Geotechnical Investigation Report

1386 & 1394 Greely Lane, Ottawa, Ontario

February 27, 2025

Prepared for:
Cassidy EW Construction Consultant Ltd.

Cambium Reference: 17281-001

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Table of Contents

List of Embedded Tables

List of Appended Figures

List of Appendices

1.0 Introduction

Cambium Inc. (Cambium) was retained by Cassidy EW Construction Consultant Ltd. (the Client) to conduct a geotechnical investigation and provide geotechnical engineering design advice for the proposed commercial redevelopment to be located at 1386 and 1394 Greely Lane in Greely (Ottawa), Ontario. A Site Location Plan is provided as Figure 1.

This investigation will be used to support a future site plan application with the City of Ottawa. A Phase II Environmental Site Assessment (ESA) and Hydrogeological Investigation is also being completed by Cambium concurrently with the geotechnical investigation. The results of these studies are being provided as separate reports.

Based on preliminary site plans dated January 2025 provided to Cambium, it understood that the current plans for the site are to construct a one-storey building at the site of slab-on-grade design, measuring about 55 m by 23 m. It is anticipated that perimeter foundations will extend to below the local frost penetration depths. The development will include at grade parking and driveways to the back of the building.

The proposed finished floor elevations (FFE) have not yet been determined; however it is understood that the grades will be slightly raised by about 270 mm. The grade in the area of the raised septic bed will be lowered as a result of removal of the bed.

It is assumed that the proposed buildings will be privately serviced.

2.0 Site Description

The existing site is currently developed commercially, with a slab on grade commercial building on the north side of the site. There are temporary sea-can storage units on the site adjacent to the commercial building, and an additional single storey metal storage building. A driveway connects to the adjacent Greely Lane at two locations also on the north side of the site.

The remainder of the site is landscaped and grass covered. Based on plans provided by the Client, the southern portion of the site is predominantly the septic bed for the commercial development. This septic bed is raised at a higher elevation than the grade of the site. The septic tanks are located along the western boundary of the site.

3.0 Methodology

3.1 Borehole Investigation

A borehole investigation was conducted at the site on March 7 to 8, 2023, to assess subsurface conditions. Nine boreholes were advanced across the site to varying depths and locations based the proposed development. A summary of the boreholes is provided below:

- Boreholes BH101-23 through BH104-23 were advanced at the locations of proposed building footprints to depths of 6.1 to 6.7 metres below ground surface (mbgs).
- Boreholes BH105-23 through BH107-23 were advanced near the property boundaries to a depth of 3.7 mbgs. These boreholes were advanced as part of the Phase II ESA and were fitted with groundwater monitoring wells.
- Boreholes BH108-23 and BH109-23 were advanced in areas of future driveways and to delineate shallow subsurface stratum.

The locations of the boreholes relative to the existing site conditions are provided as Figure 2.

Drilling and sampling was 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 with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) results (N values) were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive materials. Soil samples were collected at approximately 0.75 m intervals. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage. Open boreholes were checked for groundwater and general stability prior to backfilling. The boreholes and monitoring wells were backfilled in accordance with O.Reg. 903, as amended.

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.

GPS coordinates of each borehole were obtained using a handheld GPS device. Borehole elevations were surveyed using real-time kinematic (RTK) surveying equipment systems referenced to a site benchmark taken from the topographic survey completed on June 29, 2023 and updated July 12, 2024 by Fairhall, Moffat, and Woodland Ltd. Elevations are taken relative to the north most manhole cover of the septic tanks: 98.59 meters above sea level (mASL), and should be considered approximate.

3.2 Laboratory Testing

Physical laboratory testing was completed on select soil samples to assess geotechnical parameters. Natural moisture contents were measured for all soil samples (ASTM D2216), and particle size distribution testing and Atterberg index tests were completed on select samples (ASTM D6913, D1140, and D4318). The results are summarized in the respective stratigraphy sections in Section 3.0 and noted on the corresponding borehole logs. Detailed results diagrams of the particle size distribution testing and Atterberg Limits tests are provided in Appendix B.

4.0 Subsurface Conditions

The subsurface soil and groundwater conditions encountered in the boreholes are presented on the attached Borehole Logs in Appendix A. The stratigraphic boundaries indicated on the logs are inferred from non-continuous samples and observations of drilling resistance and typically represent a transition from one soil type to another, sometime gradually. The boundaries should not be interpreted to represent exact planes of geologic change. The subsurface conditions have been confirmed in a series of widely spaced boreholes and will vary between and beyond the borehole locations.

Subsurface conditions generally consist of surficial deposits of pavements or topsoil overlying a relatively thin deposit of fill overlying native deposits of clays and silts. The individual soil units are described in detail below.

4.1 Topsoil

Topsoil was encountered from the surface of all boreholes with the exception BH101-23 and BH108-23. The thickness of the topsoil ranges from 100 to 910 mm.

It should be noted that the topsoil encountered in BH103-23 and BH109-23 are significantly thicker than the other locations due to the material being mixed with other fill materials, and the organic content in the material reduces with depth.

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

4.2 Pavement Structure

4.2.1 Asphaltic Concrete

Asphaltic concrete was encountered from the surface of BH101-23 and BH108-23 that were advanced in the existing paved areas. The thickness of the asphalt measures 75 mm and 50 mm in BH101-23 and BH108-23, respectively.

4.2.2 Base Material

Pavement base material was encountered underlying the asphaltic concrete. The base material is composed of brown gravelly sand with some silt. The thickness of the material measures 380 mm and 560 mm in BH101-23 and BH108-23, respectively.

One SPT N-value was measured in BH108-23 at a value of 64, indicative of a very dense relative density. It should be noted that the N-value measured through the pavement-based material in BH101-23 also yielded results indicative of a very dense relative density although the SPT included the underlying silty sand fill material.

4.3 Fill Material

Fill material other than the pavement structure was encountered at all borehole locations. The fill material varies slightly in composition between borehole locations but is predominantly composed of silty sandy. The material ranges from trace gravel to gravelly, and trace clay was noted in BH105-23 and BH107-23. Roots were noted within the fill material in BH102-23. The fill material varies in colour between brown and grey depending on location.

The thickness of the fill material ranges from 0.1 o 1.4 m and extends to depth ranging from 0.3 to 1.5 mbgs.

SPT N-values measured in the silty sand fill material range from 3 to 11, indicative of a very loose to compact relative density.

A laboratory particle size distribution analysis was completed on two samples of fill material taken from the indicated depths. The analysis results are provided in Appendix B and are summarized below based on the MIT soil classification system.

Embedded Table 1 Grain Size Distribution Testing – Fill Material

Sample	Depth (mbgs)	% Gravel	% Sand	% Silt and Clay
BH101-23 SS1B	0.5 to 0.8	20	53	27
BH108-23 SS1B	0.6 to 0.8	0	63	37

The distribution results of the samples are compared to the Ontario Provincial Standards Specification (OPSS.MUNI) 1010 gradation envelope for Granular A and B Type I on their

respective results diagrams in Appendix B. Based on comparison, the existing fill materials do no meet the OPSS gradation requirements.

4.4 Clayey Silt

Native deposits of clayey silt were encountered underlying the fill material at all borehole locations. The clayey silt is sandy and grey in colour. A notable decrease in clay content is observed in BH103-23 and BH104-23 at a depth of 2.3 mbgs as the material transitions to the non-cohesive underlying deposits.

The clayey silty deposits were encountered at depths ranging from 0.3 to 1.5 mbgs. Boreholes BH108-23 and BH109-23 terminated within the clayey silt deposits at depths of 1.5 mbgs. The deposit was fully penetrated at all other borehole locations. The thickness of the deposits at these locations range from 0.9 to 2.3 m, and the deposits extend to depths ranging from 2.3 to 3.2 mbgs.

