Geotechnical Investigation Report - Mapleview South Development Block B (192), Barrie, Ontario

June 25, 2024

Prepared for:
Mapleview South (Innisfil) Limited

Cambium Reference:19953-002

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1.0 Introduction

Cambium Inc. (Cambium) was retained by Mapleview South (Innisfil) Limited (Client) to complete a geotechnical investigation in support of the detailed design of a medium density block identified as Block B or Block 192 at 953 Mapleview Drive East in Barrie, Ontario (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.

This report provides the results of the geotechnical exploration and testing and should be read in conjunction with the *"Standard Limitations"* in Section 8.0 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.

A previous geotechnical investigation was completed by Cambium in 2018 within the property extents of the entire parcel of 953 Mapleview Drive West to confirm subsurface conditions across the Site with the findings, the recommendations and results from that investigation summarized under a different cover (Cambium Ref. No.: 7468-001) [1].

Additionally, Cambium installed two monitoring wells in March 2024 to support the design of a stormwater management facility and associated low impact development (LID) exfiltration systems located in between Blocks 193 and 192. The findings and water levels obtained from

the monitoring wells are summarized under a different cover (Cambium Ref. No.: 19953-001) [3].

1.1 Reviewed Documents

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

[1] Cambium Inc. – Barrie, Ontario
Geotechnical Investigation Report – Mapleview South Development, Mapleview Drive East, City of Barrie, Ontario, Project Number: 7468-001; December 5, 2018.

[2] Cambium Inc. – Barrie, Ontario
Monthly Groundwater Levels Letter– Mapleview South Development, 953 Mapleview Drive East, Barrie, Ontario, Project Number: 7468-001; April 18, 2019.

[3] Cambium Inc. – Barrie, Ontario
Monitoring Well Installation Summary Letter– Mapleview South Development, 953 Mapleview Drive East, Barrie, Ontario, Project Number: 19953-001; June 12, 2024.

[4] Jones Consulting Group Ltd. – Barrie, Ontario
Mapleview South (Innisfil) Ltd., Block 192 Preliminary Servicing Plan, Project REI-17055, Drawing No. GS-1, May 2023.

1.2 Standards and Guidelines

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

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

[6] National Building Code of Canada – Natural Resources Canada; 2015

2.0 Site and Project Description

2.1 Site Description

The Site within Block B consists of an undeveloped area which has undergone grading and earthworks within the parcel footprint relatively recently. The parcel has an area of approximately 0.74 hectares and is bound by Block 199 Stormwater Drainage and Pedestrian Access to the north, future development lands to the west and east and a drainage channel to the south. At the time of the investigation, an erosion and sediment control (ESC) basin occupying the centre of the proposed Block B development. The extent of the basin limited the areas in which the boreholes could have been advanced throughout the Site. The site slopes downward past the southern edge of the ESC basin with an elevation change of approximately 3.0 m.

A Site Location Plan is provided as Figure 1 of this report for reference.

2.2 Project Description

As per information provided by the Client [4], Block B will consist of with a single five-storey building containing 100 to 120 units, one level of underground parking, surface parking, a stormwater infiltration gallery and a structural retaining wall. The development will be accessed from the southwest corner of the Site.

3.0 Methodology

3.1 Borehole Investigation

Four boreholes were advanced throughout the Site on May 8 and 9, 2024, at predetermined locations confirmed with the Client to assess the subsurface conditions. The boreholes were designated as BH501-24 to BH504-24 and were terminated at depths ranging from 6.5 m below ground surface (mbgs) to 6.7 mbgs.

A Borehole Location Plan is provided as Figure 2 of this report for reference.

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 and caving conditions were noted in the open boreholes during and upon completion of drilling. All 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.

The prepared borehole logs are provided in Appendix A. Site soil and groundwater conditions and our geotechnical recommendations are presented in the following sections of this report.

3.2 Site Survey

The elevations and coordinates for all boreholes were obtained using a GNSS receiver during a survey following the completion of drilling. A topographic survey was provided by the Client and the benchmark utilized for this survey was the fire hydrant flange located on the north side of Mapleview Drive East with a geodetic elevation of 260.96 metres above sea level (mASL).

3.3 Physical Laboratory Testing

Physical laboratory testing, including three particle size distribution analyses (LS-702, 705), was 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. The physical laboratory testing results are presented in Appendix B and are discussed in Section 4.0.

4.0 Subsurface Conditions

The stratigraphy encountered in the boreholes is 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 encountered subsurface conditions consist of either surficial engineered fill or reworked native deposits which transitioned to undisturbed native deposits. The native deposits at the Site generally consisted of non-cohesive silty sand to sand soils interbedded. Bedrock was not encountered during this investigation.

4.1 Regional Geology

Ontario Geological Survey (OGS) quaternary geologic mapping indicates that the Site is projected to fall within the Newmarket till formation, which includes sandy silt to silt matrix, moderate to high matrix carbonate content and clast content moderate to high. This mapping indicates that the material expected to be encountered at the site should be relatively consistent, and the main difference between any materials at site would be the mechanism for which they were deposited.

Physiographic mapping (Chapman, L.J. & Putnam, D.F., 2007) shows the Site within the till plains (drumlinized) formation.

4.2 Surface Soils

A surficial layer of reworked native or engineered fill was encountered in all boreholes advanced at the Site. It is understood that the Site has undergone grade changes since the

2018 geotechnical investigation conducted by Cambium with the import and placement of engineered fill throughout the Site. Cambium conducted full time inspection and compaction testing during the placement of engineered fill in 2019 and 2020 (Cambium reference number: 7468-002) with the findings, the placement locations and compaction testing results provided to the Client at the time of the inspections. Engineered fill inspections and compaction testing was conducted within the vicinity of BH504-24 for the ESC basin that was constructed north of this borehole location. Approximately 4.0 to 5.0 m of engineered fill was placed along the southern extents of the ESC basin and approximately 0.4 to 0.8 m of additional fill is expected to be placed during future earthworks operations. Therefore, as the site grading conducted throughout the site consisted of placement of the existing native material from the site or imported fill materials, as well as the construction of the ESC basin that is located between BH501-24, BH502-24 and BH504-24, the material encountered within the first few meters of each borehole likely consists of disturbed or reworked native soils. The composition of the non-cohesive imported fill or disturbed/reworked native materials ranged from a silty sand to sandy silt material in all boreholes advanced at the Site. The soils were predominantly brown to grey in colour and were generally moist during the investigation.

SPT N values within disturbed/reworked native deposits generally ranged between 6 and 9, indicating loose relative density. Organics were noted within the imported fill or disturbed/reworked native soils in BH502-24 and BH504-24; which are mostly present from the caved material due to the drilling method (i.e., use of solid stem augers).

Natural moisture contents in the non-cohesive deposits ranged between 6.5% and 12.2% based on laboratory testing.

A summary of the composition, relative density, and extent of the reworked or disturbed deposits encountered within each of the boreholes is provided below in Table 1.

