanville	**UTM:**	17T 4863190m N, 688840 m E	**Elevation:**	96.48 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
97 / 0		TOPSOIL: Dark brown silty topsoil, trace organics, moist, loose	1	SS	80	7			Cap; Monument	
96 / 1		CLAY AND SILT: Brown clay and silt, some sand, DTPL, stiff	2	SS	100	12			Bentonite Plug; PVC Standpipe	
95 / 2		TILL: Light brown sand and silt till, some clay, trace gravel, moist, compact	3	SS	100	26				Water level measured at 1.36 mbgs on June 20, 2022
94 / 3		-Dry, very dense	4	SS	45	50/ 100 mm			Sand Pack; PVC Screen	
93 / 4			5	SS	100	50/ 75mm				
92 / 5			6	SS	0				Cap	Borehole open and dry upon completion
91		Borehole terminated at 5.0 mbgs in SAND AND SILT TILL								

Logged By: TA **Input By:** KL

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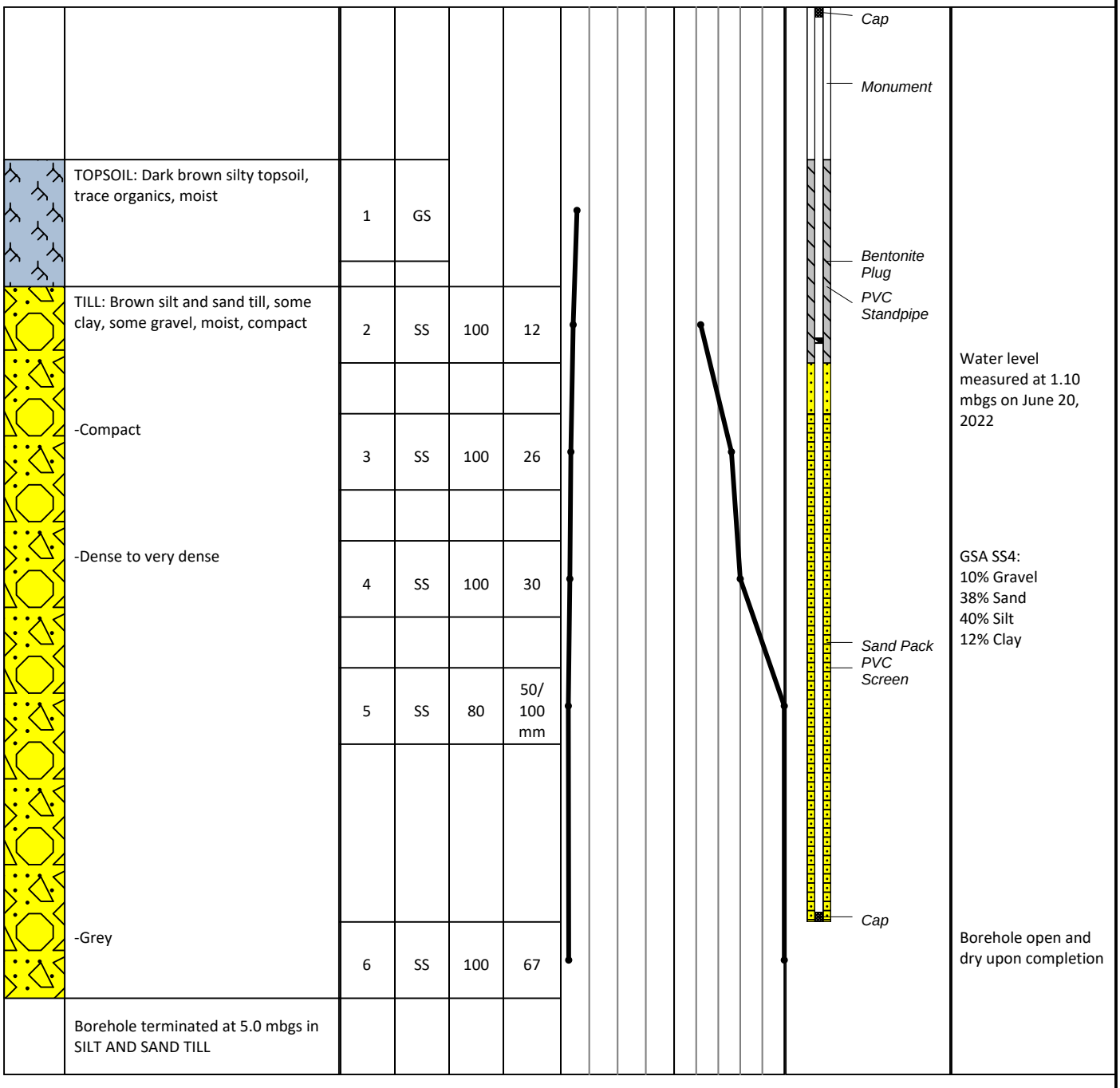
Log of Borehole: BH/MW105-22