SPT N-values measured in the clayey silt range from 3 to 10, indicative of a soft to stiff consistency.

A laboratory particle size distribution analysis was completed on two samples of clayey silt taken from the indicated depths. The analysis results are provided in Appendix B and are summarized below based on the MIT soil classification system.

Embedded Table 2 Grain Size Distribution Testing – Clayey Silt

Sample	Depth (mbgs)	% Gravel	% Sand	% Silt	% Clay
BH101-23 SS3	1.5 to 2.1	0	22	57	21
BH104-23 SS4	2.3 to 2.9	0	25	57	18

Atterberg limits testing was completed on the above samples. The analysis results are provided in Appendix B and are summarized below.

Embedded Table 3 Atterberg Limits Testing – Clayey Silt

Sample	Depth (mbgs)	Plastic Limit (%)	Liquid Limit (%)	Description	Moisture Content (%)
BH101-23 SS3	1.5 to 2.1	12.5	19.8	Low plasticity clay	18.8
BH104-23 SS4	2.3 to 2.9	13.1	18.5	CL-ML	18.0

4.5 Silty Sand

A native deposit of grey silty sand was observed in BH101-23 underlying the clayey silt deposit at a depth of 2.6 mbgs. The deposit measures 0.5 m in thickness and extends to a depth of 3.1 mbgs. A seam similar in composition was noted in BH104-23 at a depth of 3.1 mbgs. The seam measured 100 mm.

4.6 Silt

Native deposits of silt were encountered underlying the clayey silt and silty sand in boreholes BH101-23 through BH107-23. The deposit is grey in colour and contains some sand to sandy and trace clay.

The silt deposits were encountered at depths ranging from 2.3 to 3.2 mbgs. Where encountered, all boreholes terminated within the silt at depths ranging from 3.7 to 6.7 mbgs.

SPT N-values measured in the silt deposit range from 5 to over 50, indicative of a loose to very dense relative density. It is likely that the measurement of 5 is due to cohesive material within the deposit at this depth as the soil transitions. Omitting the N-value of 5, the blow counts within these deposits range from 15 to over 50, indicative of a compact to very dense relative density.

A laboratory particle size distribution analysis was completed on two samples of clayey silt taken from the indicated depths. The analysis results are provided in Appendix B and are summarized below based on the MIT soil classification system.

Embedded Table 4 Grain Size Distribution Testing – Silt

Sample	Depth (mbgs)	% Gravel	% Sand	% Silt	% Clay
BH101-23 SS6	3.8 to 4.4	0	19	77	4
BH104-23 SS6	3.8 to 4.4	0	22	74	4

4.7 Groundwater

Unstabilized groundwater level observations were made following drilling at all borehole locations. Three groundwater monitoring wells were installed in select boreholes (BH105-23 through BH107-23). These boreholes were installed to measure stabilized groundwater conditions as well as provide groundwater data for the Phase II ESA, submitted separately.

A summary of our groundwater observations made on the day of drilling, as well as one reading event, is provided below.

Embedded Table 5 Groundwater Level Measurements

Borehole	Surface Elevation (mASL)	Depth/Elevation of Groundwater (mbgs/mASL)		
		Following Drilling	15/03/2023	19/04/2024
BH101-23	99.0	1.1/97.9	n/a	n/a
BH102-23	98.7	1.5/97.2	n/a	n/a
BH103-23	98.7	0.9/97.8	n/a	n/a
BH104-23	98.8	0.6/98.2	n/a	n/a
BH105-23	98.9	2.0/96.9	1.3/97.6	0.6/98.3
BH106-23	98.6	1.5/97.1	0.9/97.7	0.3/98.3
BH107-23	98.1	1.8/96.3	1.1/97.0	0.4/97.7
BH108-23	99.1	0.8/98.3	n/a	n/a
BH109-23	98.6	1.1/97.5	n/a	n/a

Based on the stabilized groundwater measurements, design groundwater levels can be taken at about 1±mbgs with high groundwater levels measured up to 0.5±mnbgs. Cambium is completing a Hydrogeological Investigation for the site and the results are presented separately.

It should be noted that groundwater levels at the site may fluctuate seasonally and in response to climatic events.

5.0 Geotechnical Design Considerations

The following recommendations are based on borehole information and are intended to assist designers. Recommendations should not be construed as providing instructions to contractors, who should form their own opinions about site conditions. It is possible that subsurface conditions beyond the borehole locations may vary from those observed.

The site is currently developed and in use. Therefore, boreholes could not be advanced in certain areas of the site, such as within the footprints of existing structures and through the existing septic bed on the southern half of the property. Verification will be required during construction to confirm that subsurface conditions in these areas match those encountered in our investigation. If significant variation is encountered, additional investigation work may be required, including additional test holes.

It is understood that the current plans for the site are to construct a single storey building of slab-on-grade construction (i.e. no basement) at the site. The development will include at grade parking and driveways to access delivery doors at the back of the building.

5.1 Excavations

The proposed site grading plan has not been reviewed, however based on conversations, it is understood that the grade will be raised by about 270 mm. The grade in the area of the raised septic bed will be dropped as part of the redevelopment of the site. In addition, perimeter foundations for the buildings will likely extend lower than the local frost depths. Therefore, excavations for the proposed development are anticipated to extend through the existing fill material and into the underlying clayey silt deposit.

All excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). The fill materials and native clayey silt may be classified as Type 3 soils above the groundwater table in accordance with OHSA. Below the groundwater table these soils may be classified as Type 4 soils.

Type 3 soils may be excavated with side slopes no steeper than 1H:1V.

Type 4 soils may be excavated with side slopes no steeper than 3H:1V.

Excavation side slopes should be protected from exposure to precipitation and associated ground surface runoff 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).

5.2 Dewatering

Based on measurements taken in March 2023 and April 2024, the depth of the groundwater table at the site can be taken at ±1 mbgs with seasonal high levels measured around 0.5±mbgs. As such, excavations will encounter groundwater seepage. The site is underlain by a deposit of clayey silt that transitions to a non-cohesive silt/sandy silt deposit. Cohesive deposits will preclude groundwater flow, as such, it is anticipated that most of the groundwater seepage will originate from the overlying sandy fill material. If excavations extend through the cohesive deposits, groundwater seepage should be anticipated from the base of the excavations.

Groundwater seepage should be controllable with filtered sumps and pumps from inside the excavation. If excavations extend into underlying noncohesive deposits, flows from the base of the excavation may disturb founding soils. As a result, depending on the time of year of excavation, depth of stabilized groundwater levels, and depth of excavation, positive dewatering of the site may be required in advance of excavation work. It is recommended that the groundwater levels are monitored in advance of construction in order to inform construction methodology.

Cambium has completed a Hydrogeological investigation at the site. The results are provided in a separate report and should be read in conjunction with this report.

The Ministry of the Environment, Conservation and Parks stipulate the requirements for Permit to Take Water (PTTW) approvals for construction related activities. Under the requirements, specific construction related water taking activities are eligible for Environmental Activity and Sector Registry (EASR). The trigger volume for EASR is water taking more than 50,000 litres/day. Volumes beyond 400,000 litres/day will require the application of a PTTW.

This includes water that is collected from open excavations as well as precipitation and/or surface runoff that enters the excavation.

It is noted that the elevation of the groundwater table will vary due to seasonal conditions and in response to heavy precipitation events.

5.3 Foundation Design

The proposed development will consist of a low-rise slab on grade structure. Foundations for this building may consist of shallow spread footings founded directly on the underlying native clayey silt deposits. Foundations bearing on this stratum will have limited capacity to carry heavy loads.