Table 1 Extent of Possible Imported Fill or Disturbed/Reworked Soils

Borehole ID	Soil Composition	Relative Density or Consistency	Encountered Disturbed or Reworked Layer(s) mbgs / mASL[1]	Approximate Thickness of Disturbed or Reworked Layer(s) (m)
BH501-24	Silty Sand	Compact to Loose	Surface / 255.8	1.5
BH502-24	Silty Sand	Compact	Surface / 256.5	1.5
BH503-24	Silt and Sand	Compact to Loose	Surface / 256.8	1.5
BH504-24	Silty Sand	Compact	Surface / 252.9	4.6

[1]Approximate depth/elevation inferred from non-continuous sampling.

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4.3 Non-Cohesive Native Deposits

Deposits of undisturbed non-cohesive native soils were encountered beneath the upper disturbed layers within all the boreholes advanced at the Site. The non-cohesive native deposits varied in composition from a sand to a silty sand material with varying amounts of gravel and clay and extended to the termination depths ranging from 6.5 mbgs to 6.7 mbgs.

The non-cohesive deposits were generally brown to grey in colour and noted as moist to wet at the time of the investigation with natural moisture contents ranging from 7.3% to 14%.

The SPT N values recorded within non-cohesive native deposits ranged from 10 to 78 blows, indicating a compact to very dense relative density.

Laboratory particle size distribution analyses were completed for three samples in the non-cohesive soils layer in order to assess the soil composition. The testing results are provided in Appendix B and are summarized in Table 2 based on the USCS.

Table 2 Particle Size Distribution – Non-Cohesive Deposits

Sample ID	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH501-24 SS7	6.1 – 6.7	Silty Sand some Clay trace Gravel	5	56	25	14	7.7
BH503-24 SS6	4.6 – 5.2	Silty Sand some Gravel some Clay	16	40	31	13	8.6
BH504-24 SS7	6.1 – 6.7	Sand and Silt some Clay trace Gravel	5	40	37	18	10.2

4.4 Bedrock

Bedrock was not confirmed in any of the boreholes advanced by Cambium at the Site. The boreholes were terminated depths ranging from 6.5 mbgs to 6.7 mbgs, corresponding to absolute elevations between 250.75 mASL and 251.57 mASL.

4.5 Groundwater

The encountered soils were predominantly described as being moist to wet throughout the borehole investigation. No saturated soils (by visual observation) were noted.

Groundwater (free water) was observed in boreholes BH502-24 and BH503-24 upon completion of drilling, at depths ranging from 5.5 mbgs to 5.6 mbgs. Caving (sloughing) was not observed in any of the boreholes advanced at the Site. The groundwater level observations in the boreholes are not representative of the stabilized groundwater conditions and as such, the groundwater table elevation will vary. The groundwater and caving observations are summarized below in Table 3.

Table 3 Groundwater and Caving Observations During Drilling

Date	Borehole	Borehole Elevation (mASL)	Groundwater in Borehole upon Completion (mbgs)	Elevation of Groundwater in Borehole upon Completion (mASL)	Caving Depth (mbgs)
May 8, 2024	BH501-24	257.29	-[2]	-[2]	-[1]
	BH502-24	258.04	5.5	252.54	-[1]
May 9, 2024	BH503-24	258.27	5.6	252.67	-[1]
	BH504-24	257.45	-[2]	-[2]	-[1]

[1] – caving not observed upon completion of drilling

[2] – groundwater not observed within open borehole upon completion of drilling

It is noted that the encountered groundwater levels reflect the groundwater conditions in the boreholes at the time of the borehole investigation. Groundwater levels at the Site may be 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 based on this report.

5.1 Project Assumptions

Based on information provided by the Client, [4], it is understood that development within Block B will consist of a single five-storey building containing 100 to 120 units, one level of underground parking, surface parking, a stormwater infiltration gallery and a structural retaining wall. The finished floor elevation of the parking structure is 257.07 mASL with the finished floor elevation of the ground level to be 261.60 mASL. The retaining wall structure will be along the south and southeast perimeter of the Site.

5.2 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 granular 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 become 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.

Based on the previous testing and inspection works conducted at the Site by Cambium in 2019 and 2020, the areas within or near BH504-24 which is located just south of the existing ESC basin contain sections of engineered fill which was used to construct the basin. The materials placed within those areas has been certified and satisfies the requirements outlined in Section 5.7.1 as engineered fill.

5.3 Frost Penetration

Based on climate data and design charts, the maximum frost penetration depth below the surface at the Site is estimated at 1.5 mbgs. Exterior footings for the proposed structure 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 sufficiently insulated.

5.4 Excavations and Shoring

Based on the information provided by the Client, the proposed development will have one level of underground parking. At the time of drafting this report, the finished floor elevation (FFE) of the parking structure is 257.07 mASL. With the existing grade at the time of the investigation at

the Site ranging from 257.29 mASL to 258.27 mASL, an excavation of at least 1.0 mbgs should be assumed for the construction of foundations. If alterations to the proposed development are made, or if deeper excavations are required to achieve higher bearing capacities, Cambium should be contacted to revise the following recommendations.

Based on [2] and information provided by the Client [4], the high groundwater table is approximately 256.31 mASL within the proposed residential structure footprint and 252.3 mASL in proximity of the LID and southern/southeastern retaining walls. Therefore, with only one level of underground parking being proposed, impermeable shoring for the proposed structure is unlikely to be required.

If a shoring design is conducted for the proposed parking garage, the lateral earth pressures found in Section 5.9 should be applied to the design. The shoring must be designed prior to construction by a qualified geotechnical engineer considering loading conditions based on the subsoil stratigraphy described above, and Cambium should be retained to conduct a plan review and make any necessary changes. It is common practice for a specialist contractor to design and install the exaction support system.

Alternatively, given the proposed excavation depths within the building footprint and the proposed building’s proximity to nearby infrastructure and property lines, consideration should be given to conducting unsupported excavations carried out in accordance with the latest edition of the Occupational Health and Safety (OHSA) may be used.

Unsupported dry excavations according to OHSA should not exceed 3 m in depth. For any unsupported excavations with a depth greater than 3 m, slope stability analysis and whether other measures (benching, support/shoring, etc.) are necessary. In addition, the crest of unsupported excavation slopes should not be subjected to loading (i.e., due to stockpiling). If excavation slopes are to be developed in close proximity to property lines (such as along the northern property line), a geotechnical engineer should be retained to conduct slope stability analysis and confirm any additional requirements.

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 overburden soils at the Site above the groundwater table and within continually dewatered depths can be considered Type 3 soils, as such, excavation side slopes should be no steeper than 1H:1V. 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).

5.5 Groundwater Control and Dewatering

Groundwater (free water) were observed in the boreholes advanced throughout the Site upon completion of drilling at depths as high as 5.6 mbgs (252.5 mASL). During the water level monitoring events conducted from May 2018 to April 2019 which are summarized in [2], the groundwater elevation measured in the monitoring wells adjacent or relatively close to Block B were recorded at elevations ranging from 255.7 to 256.3 mASL. As such, excavations are not expected to encounter significant groundwater seepage.