Client:	MTC	**Project Name:**	Geotechnical Investigation	**Project No.:**	19211-001
Contractor:	DrillTech Drilling Ltd	**Method:**	Solid Stem Auger	**Date Completed:**	June 9, 2022
Location:	725 Lake Road, Bowmanville	**UTM:**	17T 4863197 m N, 688889 m E	**Elevation:**	98.24 masl

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
99 / 0										
98		TOPSOIL: Dark brown silty topsoil, trace organics, moist	1	GS						
98 / 1		TILL: Brown silt and sand till, some clay, some gravel, moist, compact	2	SS	100	12				
97		-Compact	3	SS	100	26				
97 / 2										
96		-Dense to very dense	4	SS	100	30				
96 / 3										
95			5	SS	80	50/100 mm				
95 / 4										
94		-Grey	6	SS	100	67				
94 / 5										
93		Borehole terminated at 5.0 mbgs in SILT AND SAND TILL								



Logged By: TA **Input By:** KL

Appendix B

Physical Laboratory Testing Results

Grain Size Distribution Chart

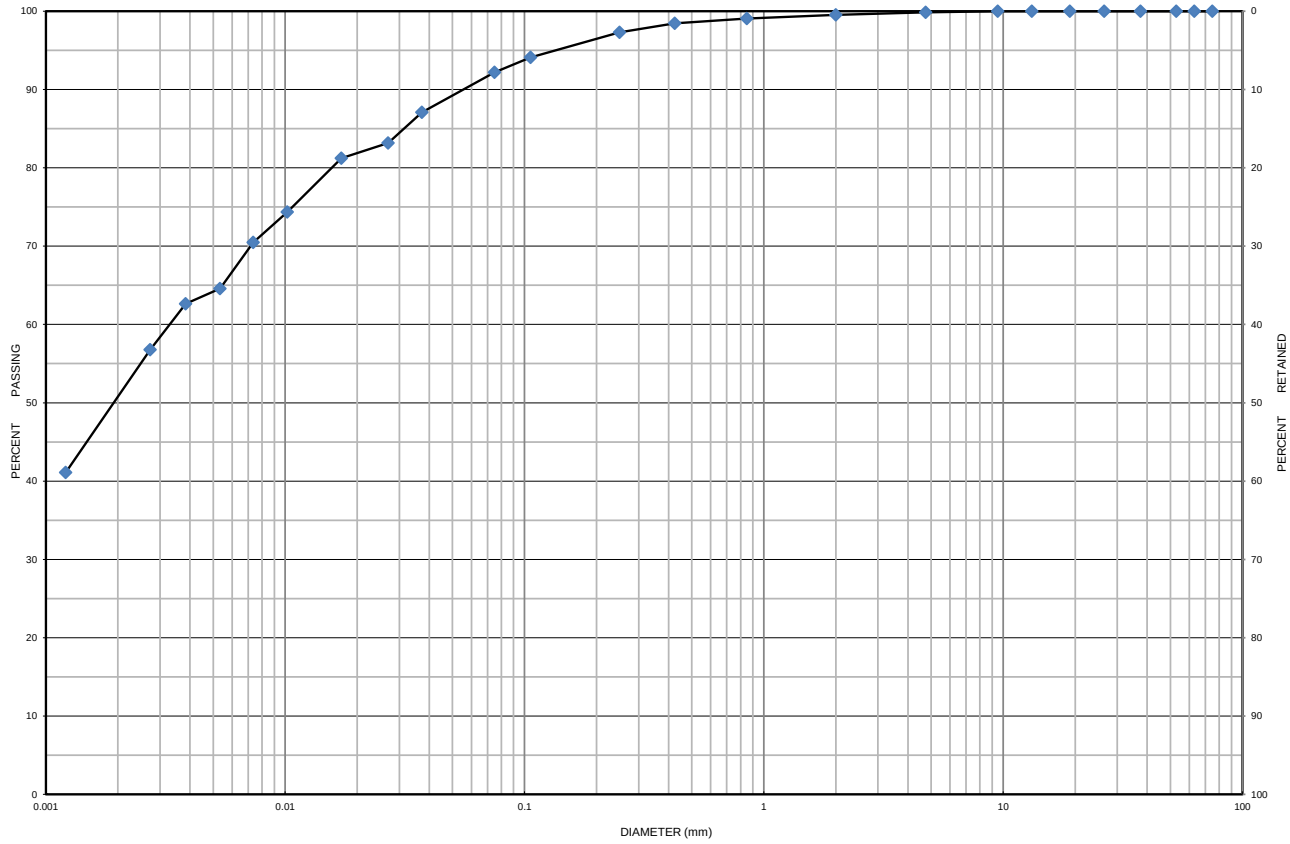
Project Number: *15360-001* **Client:** *MTC*