Subgrades for foundations should be cut neat down to the acceptable native, undisturbed material and free of loose or disturbed material, or standing water. The subgrades should be approved by geotechnical personnel prior to the construction of concrete footings or placement of engineered fill for grade raise purposes.

Foundations made to bear directly on top of the undisturbed clayey silt can be sized using a net geotechnical reaction at **SLS** of **80 kPa** and factored geotechnical resistance at ULS of **150 kPa**. Settlement potential at these loading conditions should be less than 25 mm and differential settlement should be less than 20 mm.

For areas where the proposed founding levels are above the level of the top of native undisturbed soils, or where sub excavation is required, footings can be made to bear directly on a pad of Engineered Fill such as that conforming to OPSS.MUNI 1010 Granular B Type II. Any engineered fill placed below proposed foundations should consist of 100% crushed rock, such as crusher run limestone (CRL) and should be placed directly on undisturbed native deposits. The imported engineered fill should be placed in maximum 200 mm thick lifts compacted to at least 98 % of the standard proctor maximum dry density (SPMDD) value. To allow for adequate spread of the loading below and beyond the footings, the engineered fill should extend a horizontal distance of at least 300 mm beyond the edge of the footings and then down and away from the edges at an angle of 1H:1V, or flatter. Excavations should be sized to accommodate fill placement. Foundations made on top of adequately compacted

engineered fill should be sized using a net reaction at **SLS** of **80 kPa** and factored geotechnical resistance at **ULS** of **150 kPa**. Settlement potential at these loadings conditions should be less than 25 mm and differential settlement should be less than 20 mm.

To reduce cracking in the footings, foundation walls, and concrete slab on grades where footings change between different subgrade materials, suitable transition zones should be created and the footings adequately reinforced.

Footings stepped from one level to another must be at a slope not exceeding 10H:7V from the outside edges of each foundation.

5.3.1 Lateral Resistance

The factored geotechnical resistance to sliding of foundation elements is developed by friction between the base of the concrete footing and the soil. This friction (**R**) depends on the normal load at the soil contact (**N**) and the frictional resistance of the soil (**tan φ**) expressed as $\boldsymbol{R_f = N\,tan\varphi}$, which is the unfactored resistance. The factored geotechnical resistance at ULS is $\boldsymbol{R_f = 0.8\,N\,tan\varphi}$ for foundations on soil.

5.3.2 Frost Protection of Foundations

All exterior footings of the proposed building should be provided with at least 1.8 m of earth cover for frost protection purposes. If the required depth of earth cover is not practicable, a combination of earth cover and polystyrene insulation could be considered. An insulation detail could be provided upon request.

Due to elevated groundwater at the site during seasonal high periods, it is recommended that a bond break is applied to the exterior foundation walls.

5.4 Backfill and Compaction

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 overlying fill material may be used as backfill material, if required. Due to the elevated silt content of the material, it is recommended that an adequate bond break is applied between the foundation wall and backfill to avoid frost adhesion.

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 the SPMDD value. Light, walk behind compaction equipment should be used in proximity to foundation walls.

5.5 Perimeter Drainage

Perimeter foundation drainage is not considered necessary for slab-on-grade structures. The finished floor slab elevation must be set 300 mm or higher than the exterior grade.

If the design requests perimeter drainage for the foundations, the system should consist of geotextile wrapped perforated 100 mm diameter pipes surrounded by a trench of 19 mm clear stone around the foundations. The system should outlet to a suitable discharge point under gravity flow away from the structure. The design of the system must conform to applicable plumbing code requirements.

5.6 Seismic Site Classification

The Ontario Building Code (2012) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration, and the site classification.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the top 30 m of the site stratigraphy underlying the foundation base, where shear wave velocity (V_s) measurements have been taken. Alternatively, the classification can be estimated on the basis of rational analysis of undrained shear strength in cohesive deposits (s_u) or penetration resistance (N-values).

$$\upsilon_{s-avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{\upsilon_{si}}} \qquad S_{u-avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{s_{ui}}} \qquad N_{avg} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

Shear wave velocity | **Undrained shear strength** | **SPT N-values**

The foundations for the proposed building will likely be underlain by native cohesive deposits of clayey silt. Based on this information, it is recommended that the designation for the seismic analysis is Class D, as per Table 4.1.8.4.A of the Ontario Building Code. Tables 4.1.8.4.B and 4.1.8.4.C of the same code provide the applicable acceleration and velocity based site coefficients, as shown in the following Embedded Table 6.

Embedded Table 6 Acceleration and Velocity Based Site Coefficients

Site Class	**Values of F_a**				
	$S_a(0.2) \leq 0.25$	**$_a(0.2) \leq 0.5$**	**$_a(0.2) \leq 0.75$**	**$_a(0.2) \leq 1.00$**	**$_a(0.2) \leq 1.25$**
D	1.3	1.2	1.1	1.1	1.0
Site Class	**Values of F_v**				
	$S_a(1.0) \leq 0.1$	**$S_a(1.0) \leq 0.2$**	**$S_a(1.0) \leq 0.3$**	**$S_a(1.0) \leq 0.4$**	**$S_a(1.0) \leq 0.5$**
D	1.4	1.3	1.2	1.1	1.1

5.7 Lateral Earth Pressure

The appropriate values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follows in Embedded Table 7.

Embedded Table 7 Lateral Earth Pressure Coefficients

Stratum/Parameter	γ	φ	Ka	Ko	Kp
Existing Earth Fill	20	28	0.36	0.53	2.77
Granular Backfill	22	35	0.27	0.42	3.70

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

φ = internal angle of friction (degrees)

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 above earth pressure parameters pertain to a horizontal grade condition behind a retaining structure. Values of earth pressure parameters for an inclined retained grade condition will vary.

Walls subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following equation:

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

Where, P = the horizontal pressure at depth, h (m)

K = the earth pressure coefficient

hw = the depth below the ground water level (m)

γ = the bulk unit weight of soil, (kN/m3)

γ’ = the submerged unit weight of the exterior soil, (γ - 9.8 kN/m3)

q = the complete surcharge loading (kPa)

5.8 Slabs-on-grade

All organic material and deleterious material must be removed prior to constructing the slab on grade. These materials do not constitute an adequate subgrade for support of a slab on grade.

The final site grades are not currently known. Depending on site grading, the native deposits at the site may support the proposed floor slabs. Alternatively, compacted engineered fill is also suitable for support of the conventional slab on grade provided that the pad is adequately prepared and approved by Cambium. The engineered fill should be placed directly on undisturbed native deposits. The imported engineered fill should be placed in maximum 200 mm thick lifts to at least 98 % of the SPMDD value. Selection of the type of engineered fill should be approved by Cambium prior to use.

The modulus of subgrade reaction appropriate for slab on grade design on the soils at the site is as follows:

- Native Undisturbed Clayey Silt 20,000 kPa/m
- Engineered Fill: 30,000 kPa/m

The subgrade for the slab must be cut-neat and inspected by Cambium, prior to the placement of an aggregate base. If there are areas containing excessive amounts of deleterious/organic material or moisture, they must be locally sub-excavated and backfilled with approved clean earth fill or Engineered Fill such as OPSS Granular B (Type I or II) and compacted to a minimum of 98% SPMDD.

Any interior areas that may be exposed to freezing conditions for extended periods of time, such as the proposed loading bay doors being left open during winter months, the floor slab may be susceptible to frost heaving. The subgrade underlying these areas should be adequately insulated to prevent frost penetration. Frost protection can be provided using approved polystyrene insulation, non-frost susceptible granular material, or a combination of both.