It is unlikely that excavations to the provided foundation elevations will encounter significant groundwater seepage. It can be anticipated that the groundwater seepage, if encountered, should be controllable with filtered sumps and pumps.

If deeper excavations are required throughout the site, Cambium should be notified as it is likely that excavations extending below approximately 255.7 mASL will encounter groundwater and will require more extensive dewatering. Dewatering methods must ensure that the water table is 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. 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 sumps and pumps, and/or well points, and/or eductors. 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.

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.

It is noted that the elevation of the groundwater table will vary due to seasonal conditions and in response to heavy precipitation events and should be expected to be notably higher in the spring (i.e., March to June). To minimize predictable water issues and costs, it is recommended that the excavation and in ground construction be performed in drier seasons.

5.6 Foundation Design

It is understood that the proposed development at the Site will consist of a five-storey residential building with one level of underground parking. The elevations of the finished floors were provided in Section 5.1. It is assumed that the building will be constructed on shallow footings. Cambium should be contacted if alternative design recommendations are required. All exterior foundations must be provided with a minimum of 1.5 m of earth cover for frost protection or alternative equivalent insulation.

5.6.1 Conventional Footings

From a geotechnical perspective, conventional shallow footings placed on competent native soils may be used to transfer loads from the proposed structures to the soils below. In general, the compact to very dense non-cohesive soils encountered below a depth of 1.5 mbgs throughout the Site are considered competent to directly support loads from shallow footings.

Design and construction recommendations for potential foundation systems are outlined below. Foundations for such structures at this site may consist of shallow spread or strip

footings founded directly on native, undisturbed soils. It is understood that the Site may be regraded, and our foundation recommendations may change depending upon the final grades. Cambium should be contacted to review the final grading plan and provide any necessary changes to the foundation recommendations outlined below.

From a geotechnical perspective, the proposed structures can be supported on standard strip and/or spread footings founded on competent native soils (sand to silty sand, compact to very dense relative density). Table 4 gives design geotechnical bearing capacities for serviceability limit state (SLS) and ultimate limit state (ULS) based on geotechnical principles outlined in Section [5] for shallow foundations bearing on native soils.

Table 4 Preliminary Bearing Capacities for Foundations on Native Soils

Borehole	Soil Description	Depth (mbgs)	Elevation (mASL)	Maximum Geotechnical Reaction SLS (kPa)	Maximum Geotechnical Reaction ULS (kPa)
BH501-24	Silty Sand	Below 1.5	Below 255.8	175	225
BH502-24	Silty Sand	Below 1.5	Below 256.5	175	225
BH503-24	Silty Sand	1.5 – 6.0 Below 6.0	256.8 – 252.3 Below 252.3	125 175	175 225
Note: assumes all foundations provided with at least 1.5 m of adjacent earth cover					

It should be noted that the soils encountered within borehole BH503-24 were found to be less dense compared to the soils encountered in BH501-24 and 502-24, indicating that the soils towards the southwestern limits of the proposed building footprint would require deeper footing excavations to achieve similar bearing capacities. To minimize the depth of excavations required along the southwestern limits of the building footprint, designers should consider utilizing a foundation design that correspondence to the lower provided bearing capacity.

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 and, as such, the recommendation provided above should be considered preliminary.

Total and differential settlements are expected to be less than 25 mm and 10 mm, respectively. All footings should be stepped along an imaginary line of 7 vertical to 10 horizontal (7V:10H) or flatter where variable founding levels take place.

For the retaining wall, the proposed structure can be supported on shallow foundations on competent native soils (sand to silty sand, compact to very dense relative density). Table 5 gives design geotechnical bearing capacities for serviceability limit state (SLS) and ultimate limit state (ULS) based on geotechnical principles outlined in Section [5] for shallow foundations bearing on native soils.

Table 5 Preliminary Bearing Capacities for Retaining Wall Foundations on Native Soils

Borehole	Soil Description	Depth (mbgs)	Elevation (mASL)	Maximum Geotechnical Reaction SLS (kPa)	Maximum Geotechnical Reaction ULS (kPa)
BH504-24	Sand to Silty Sand	Below 1.5	Below 255.9	125	150

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

All foundation components must be evaluated by a qualified geotechnical engineer to ensure that founding soils exposed in the base of the excavation are consistent with the recommended design bearing pressure intended by the geotechnical engineer.

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) [6], Section 9.15.3.9.

Cambium should be contacted to review final site grading plans and foundation dimensions and elevations, in order to confirm the bearing capacities provided in this report. A qualified geotechnical engineer should be retained to confirm bearing capacities onsite, following excavation to the proposed footing subgrade elevations, or to develop further recommendations such as the required depth of engineered fill pads.

5.6.2 Foundations on Engineered Fill

Alternatively, in areas where the proposed founding levels are above the level of competent native soil, or where sub excavation is required, footings made to bear directly on a pad of engineered fill extending down to dense native soils and constructed per the recommendations in Section 5.7.1. From a preliminary perspective, footings placed on approved engineered fill and appropriately protected from frost may be designed for a preliminary 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 grade raises, 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.

If higher bearing capacities are required, Cambium should be consulted to provide further foundation recommendations (i.e., ground improvement, deep foundations, etc.). In addition, compact to dense soils were observed at varying depths and higher design bearing capacity values may be possible depending on footing elevations and location.

5.6.3 Subdrainage and Floor Slabs

The guidelines below are based on the assumptions that a “drained” foundation system will be provided. These guidelines should be revisited if it is decided that the construction of the underground parking structure would be water-tight.

To prevent hydrostatic pressure from building up beneath the floor and potential groundwater infiltration, if required, it is suggested that the granular base for the floor be drained. Provision should be made for at least 300 mm to 600 mm of geotextile (Terrafix 270R or equivalent) wrapped 19 mm diameter crushed clear stone to underlie the floor. A vapour barrier beneath the slab should be provided. Perimeter and under floor slab drainage systems would be also required for the proposed building. The perforated pipes should discharge to a positive outlet such as a storm water sewer or a sump from which the water is pumped. Basement floor slabs, elevator pits and foundation walls should also be waterproofed.

5.7 Backfill and Compaction

Engineered fill, if required for foundations, should consist of free-draining granular material meeting the specifications of OPSS 1010 Granular B or an approved equivalent and should be placed in maximum 200 mm thick lifts compacted to 100% of SPMDD, as confirmed by nuclear densometer testing.

Imported material for engineered fill should consist of clean, no-organic, soils, free of chemical contamination or deleterious material. The moisture content of the engineered fill will need to be close enough to optimum at the time of placement to allow for adequate compaction.

Foundation wall, retaining wall and any buried utility backfill material should consist of free draining imported granular material. Excavated silty clay to silt and clay materials, may not be suitable for re-use as backfill for foundation walls and for grading purposes. Geotechnical testing of the material will be required to confirm suitability and compaction parameters (i.e., Proctor testing to confirm optimum moisture content). The fines (silt and clay) content of materials utilized as backfill for foundation walls/grading should not exceed 35%, which will

need to be confirmed by sampling from stockpiled material and conducting confirmatory grain size analyses.