Project Name: *Geo – 725 Lake Road, & part 4 of 318 Bennet Rd N*

Sample Date: *June 10, 2022* **Sampled By:** *Tessa Arsenault - Cambium Inc.*

Location: *BH 101-22 SS 2* **Depth:** *0.8 m to 1.2 m* **Lab Sample No:** *S-22-0948*

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 2	0.8 m to 1.2 m	0	8	41	51	20.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clay and Silt trace Sand	CL	0.0033	-	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *June 26, 2022*

(Senior Project Manager)

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Grain Size Distribution Chart

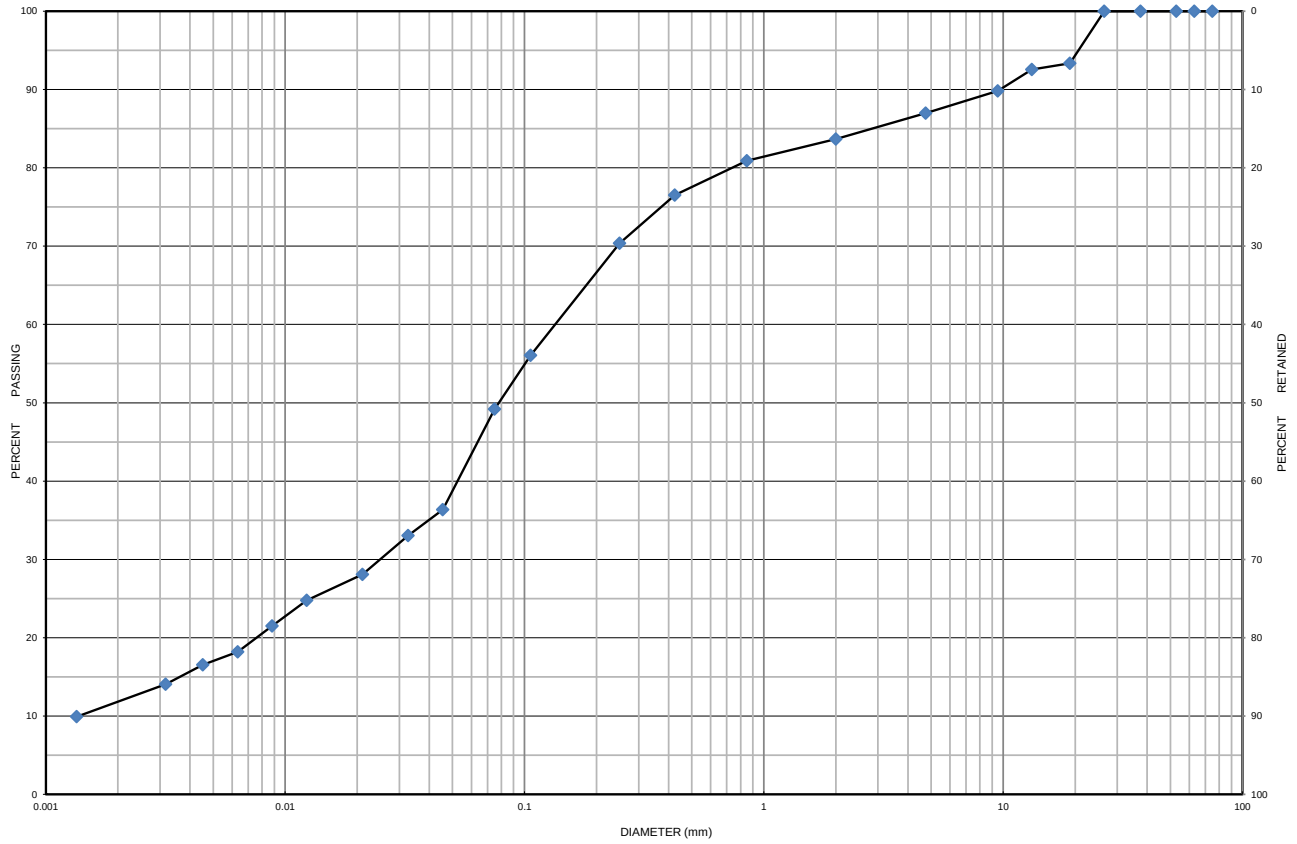
Project Number: *15360-001* **Client:** *MTC*