It is recommended that the slab be provided with a capillary moisture barrier. This is made by placing the slab on a minimum 200 mm layer of clear stone and nominally compacted by vibration to a dense state. Alternatively, the capillary moisture barrier can be composed of a 200 mm thick layer of OPSS.MUNI 1010 Granular A, compacted to a minimum 98% of the SPMDD.

Under slab drainage is not required beyond the capillary moisture barrier provided the floor slab elevation is set at 300 mm or higher than the exterior grade. Due to the elevated high groundwater levels at this site, it is recommended that the finished floor slab is also set about 0.6 m above the measured high groundwater level.

5.9 Pavement Design Considerations

5.9.1 Subgrade Preparation

The performance of the pavement is dependent upon proper subgrade preparation. All topsoil and organic materials are to be removed from the subgrade. The subgrade should be proof rolled and inspected by Cambium personnel. Any areas where rutting or appreciable deflection is noted should be sub-excavated and replaced with suitable earth fill. The earth fill may be taken from other parts of the site for reuse. The fill should be compacted to at least 98% of SPMDD.

The most severe loading conditions on pavement subgrades may occur during construction, and subgrades may become disturbed due to construction operations. Therefore the recommended pavement structure provided may not be adequate due to the presence of localized disturbed areas that occur during construction and it may be necessary to increase the thickness of the Granular B Type II subbase and/or incorporate a woven geotextile separator between the subgrade surface and the granular base. The requirement for an increase in the pavement structure and/or incorporating geotextile will be evaluated by Cambium personnel during proof roll inspections.

5.9.2 Flexible Pavement Structure

The pavement structure recommended in Embedded Table 8 below is based on assumptions of the anticipated traffic and loading conditions. Depending on the occupancy of the proposed building and loading conditions on the driveway areas and parking, the recommended structure below can be updated.

Embedded Table 8 Recommended Minimum Pavement Structure

Pavement Layer	Thickness and Material
Surface Course Asphalt	40 mm HL3 or SP 12.5
Binder Course Asphalt	60 mm HL8 or SP 19
Granular Base	150 mm OPSS 1010 Granular A
Granular Subbase	400 mm OPSS 1010 Granular B

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

Compaction of the subgrade should be verified by the Engineer prior to placing the granular fill. Granular layers should be placed in no more than 300 mm thick lifts and compacted to at least 98% of SPMDD (ASTM D698) standard. The granular materials specified should conform to OPSS standards, as confirmed by appropriate materials testing.

5.9.3 Pavement Transitions

Existing asphaltic concrete should be neatly saw cut at pavement transition areas. The joints should tack coat in accordance with OPSS.MUNI 310 requirements. In order to avoid differential frost heaving where granular thicknesses vary between different pavements, a gradual frost taper should be provided.

5.9.4 Pavement Drainage

The design of a storm water management system is beyond the scope of this investigation; however it is recommended that the subgrade, subbase, base, and asphalt surfaces should be shaped and crown to promote drainage of the pavement structure.

5.10 Report Limitations

5.10.1 Design Review and Inspections

Testing and inspections should be carried out during construction operations to test concrete and to examine and approve subgrade conditions, placement and compaction of fill materials, granular base courses, and asphaltic concrete.

We 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. In particular, boreholes were not advanced within the area of the existing

building footprints and through the septic bed on the south side of the site. The subgrade conditions in these areas must be verified by Cambium personnel to confirm that they correlate with the subsurface conditions encountered in the boreholes.

5.11 Changes in Site and Project Scope

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

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

The design parameters provided and the engineering advice offered in this report are intended for use by the owner and its retained design consultants. It is understood that the design plans for the site are currently in the preliminary stages, and changes may still occur, including configuration, sizing, scope, etc. Cambium should be retained to conduct further review to interpret the implications of such changes with respect to this report.

6.0 Closing

Please note that this work program and report are governed by the attached Qualifications and Limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (705) 742-7900.

Respectfully submitted,

Cambium Inc.

Originally signed by:

Stuart Baird, M.Eng., P.Eng.
Director of Geotechnical and CQV

Originally signed and stamped by:

Blasco Vijayabaskaran, P.Eng.
Geotechnical Engineer/Project Manager

\\cambiumincstorage.file.core.windows.net\projects\17200 to 17299\17281-001 Cassidy EW - Ph II ESA & GEO - 1386 & 1394 Greely Ln, Ottawa\Deliverables\REPORT - GEO\Final\2025 Report\2025-02-27 GEO RPT - 1386 & 1394 Greely Lane.docx

BV

7.0 Standard Limitations

Limited Warranty

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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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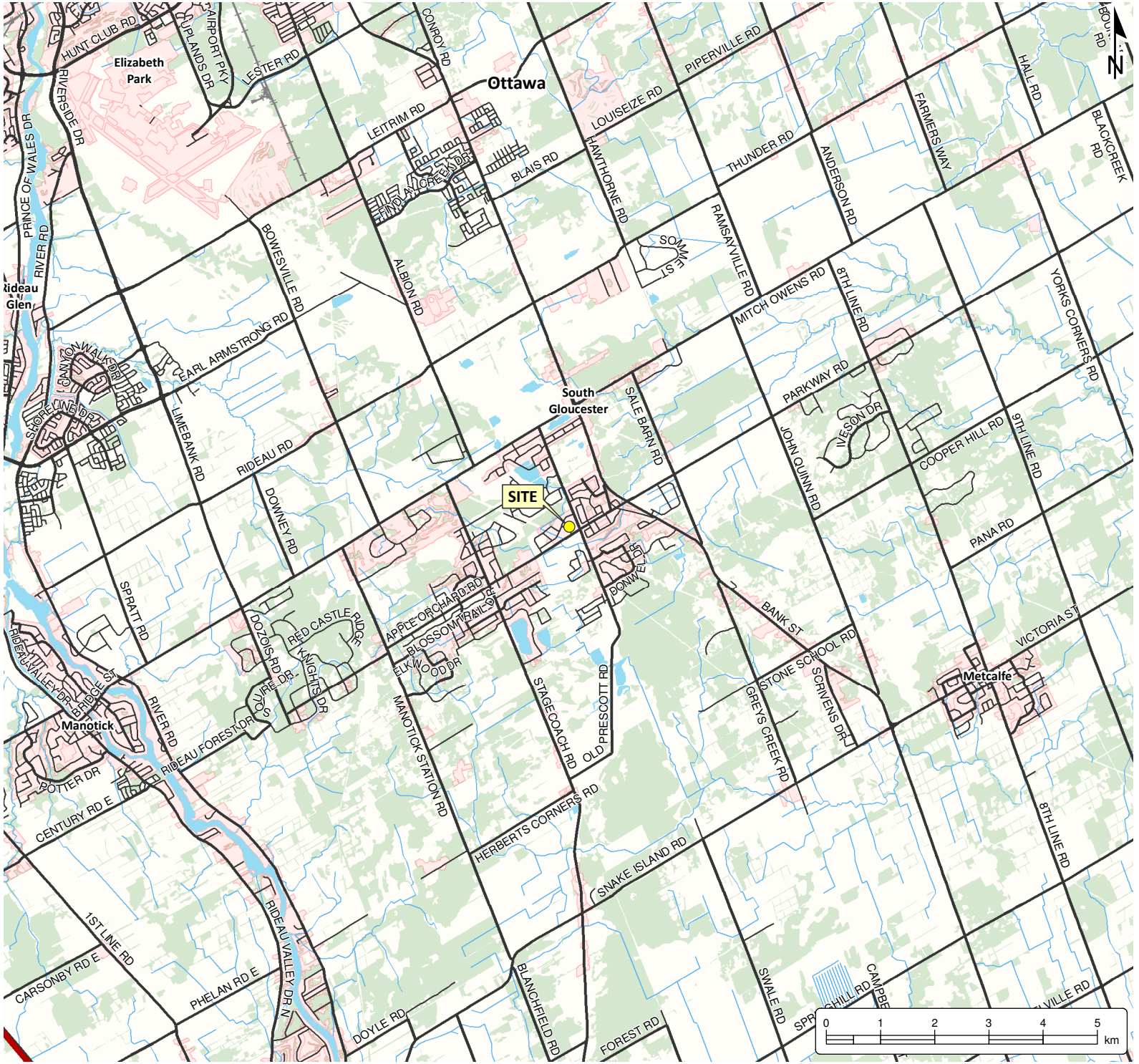
Appended Figures