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.

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.

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 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. The area(s) should then be proof-rolled in conjunction with an inspection by Cambium 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. Some of the localized near-surface loose/soft soils will also likely need to be removed prior to placement of engineered fill as directed by Cambium during proof-rolling.

IV. Materials for reuse as engineered fill must be approved by Cambium prior to placement. In this regard, approved disturbed native or the native soil which are near their optimum water contents and do not contain topsoil or organics or any other deleterious materials can be reused on Site as engineered fill. The materials for use as engineered fill must be maintained within about 2% of optimum water content for compaction. Based on the measured natural water contents, most of the native sandy soils are generally moist to wet and may require drying during engineered fill construction. Their actual water content will need to be assessed in comparison to the laboratory optimum water contents for compaction at the time of construction. 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 that meet OPSS 1010.MUNI SSM or Granular B Type I material or approved equivalent. The approved material should be placed in maximum 300 mm thick loose lifts, compacted to 100% of SPMDD. 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, 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.

VII. 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.

VIII. 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.

IX. The final surface of the engineered fill should be protected as necessary from construction traffic, ponded water and freezing, and should be sloped to provide positive drainage for surface water during and following the construction period. During periods of freezing weather, additional soil cover should be placed above final subgrade to provide frost protection.

5.8 Buried Utilities

Bedding and cover material for any buried utilities should consist of OPSS 1010 Granular A or B Type II, placed in accordance with pertinent Ontario Provincial Standard Drawings (OPSD 802.013). The bedding and cover material shall be placed in maximum 200 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 98% of SPMDD, taking care not to damage the utility pipes during compaction.

If wet or saturated conditions exist within any utility excavation, consideration should be given to using 19 mm diameter crushed clear stone wrapped in a geotextile filter fabric as pipe bedding.

5.9 Lateral Earth Pressure

Lateral earth pressure coefficients (K) are shown in Table 6 and may be used for the preliminary design of temporary and permanent structures at the Site. It is assumed that potential lateral loads will result from cohesion less, frictional materials, such as granular backfill and the encountered near surface native sand.

Table 6 Lateral Earth Pressure Coefficients

Stratum/Parameter	γ / γ ‘ [kN/m^3]	Φ [°]	c [kN/m^2]	K_o [-]	K_a [-]	K_p [-]
Compacted Granular A and Granular B Type II	22 / 12	34	0	0.44	0.28	3.54
Sand, Silty Sand, Silt and Sand *Compact to very dense*	20 / 11	32	0	0.47	0.31	3.25
Engineered Fill (per recommendations provided above)	20.5 / 11.5	32	0	0.47	0.31	3.25

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.

5.9.1 Earthquake-Induced Pressures

Earthquakes will induce additional pressures on retaining structures.

For active earth pressure loads:

$$P_{ae} = \frac{1}{2}\gamma H^2(1 - k_v)K_{ae}$$

Where

P_{ae} = resultant active lateral earth load inducing static and dynamic loads;

γ = unit weight of the soil behind the wall;

k_v = vertical component of the earthquake acceleration (as a decimal fraction of the acceleration due to gravity);

k_h = horizontal component of the earthquake acceleration (as a decimal fraction of the acceleration due to gravity); and

K_{ae} = horizontal component of active earth pressure coefficient including effects of earthquake loading;

And

$$K_{ae} = \frac{\cos(\delta + \alpha cos^2(\phi' - \varphi - i))}{cos^2 i \ \cos\delta \cos(\delta + i + \varphi)(1 + X_a^{1/2})^2}$$

$$X_a = \frac{\sin(\delta + \varphi')\sin(\phi' - \varphi - \beta)}{\cos(\delta + i + \varphi)\cos(\beta - i)}$$

$$\varphi = \tan^{-1}[k_h/(1 - k_v)]$$

$$i = 90 - \alpha$$

For the site, γ is as above for either native soils or compacted granular fill, α=90°, i=0, and δ=14°.

For temporary shoring, Kh=0.057 and Kv=0.038, while for permanent structures Kh=0.134 and Kv =0.09.

5.9.2 Shoring Design

It is likely that extensive shoring design and construction will be required where the property line runs adjacent to Mapleview Drive East if the proposed parking garage is to be constructed directly adjacent to the property line. If a shoring design is conducted for the proposed parking garage, the lateral earth pressures found herein should be applied to the design and Cambium should be retained to conduct a plan review and make necessary changes.

5.10 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 metres of the site stratigraphy, where shear wave velocity (v_s) measurements have been taken. Alternatively, the classification is estimated on the basis of rational analysis of undrained shear strength (s_u) or penetration resistances (N_{60} values).

The boreholes advanced on site were maximum of about 6.7 mbgs. Therefore, the site classification recommendation would be based on the available information as well as our interpretation of conditions below the boreholes based on our knowledge of the soil conditions in the area. It is assumed that the soils encountered in the samples retrieved remain continuous to a minimum depth of 30 m below the bottom of any foundations. In addition, average 'N_{60}' values for soils were assumed for the site. 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 ("MASW") to evaluate whether an improved seismic site class can be obtained. Further details regarding shear wave velocity testing could be provided upon request.

5.11 Pavement Design

The performance of pavement is dependent on proper subgrade preparation. All topsoil and organic materials should be removed and backfilled with approved engineered fill or native material (if tested and approved for use by a qualified geotechnical/pavement engineer), compacted to 98% of SPMDD. The subgrade should be proof rolled and inspected by a geotechnical engineer. Any areas were boulders, rutting, or appreciable deflection is noted

should be sub-excavated and replaced with suitable fill. The fill should be compacted to at least 100% of SPMDD.

The recommended pavement structure provided is referenced from the City of Barrie's "Right-of-Way Infrastructure Standards, Appendix C", as a minimum, consist of the pavement layers identified in Table 7. Cambium recommends the parking structure for the Site adhere to the minimum pavement structure provided and is sufficient for the Site.

Table 7 Minimum Pavement Structure

Pavement Layer	Compaction Requirements	Minimum Thickness and Material Requirements
Surface Course Asphalt	92% - 96.5% MRD (OPSS 310)	40 mm HL3
Binder Course Asphalt	92% - 96.5% MRD (OPSS 310)	70 mm HL4 or HL8
Granular Base	100% SPMDD (ASTM-D698)	150 mm OPSS 1010 Granular A
Granular Subbase	100% SPMDD (ASTM-D698)	450 mm OPSS 1010 Granular B Type I

Final material and thickness requirements, and any material/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 any 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 0.5% to shed runoff. Abutting pavements should be saw cut 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. 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.

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Project Coordinator - Geotechnical

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Stuart Baird, M.Eng., P.Eng.
Director – Geotechnical, CQV, Building Sciences

SEB/cm

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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.