Project Name: *Geo – 725 Lake Road, & part 4 of 318 Bennet Rd N*

Sample Date: *June 10, 2022* **Sampled By:** *Tessa Arsenault - Cambium Inc.*

Location: *BH 103-22 SS 5* **Depth:** *3 m to 3.5 m* **Lab Sample No:** *S-22-0949*

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 5	3 m to 3.5 m	13	38	37	12	6.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Gravel some Clay	SM	0.1450	0.0260	0.0014	103.57	3.33

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Grain Size Distribution Chart

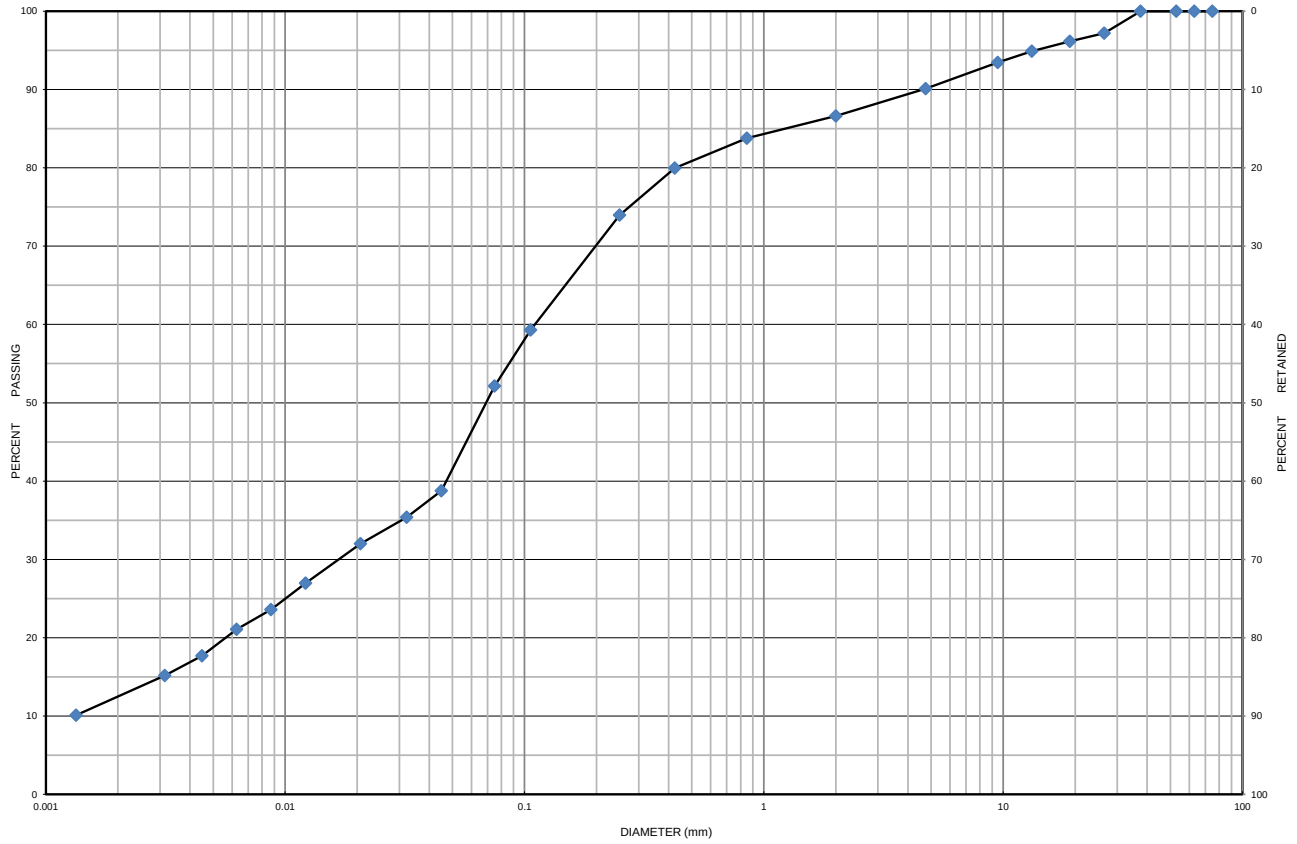
Project Number: *15360-001* **Client:** *MTC*

Project Name: *Geo – 725 Lake Road, & part 4 of 318 Bennet Rd N*

Sample Date: *June 10, 2022* **Sampled By:** *Tessa Arsenault - Cambium Inc.*

Location: *BH 105-22 SS 4* **Depth:** *2.3 m to 2.7 m* **Lab Sample No:** *S-22-0950*

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 105-22	SS 4	2.3 m to 2.7 m	10	38	40	12	7.6

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt and Sand some Clay some Gravel	ML	0.1200	0.0170	0.0014	85.71	1.72

Additional information available upon request

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