GEOTECHNICAL INVESTIGATION

CASSIDY E.W.
CONSTRUCTION CONSULTANT LTD.
1386 - 1394 Greely Lane,
Ottawa, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railroad
- Watercourse
- Water Area
- Wooded Area
- Built Up Area

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

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SITE LOCATION MAP

Project No.:	17281-001	Date:	March 2023
		Rev.:	
Scale:	1:100,000	Projection:	NAD 1983 UTM Zone 18N
Created by:	DBB	Checked by:	BVJ
Figure:	1		

O:\GIS\MXDs\17200-17299\17281-001 Cassidy EW - Ph I ESA & GEO - 1386 & 1394 Greely Ln, Ottawa\2023-03-23 FIG 1 - Site Location Map.mxd

GEOTECHNICAL INVESTIGATION

CASSIDY E.W.
CONSTRUCTION CONSULTANT LTD.
1386 - 1394 Greely Lane,
Ottawa, Ontario

LEGEND

- Benchmark
- Borehole

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
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BOREHOLE LOCATION PLAN

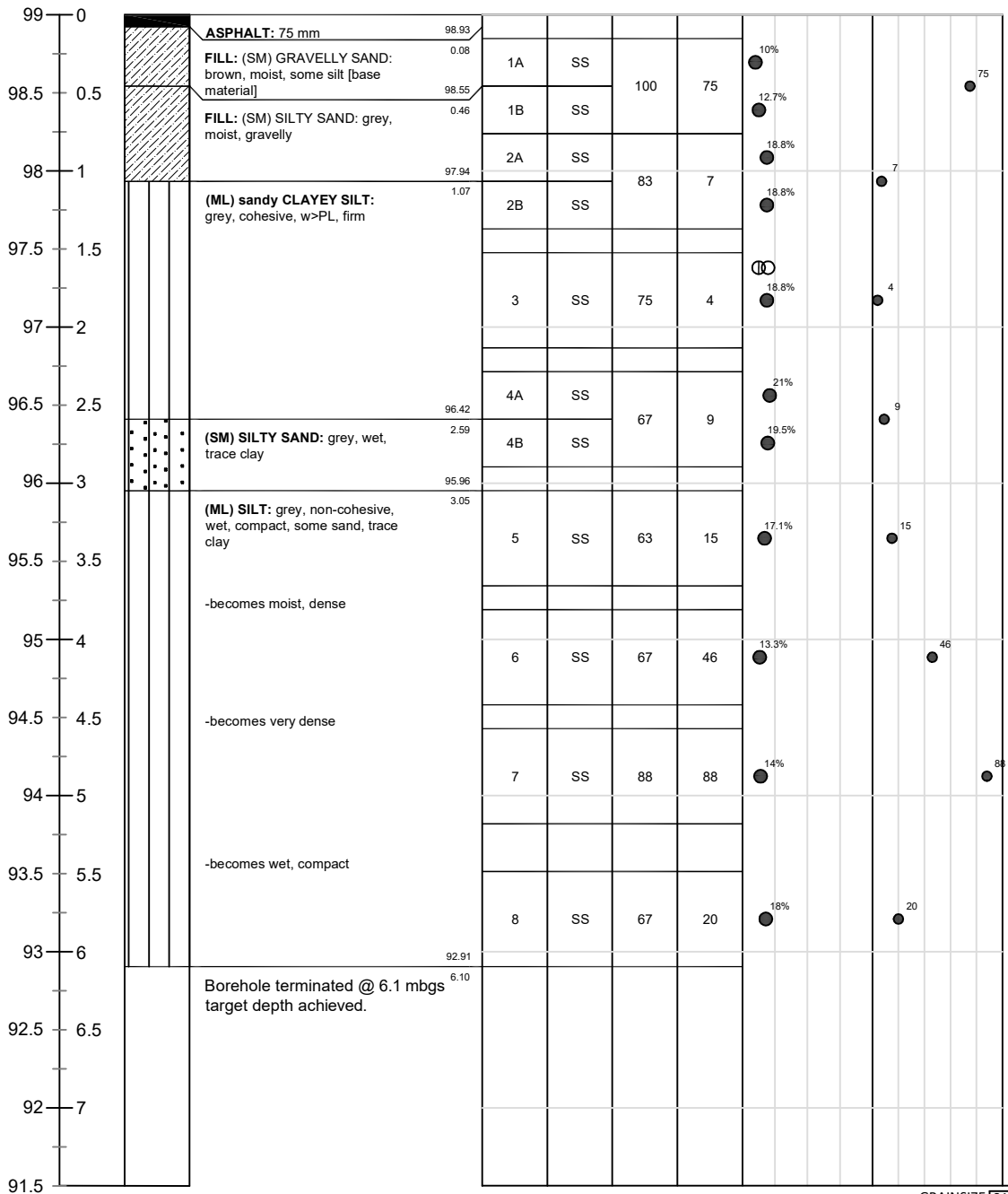
Project No.: 17281-001		Date: March 2023 Rev.:	
Scale: 1:750		Projection: NAD 1983 UTM Zone 18N	
Created by: DBB	Checked by: BVJ	Figure:	**2**

O:\GIS\MXDs\17200-17299\17281-001 Cassidy EW - Ph I ESA & GEO - 1386 & 1394 Greely Ln, Ottawa\2023-03-23 FIG 2 - Borehole Location Plan.mxd

Appendix A

Borehole Logs

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH101-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	99.01 mASL	**Date Completed:**	March 8, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011868 **E:** 455169		



GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS1B	20	53	27	
SS3	0	22	57	21
SS6	0	19	77	4

Logged By: FI **Input By:** BV

Peterborough, Barrie, Whitby, Kingston, Ottawa

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH102-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	98.72 mASL	**Date Completed:**	March 8, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011843 **E:** 455153		

Elevation (m)	Depth	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
98.7	0	**TOPSOIL:** 100 mm	98.62	1A	SS			20.9%			
		FILL: (SM) SILTY SAND: brown, wet, compact, gravelly, with roots	0.10	1B	SS	63	11	13.6%	11		
98.2	0.5										
			97.75	2A	SS			20%			
97.7	1	**(ML) sandy CLAYEY SILT:** grey, cohesive, w>PL, firm	0.97	2B	SS	92	4	19.5%	4		
97.2	1.5										
				3	SS	75	4	19.8%	4		
96.7	2	-becomes soft									
96.2	2.5			4	SS	67	3	18.5%	3		
95.7	3		95.67								
		(ML) SILT: grey, non-cohesive, wet, compact, some sand, trace clay	3.05	5	SS	42	18	15.3%	18		
95.2	3.5	-becomes very dense									
94.7	4			6	SS	71	63	13.4%	63		
94.2	4.5										
				7	SS	79	69	13.0%	69		
93.7	5										
93.2	5.5			8	SS	75	56	14.4%	56		
92.7	6		92.62								
		Borehole terminated @ 6.1 mbgs target depth achieved.	6.10								
92.2	6.5										Borehole caved at 4.0 mbgs. Groundwater measured at 1.5 mbgs following completion.
91.7	7										
91.2											