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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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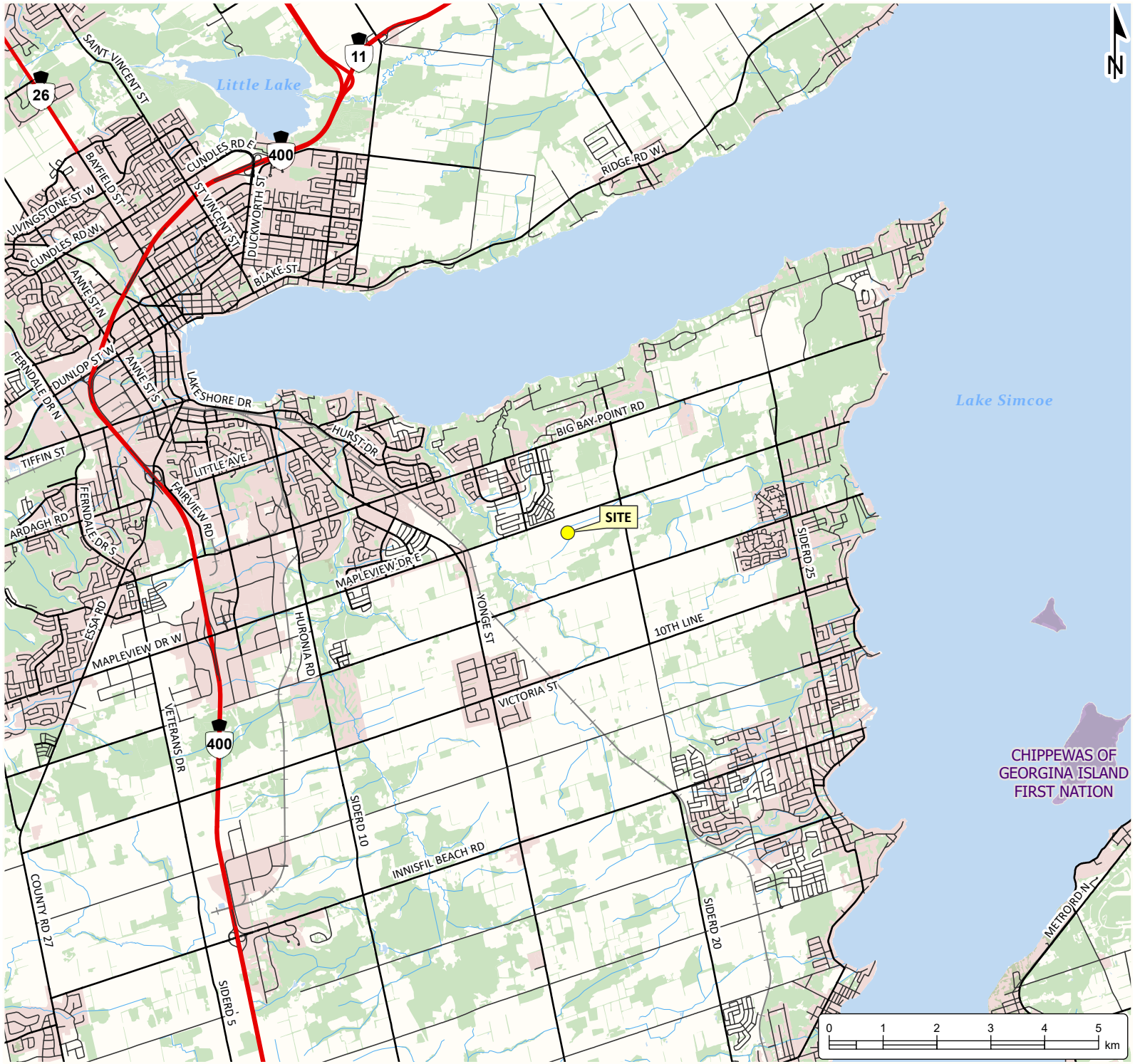
Personal Liability

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

MAPLEVIEW SOUTH
(INNISFIL) LIMITED
953 Mapleview Drive East
Barrie, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- Water Area
- First Nations Reserve
- Wooded Area
- Built Up Area

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SITE LOCATION PLAN

Project No.: 19953-002		Date: May 2024	Rev.:
Scale: 1:100,000		Projection: NAD 1983 UTM Zone 17N	
Created by: TLC	Checked by: MG	Figure: 1	

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GEOTECHNICAL INVESTIGATION

MAPLEVIEW SOUTH
(INNISFIL) LIMITED
953 Mapleview Drive East
Barrie, Ontario

LEGEND

- Benchmark
- Borehole

Notes:
- Site plan overlay was created by Jones Consulting Group LTD. project: REI-17055, drawing: SWM-3, titled: LID - Exfiltration System Drainage Area Plan, dated March 2023.
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BOREHOLE LOCATION PLAN

Project No.: 19953-002		Date: May 2024 Rev.:	
Scale: 1:1,000		Projection: NAD 1983 UTM Zone 17N	
Created by: TLC	Checked by: MG	Figure:	2

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Appendix A

Borehole Logs

Client:	Mapleview South (Innisfil) Limited c/o Briarwood Development Group	**Project Name:**	MVS Dev Med Density Blocks	**Log of Borehole:**	BH501-24
Contractor:	Ontario Soil Drilling Inc.	**Method:**	Track Mounted Solid Stem Auger	Page:	1 of 1
Project No.:	19953-002	**Elevation:**	257.29 mASL	**Date Completed:**	May 8, 2024
Location:	953 Mapleview Drive East, Barrie ON	**UTM:**	17T **N:** 4912108 **E:** 611568		

SUBSURFACE PROFILE				SAMPLE							
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) / % Moisture	Shear Strength Cu, kPa / SPT (N)	Well Installation	Log Notes
257.3	0		**(SM) SILTY SAND:** trace gravel, trace cobble, brown/grey, moist, and compact, (possible engineered FILL or native)	1	SS	100	14	8.5%	14		
256.8	0.5										
256.3	1		- trace clay, very loose	2	SS	83	3	12.2%	3		
255.8	1.5		255.77								
			1.52 **(SM) SILTY SAND:** trace gravel, trace clay, trace cobble, brown/grey, moist moist, compact	3	SS	83	24	14%	24		
255.3	2										
254.8	2.5		- less clay, dense	4	SS	100	47	10.4%	47		
254.3	3										
253.8	3.5			5	SS	100	49	8%	49		
253.3	4										
252.8	4.5		- trace cobble, moist to wet, very dense	6	SS	100	78	8.7%	78		
252.3	5										
251.8	5.5										
251.3	6										
250.8	6.5		250.76	7	SS	100	70	7.7%	70		Borehole terminated in silty sand. Borehole caving and standing water not observed upon completion of drilling. Groundwater first observed at 1.2 mbgs
250.3	7		6.53 Borehole terminated @ 6.5 mbgs due to target depth achieved.								
249.8											

GRAINSIZE DISTRIBUTION	SAMPLE	GRAVEL	SAND	SILT	CLAY
	SS7	5	56	25	14

Logged By: AM **Input By:** MH

Peterborough, Barrie, Whitby, Kingston, Ottawa

Client:	Mapleview South (Innisfil) Limited c/o Briarwood Development Group	**Project Name:**	MVS Dev Med Density Blocks	**Log of Borehole:**	BH502-24
Contractor:	Ontario Soil Drilling Inc.	**Method:**	Track Mounted Solid Stem Auger	Page:	1 of 1
Project No.:	19953-002	**Elevation:**	258.04 mASL	**Date Completed:**	May 8, 2024
Location:	953 Mapleview Drive East, Barrie ON	**UTM:**	17T **N:** 4912096 **E:** 611515		

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI; 25 50 75; % 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
258 / 0		**(SM) SILTY SAND:** trace gravel, brown/grey, moist, compact, (possible engineered FILL or reworked native)	1	SS	75	26	6.5%	26		
257.5 / 0.5		- trace cobble								
257 / 1			2	SS	100	14	7.9%	14		
256.5 / 1.5		256.52 / 1.52 **(SM) SILTY SAND:** trace gravel, trace cobble, brown/grey, moist to wet, compact	3	SS	100	10	11.5%	10		
256 / 2										
255.5 / 2.5		- dense	4	SS	100	31	9.5%	31		
255 / 3										
254.5 / 3.5		- very dense	5	SS	83	71	8.9%	71		
254 / 4										
253.5 / 4.5			6	SS	100	58	8.9%	58		
253 / 5										
252.5 / 5.5										
252 / 6										
251.5 / 6.5		- dense 251.33	7	SS	100	47	7.6%	47		Borehole terminated in silty sand. Borehole caving no observed upon completion of drilling. Standing water observed at 5.5 mbgs upon completion of drilling. Groundwater first observed at 2.7 mbgs
251 / 7		Borehole terminated @ 6.7 mbgs due to target depth achieved. 6.71								
250.5										

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

Logged By: AM **Input By:** MH

Peterborough, Barrie, Whitby, Kingston, Ottawa

Client:	Mapleview South (Innisfil) Limited c/o Briarwood Development Group	**Project Name:**	MVS Dev Med Density Blocks	**Log of Borehole:**	BH503-24
Contractor:	Ontario Soil Drilling Inc.	**Method:**	Track Mounted Solid Stem Auger	Page:	1 of 1
Project No.:	19953-002	**Elevation:**	258.27 mASL	**Date Completed:**	May 8, 2024
Location:	953 Mapleview Drive East, Barrie ON	**UTM:**	17T **N:** 4912072 **E:** 611515		

SUBSURFACE PROFILE			SAMPLE						
Elevation (m) / Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI; % Moisture	Shear Strength Cu, kPa (nat V., rem V.); SPT (N)	Well Installation	Log Notes
258.3 / 0							25 50 75	20 40 60 80		
257.8 / 0.5		**(ML) SILT:** and SAND, trace gravel, trace cobble, brown/grey, moist, compact, (possible engineered FILL or reworked native).	1	SS	100	14	8.8%	14		
257.3 / 1		- less cobble, moist to wet, very loose	2	SS	100	3	11%	3		
256.8 / 1.5		256.75 / 1.52								
256.3 / 2		**(SM) SILTY SAND:** trace gravel, trace cobble, brown/grey, moist/wet, dense	3	SS	42	33	10.6%	33		
255.8 / 2.5		- compact	4	SS	100	19	10.2%	19		
255.3 / 3		- some gravel, some clay	5	SS	25	14	9.6%	14		
254.8 / 3.5										
254.3 / 4										
253.8 / 4.5			6	SS	100	18	8.6%	18		
253.3 / 5										
252.8 / 5.5										
252.3 / 6										
251.8 / 6.5		- grey, dense	7	SS	100	42	7.3%	42		
251.3 / 7		251.56 / 6.71 Borehole terminated @ 6.7 mbgs due to target depth achieved.								Borehole terminated in silty sand. Borehole caving not observed upon completion of drilling. Standing water observed at 5.6 mbgs upon completion of drilling. Groundwater first observed at 5.2 mbgs
250.8										

GRAINSIZE DISTRIBUTION	SAMPLE	GRAVEL	SAND	SILT	CLAY
	SS6	16	40	31	13

Logged By: AM **Input By:** MH

Peterborough, Barrie, Whitby, Kingston, Ottawa

Client:	Mapleview South (Innisfil) Limited c/o Briarwood Development Group	**Project Name:**	MVS Dev Med Density Blocks	**Log of Borehole:**	BH504-24
Contractor:	Ontario Soil Drilling Inc.	**Method:**	Track Mounted Solid Stem Auger	Page:	1 of 1
Project No.:	19953-002	**Elevation:**	257.45 mASL	**Date Completed:**	May 8, 2024
Location:	953 Mapleview Drive East, Barrie ON	**UTM:**	17T **N:** 4912064 **E:** 611558		

SUBSURFACE PROFILE				SAMPLE							
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI / % Moisture	Shear Strength Cu, kPa (nat V., rem V.) / SPT (N)	Well Installation	Log Notes
								25 50 75	20 40 60 80		
257.4	0		**(SW) SAND:** and SILT, trace gravel, trace organics, brown/grey, moist, compact, (possible engineered FILL or reworked native).	1	SS	38	16	8.2%	16		
257	0.5		- trace cobble, less organics	2	SS	100	13	9.5%	13		
256.4	1			3	SS	100	20	8.4%	20		
256	1.5										
255.4	2			4	SS	75	10	9.1%	10		
255	2.5		- less cobble								
254.4	3			5	SS	100	11	9.7%	11		
254	3.5										
253.4	4										
253	4.5		252.88								
252.4	5		4.57 **(SM) SILTY SAND:** some clay, trace gravel, brown/grey, moist, compact	6	SS	100	10	14.1%	10		
252	5.5										
251.4	6										
251	6.5		250.74	7	SS	75	13	10.2%	13		
250.4	7		6.71 Borehole terminated @ 6.7 mbgs due to target depth achieved.								Borehole terminated in silty sand. Borehole caving and standing water not observed upon completion of drilling. Groundwater not observed.
250											