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

Logged By: FI **Input By:** BV

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH103-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	98.71 mASL	**Date Completed:**	March 8, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011831 **E:** 455195		

Elevation (m)	Depth	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
98.7	0	**TOPSOIL:** 300 mm	98.41	1A	SS	67	2	39.1%	2		
98.2	0.5	**FILL:** (SM) SILTY SAND: grey, wet, trace gravel	0.30 / 97.72	1B	SS			22%			
				2A	SS			22.4%			
97.7	1	**(ML) sandy CLAYEY SILT:** grey, cohesive, w>PL, firm	0.99	2B	SS	79	4	19.3%	4		
97.2	1.5	-becomes stiff		3	SS	88	8	16.7%	8		
96.7	2	-decrease in clay content, becomes CL-ML									
96.2	2.5			4	SS	92	10	15.6%	10		
95.7	3	**(ML) sandy SILT:** grey, non-cohesive, wet, compact, trace clay	95.66 / 3.05	5	SS	88	17	14.3%	17		
95.2	3.5										
94.7	4			6	SS	79	15	14.1%	15		
94.2	4.5	-becomes dense		7	SS	71	39	13.6%	39		
93.7	5										
93.2	5.5			8	SS	71	47	13.7%	47		
92.7	6		92.61								
		Borehole terminated @ 6.1 mbgs target depth achieved.	6.10								
92.2	6.5										Borehole caved at 4.9 mbgs. Groundwater measured at 0.9 mbgs following completion.
91.7	7										
91.2											

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

Logged By: FI **Input By:** BV

Peterborough, Barrie, Whitby, Kingston, Ottawa

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH104-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	98.78 mASL	**Date Completed:**	March 8, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011812 **E:** 455184		

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) 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
98.8	0	**TOPSOIL:** 125 mm	98.65 / 0.13	1A	SS			38.1%			
				1B	SS			18.5%			
		FILL: (SM) SILTY SAND: brown, wet, very loose		1C	SS	42	3	31.3%	3		
98.3	0.5										
			97.81 / 0.97	2A	SS			20.7%			
97.8	1	**(ML) sandy CLAYEY SILT:** grey, cohesive, w>PL, firm		2B	SS	75	4	20%	4		
97.3	1.5										
				3	SS	79	4	18.2%	4		
96.8	2	-decrease in clay content, becomes CL-ML, soft									
				4	SS	100	3	18%	3		2.3m: ATT SS4: 18.5%LL 13.1%PL
96.3	2.5										
95.8	3	-100 mm silty sand seam	95.55 / 3.23								
		(ML) sandy SILT: grey, non-cohesive, wet, compact, trace clay		5	SS	83	10	16.3%	10		
95.3	3.5										
94.8	4			6	SS	75	26	14.3%	26		
94.3	4.5										
				7	SS	83	28	13.9%	28		
93.8	5										
93.3	5.5	-becomes dense									
				8	SS	79	39	13.9%	39		
92.8	6		92.68								
		Borehole terminated @ 6.1 mbgs target depth achieved.	6.10								Borehole caved at 4.6 mbgs. Groundwater measured at 0.6 mbgs following completion.
92.3	6.5										
91.8	7										
91.3											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS4	0	25	57	18
SS6	0	22	74	4

Logged By: FI **Input By:** BV

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH105-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	98.91 mASL	**Date Completed:**	March 8, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011843 **E:** 455141		

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	CSV (ppm)	OV (ppm)	% Recovery	SPT (N)/DCPT	Atterberg Limits (%) LL PL PI / % Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. rem V.) (20 40 60 80) / SPT (N) / DCPT (20 40 60 80)	Well Installation	Log Notes
98.9	0	**TOPSOIL:** 150 mm	98.76	1A	SS	ND	ND			37.1%		Cap	Groundwater measured at 2.0 mbgs following completion.
		FILL: (SM) SILTY SAND: brown, wet, loose, some gravel, trace clay	0.15	1B	SS	ND	ND	67	7	19.3%	7	Bentonite Plug	
98.4	0.5											Riser	
		-becomes grey, decrease in silt content		2A	SS	ND	ND			12.1%			
97.9	1			2B	SS	ND	ND	63	11	15.4%	11		
97.4	1.5		97.39										
		(ML) sandy CLAYEY SILT: grey, cohesive, w>PL, firm	1.52	3	SS	ND	ND	92	4	19.9%	4	Sand Pack	
96.9	2											PVC Screen	
			96.47	4A	SS	ND	ND			20%			
96.4	2.5	**(ML) SILT:** grey, non-cohesive, wet, loose, some sand, trace clay	2.44	4B	SS	ND	ND	63	5	18.1%	5		
95.9	3	-becomes compact											
				5	SS	ND	ND	50	16	16.1%	16	Cap	
95.4	3.5		95.25										
		Borehole terminated @ 3.7 mbgs target depth achieved.	3.66										
94.9	4												
94.4	4.5												
93.9	5												
93.4	5.5												
92.9	6												
92.4	6.5												
91.9	7												
91.4													

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

Logged By: FI **Input By:** BV

Peterborough, Barrie, Ottawa, Kingston, Whitby

Client: Cassidy EW Construction
Contractor: OGS Inc.
Project No.: 17281-001 - B
Location: Ottawa, ON

Project Name: 1386 & 1394 Greely Lane
Method: Track Mounted Hollow Stem Auger
Elevation: 98.64 mASL
UTM: 18 T **N:** 5011800 **E:** 455161

Log of Borehole: BH106-23
Page: 1 of 1
Date Completed: March 7, 2023

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	CSV (ppm)	OV (ppm)	% Recovery	SPT (N)/DCPT	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) / DCPT 20 40 60 80	Well Installation	Log Notes
98.6	0	**TOPSOIL:** 125 mm	98.51	1A	SS	ND	ND			19.4%	51.5%	Cap	
			0.13	1B	SS	ND	ND						
98.1	0.5	**FILL:** (SM) SILTY SAND: brown, wet, very loose, trace gravel		1C	SS	ND	ND	54	3	31.1%	3	Bentonite Plug Riser	
			97.78	2A	SS	ND	ND			22.9%			
97.6	1	**(ML) sandy CLAYEY SILT:** grey, cohesive, w>PL, soft	0.86	2B	SS	ND	ND	75	3	19%	3		
97.1	1.5	-becomes firm											Groundwater measured at 1.5 mbgs following completion.
				3	SS	ND	ND	100	5	18.3%	5	Sand Pack PVC Screen	
96.6	2												
96.1	2.5			4	SS	ND	ND	92	6	19.1%	6		
95.6	3		95.59										
		(ML) sandy SILT: grey, non-cohesive, wet, compact, trace clay	3.05	5	SS	ND	ND	75	15	15.8%	15		
95.1	3.5		94.98									Cap	
		Borehole terminated @ 3.7 mbgs target depth achieved.	3.66										
94.6	4												
94.1	4.5												
93.6	5												
93.1	5.5												
92.6	6												
92.1	6.5												
91.6	7												
91.1													

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

Logged By: FI **Input By:** BV

Peterborough, Barrie, Ottawa, Kingston, Whitby

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH107-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	98.12 mASL	**Date Completed:**	March 8, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011845 **E:** 455203		