GRAINSIZE DISTRIBUTION	SAMPLE	GRAVEL	SAND	SILT	CLAY
	SS7	5	40	37	18

Logged By: AM **Input By:** MH

Appendix B

Physical Laboratory Testing Results

Grain Size Distribution Chart

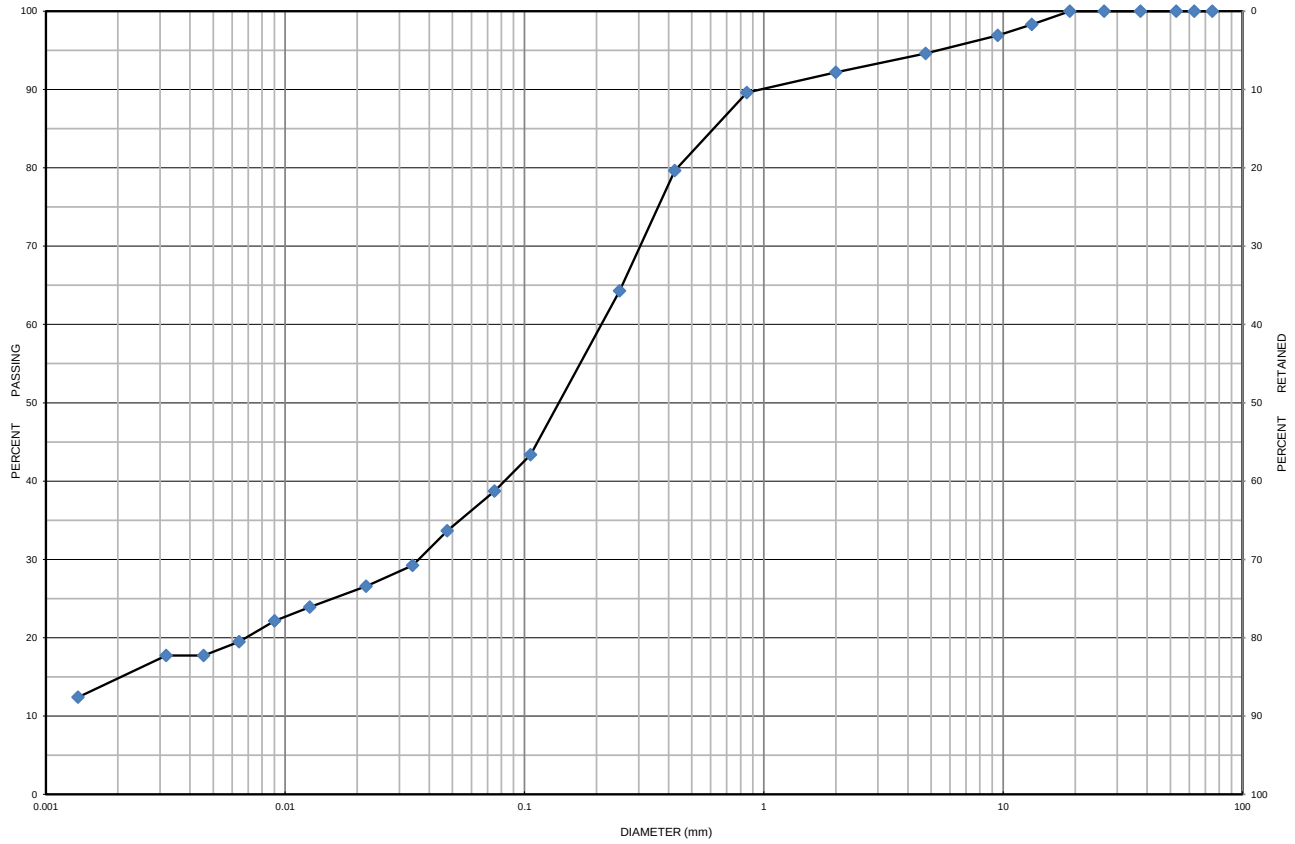
Project Number: *19953-001* **Client:** *Mapleview South (Innisfil) Limited c/o Briarwood Developn*

Project Name: *Mapleview South Development*

Sample Date: *May 8 & 9, 2024* **Sampled By:** *Abigail Mackle - Cambium Inc.*

Location: *BH 501-24 SS 7* **Depth:** *6.1 m to 6.7 m* **Lab Sample No:** *S-24-0919*

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 501-24	SS 7	6.1 m to 6.7 m	5	56	25	14	7.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand some Clay trace Gravel	SM	0.220	0.036	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *May 24, 2024*

(Senior Project Manager)

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Grain Size Distribution Chart

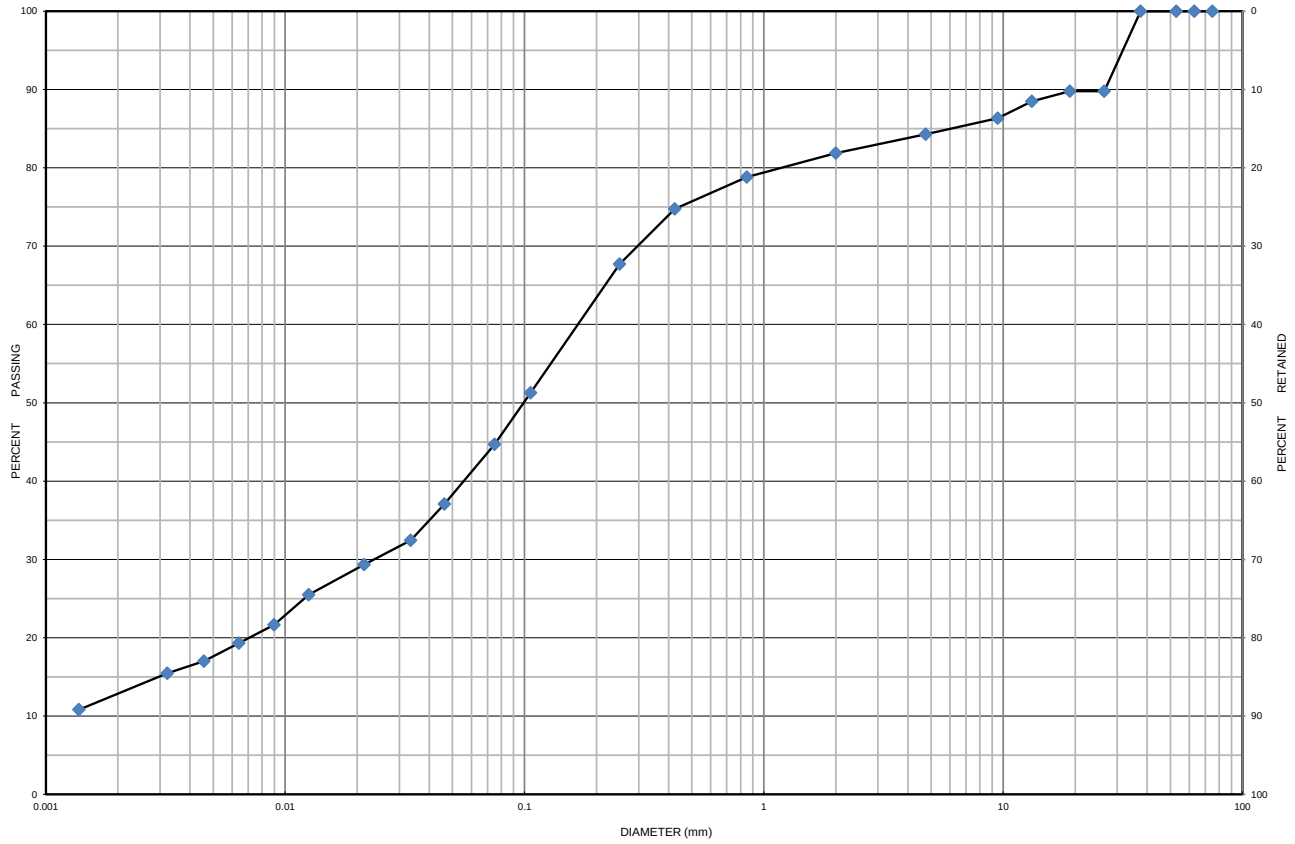
Project Number: *19953-002* **Client:** *Mapleview South (Innisfil) Limited c/o Briarwood Developn*