Elevation (m)	Depth	Description	Number	Type	CSV (ppm)	OV (ppm)	% Recovery	SPT (N)/DCPT	Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75	Shear Strength Cu, kPa 20 40 60 80 / SPT (N) / DCPT 20 40 60 80	Well Installation	Log Notes
98.1	0	**TOPSOIL:** 75 mm (98.04 / 0.08)	1A	SS	ND	ND	79	6	53.8% / 24%	6	Cap, Bentonite Plug, Riser	Groundwater measured at 1.8 mbgs following completion.
		FILL: (SM) SILTY SAND: brown, wet, trace clay (97.82 / 0.30)	1B	SS	ND	ND						
97.6	0.5	**(ML) sandy CLAYEY SILT:** grey, cohesive, w>PL, stiff	1C	SS	ND	ND			17.2%			
97.1	1		2	SS	ND	ND	79	9	15.9%	9		
96.6	1.5	-becomes firm										
96.1	2	(95.83)	3	SS	ND	ND	100	7	15.4%	7	Sand Pack, PVC Screen	
95.6	2.5	**(ML) sandy SILT:** grey, non-cohesive, wet, compact, trace clay (2.29)	4	SS	ND	ND	75	17	15.1%	17		
95.1	3											
94.6	3.5	(94.46)	5	SS	ND	ND	63	16	14.8%	16	Cap	
94.1	4	Borehole terminated @ 3.7 mbgs target depth achieved. (3.66)										
93.6	4.5											
93.1	5											
92.6	5.5											
92.1	6											
91.6	6.5											
91.1	7											
90.6												

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

Logged By: FI **Input By:** BV

Peterborough, Barrie, Ottawa, Kingston, Whitby

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH108-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	99.06 mASL	**Date Completed:**	March 8, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011890 **E:** 455169		

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) 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
99.1	0	**ASPHALT:** 50 mm	99.01								
		FILL: (SM) GRAVELLY SAND, brown, wet, some silt [base material]	0.05 / 98.45	1A	SS	100	64	14.2%	64		
98.6	0.5	**FILL:** (SM) SAND and SILT: grey, wet	0.61	1B	SS			31.5%			
98.1	1		97.99	2A	SS			16.6%			
		(ML) sandy CLAYEY SILT: grey, non-cohesive, w>PL, firm	1.07 / 97.54	2B	SS	67	3	20.1%	3		
97.6	1.5	Borehole terminated @ 1.5 mbgs target depth achieved.	1.52								Borehole remained open. Groundwater measured at 0.8 mbgs following completion.
97.1	2										
96.6	2.5										
96.1	3										
95.6	3.5										
95.1	4										
94.6	4.5										
94.1	5										
93.6	5.5										
93.1	6										
92.6	6.5										
92.1	7										
91.6											

GRAINSIZE DISTRIBUTION	SAMPLE	GRAVEL	SAND	SILT	CLAY
	SS1B	0	63	37	

Logged By: FI **Input By:** BV

Client:	Cassidy EW Construction	**Project Name:**	1386 & 1394 Greely Lane	**Log of Borehole:**	BH109-23
Contractor:	OGS Inc.	**Method:**	Track Mounted Hollow Stem Auger	Page:	1 of 1
Project No.:	17281-001 - B	**Elevation:**	98.60 mASL	**Date Completed:**	March 7, 2023
Location:	Ottawa, ON	**UTM:**	18 T **N:** 5011847 **E:** 455186		

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
98.6 — 0		**TOPSOIL:** 915 mm	1	SS	25	2	44.3%	2		
98.1 — 0.5		97.69								
97.6 — 1		0.91 **FILL:** (SM) SILTY SAND: grey, wet	2A	SS			28.9%			
		97.58 1.02 **(ML) sandy CLAYEY SILT:** grey, non-cohesive, w>PL, soft	2B	SS	83	3	20.4%	3		
97.1 — 1.5		97.08 1.52 Borehole terminated @ 1.5 mbgs target depth achieved.								Borehole remained open. Groundwater measured at 1.1 mbgs following completion.
96.6 — 2										
96.1 — 2.5										
95.6 — 3										
95.1 — 3.5										
94.6 — 4										
94.1 — 4.5										
93.6 — 5										
93.1 — 5.5										
92.6 — 6										
92.1 — 6.5										
91.6 — 7										
91.1										

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

Logged By: FI **Input By:** BV

Appendix B

Soil Laboratory Testing Results

Grain Size Distribution Chart

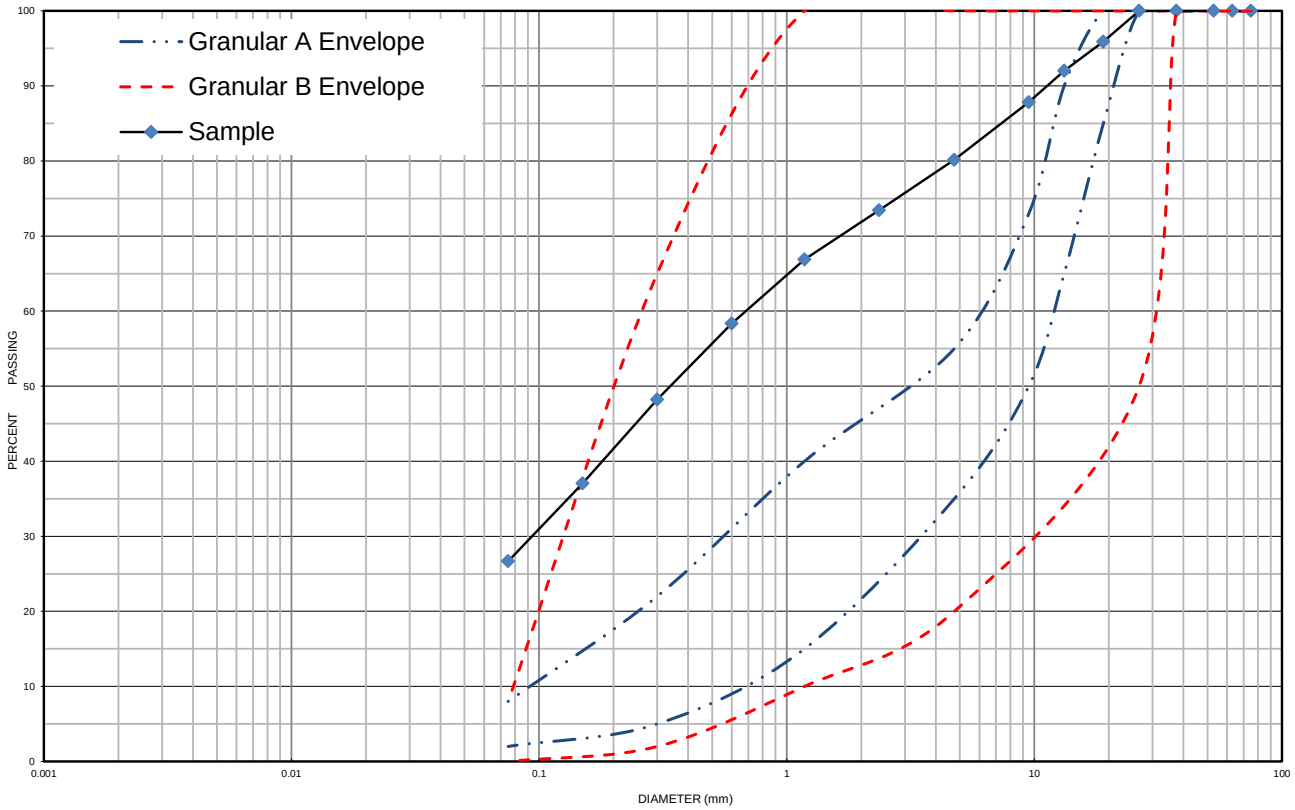
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sample Date: *March 7-8, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 101-23 SS 1B* **Depth:** *0.5 m to 0.8 m* **Lab Sample No:** *S-23-0479*

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 101-23	SS 1B	0.5 m to 0.8 m	20	53	27		12.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Gravelly Sand	SM	0.695	0.093	-	-	-