Project Name: *MVS Dev Med Density Blocks*

Sample Date: *May 8 & 9, 2024* **Sampled By:** *Abigail Mackle - Cambium Inc.*

Location: *BH 503-24 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-24-0920*

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 503-24	SS 6	4.6 m to 5.2 m	16	40	31	13	8.6

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand some Gravel some Clay	SM	0.160	0.024	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *May 24, 2024*

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Grain Size Distribution Chart

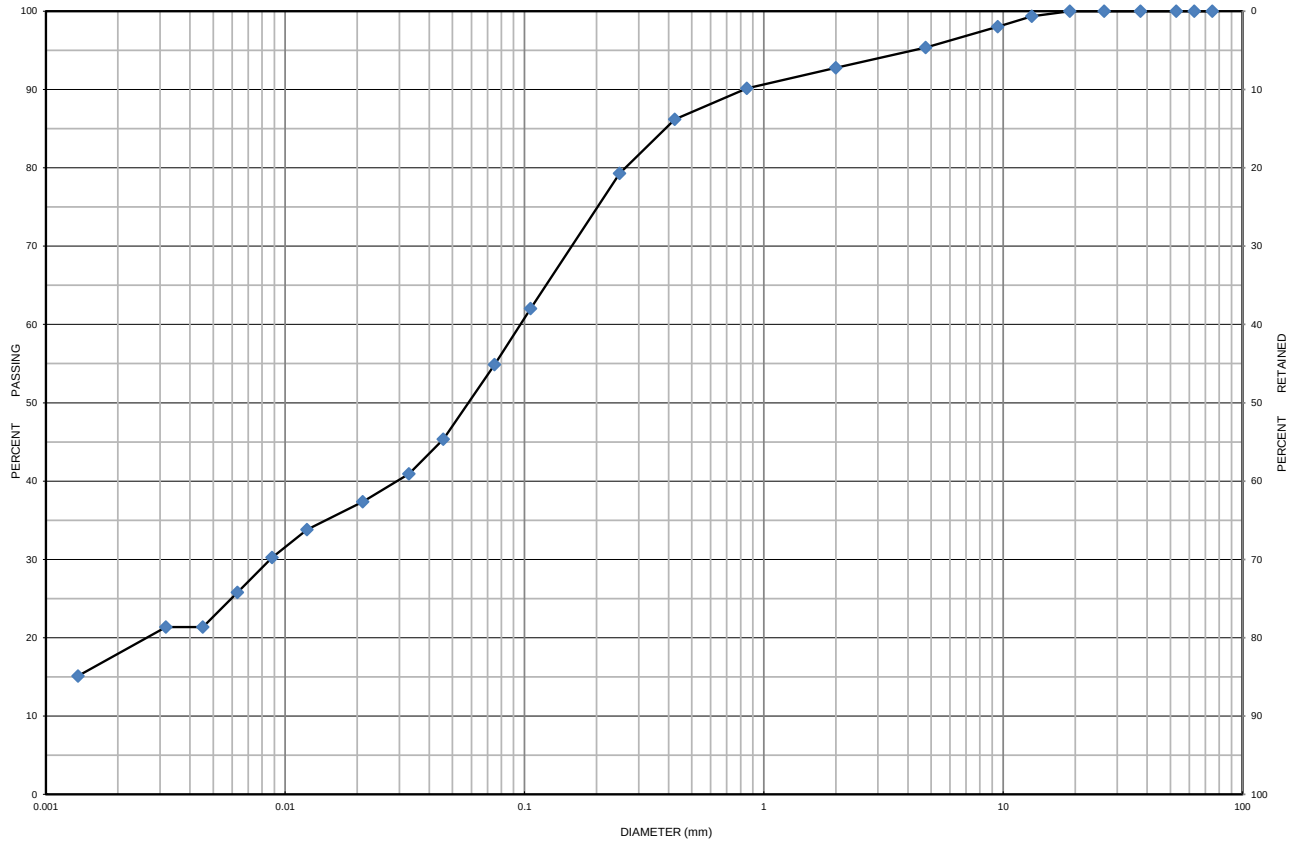
Project Number: *19953-002* **Client:** *Mapleview South (Innisfil) Limited c/o Briarwood Developn*

Project Name: *MVS Dev Med Density Blocks*

Sample Date: *May 8 & 9, 2024* **Sampled By:** *Abigail Mackle - Cambium Inc.*

Location: *BH 504-24 SS 7* **Depth:** *6.1 m to 6.7 m* **Lab Sample No:** *S-24-0921*

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 504-24	SS 7	6.1 m to 6.7 m	5	40	37	18	10.2

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Clay trace Gravel	ML	0.098	0.009	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *May 24, 2024*

(Senior Project Manager)

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Moisture Content

Project Number: 19953-002
Project Name: MVS Dev Med Density Blocks
Client: `Mapleview South (Innisfil) Limited c/o Briarwood Development Group
Date Taken: 2024-05-08

Lab Number: S-24-0918
Date Tested: 2024-05-14
Tested By: R. McCabe

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
501	1	0.00-0.61	26.8	8.5	
501	2	0.76-1.37	40.3	12.2	
501	3	1.52-2.13	50.8	14.0	
501	4	2.29-2.90	37.8	10.4	
501	5	3.05-3.66	27.7	8.0	
501	6	4.57-5.18	25.8	8.7	
501	7	6.10-6.55	63.7	7.7	NR
502	1	0.00-0.61	18.7	6.5	
502	2	0.76-1.37	20.1	7.9	
502	3	1.52-2.13	42.9	11.5	
502	4	2.29-2.90	31.9	9.5	
502	5	3.05-3.66	21.6	8.9	
502	6	4.57-5.18	27.2	8.9	
502	7	6.10-6.71	26.9	7.5	
503	1	0.00-0.61	24.5	8.8	
503	2	0.76-1.37	29.5	11.0	
503	3	1.52-2.13	28.6	10.6	
503	4	2.29-2.90	38.5	10.2	
503	5	3.05-3.66	26.7	9.6	
503	6	4.57-5.18	80.6	8.6	NR
503	7	6.10-6.71	23.6	7.3	
504	1	0.00-0.61	21.3	8.2	
504	2	0.76-1.37	33.3	9.5	
504	3	1.52-2.13	26.8	8.4	
504	4	2.29-2.90	25.0	9.1	
504	5	3.05-3.66	28.8	9.7	

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:	19953-002	**Lab Number:**	S-24-0918
Project Name:	MVS Dev Med Density Blocks	**Date Tested:**	2024-05-14
Client:	`Mapleview South (Innisfil) Limited c/o Briarwood Development Group	**Tested By:**	R. McCabe
Date Taken:	2024-05-08		

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
504	6	4.57-5.18	40.5	14.1	
504	7	6.10-6.71	104.4	10.2	NR

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