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Grain Size Distribution Chart

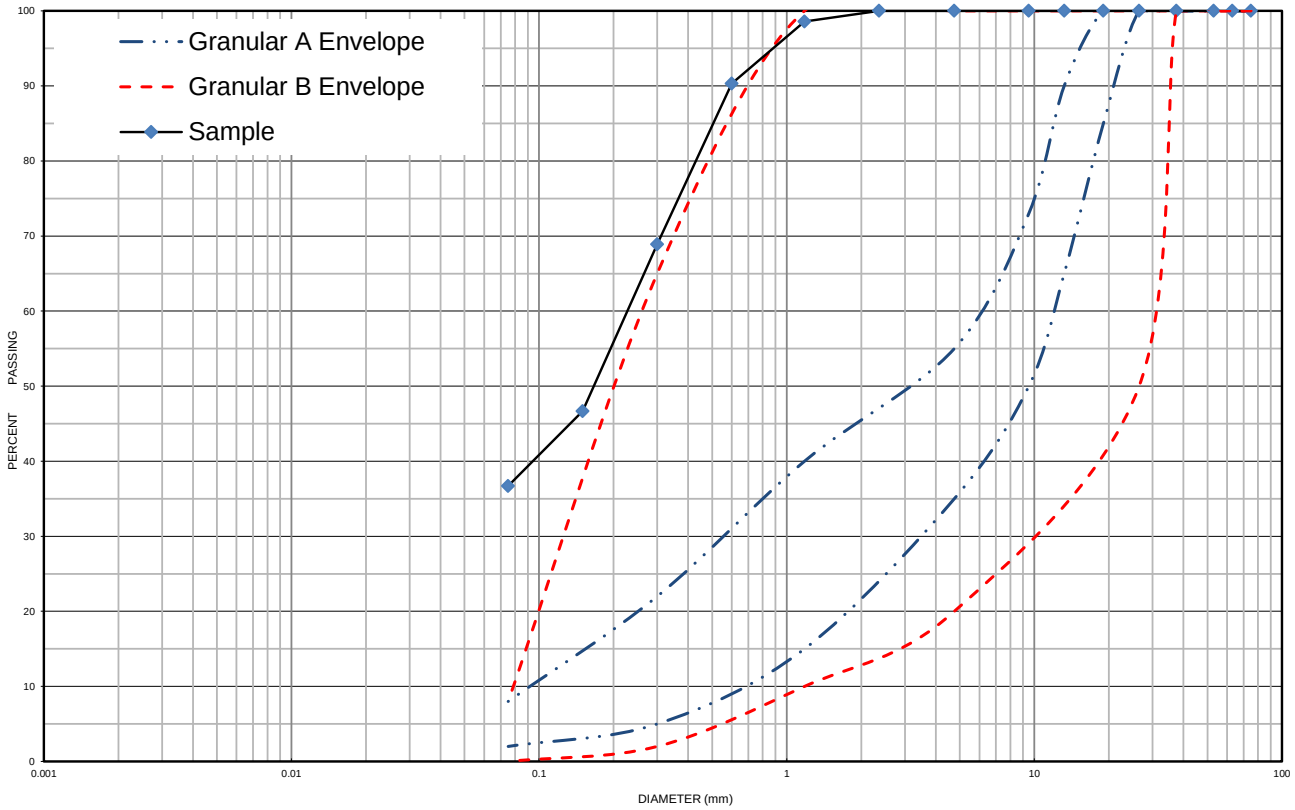
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sample Date: *March 7-8, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 108-23 SS 1B* **Depth:** *0.6 m to 0.8 m* **Lab Sample No:** *S-23-0480*

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 108-23	SS 1B	0.6 m to 0.8 m	0	63	37		31.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt	SM	0.240	-	-	-	-

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Grain Size Distribution Chart

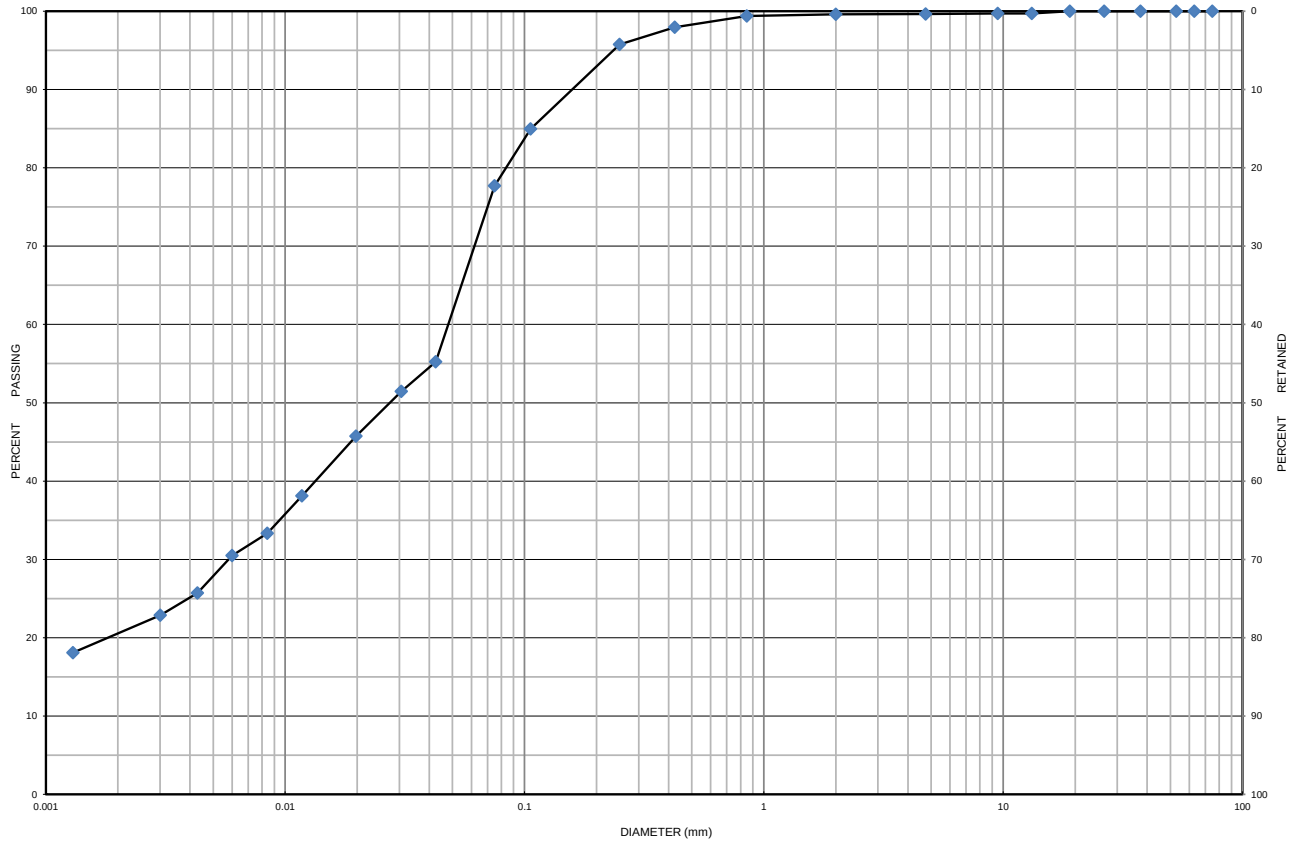
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sample Date: *March 7-8, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 101-23 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-23-0475*

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 101-23	SS 3	1.5 m to 2.1 m	0	22	57	21	18.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Clayey Silt	ML	0.0480	0.0058	-	-	-

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Grain Size Distribution Chart

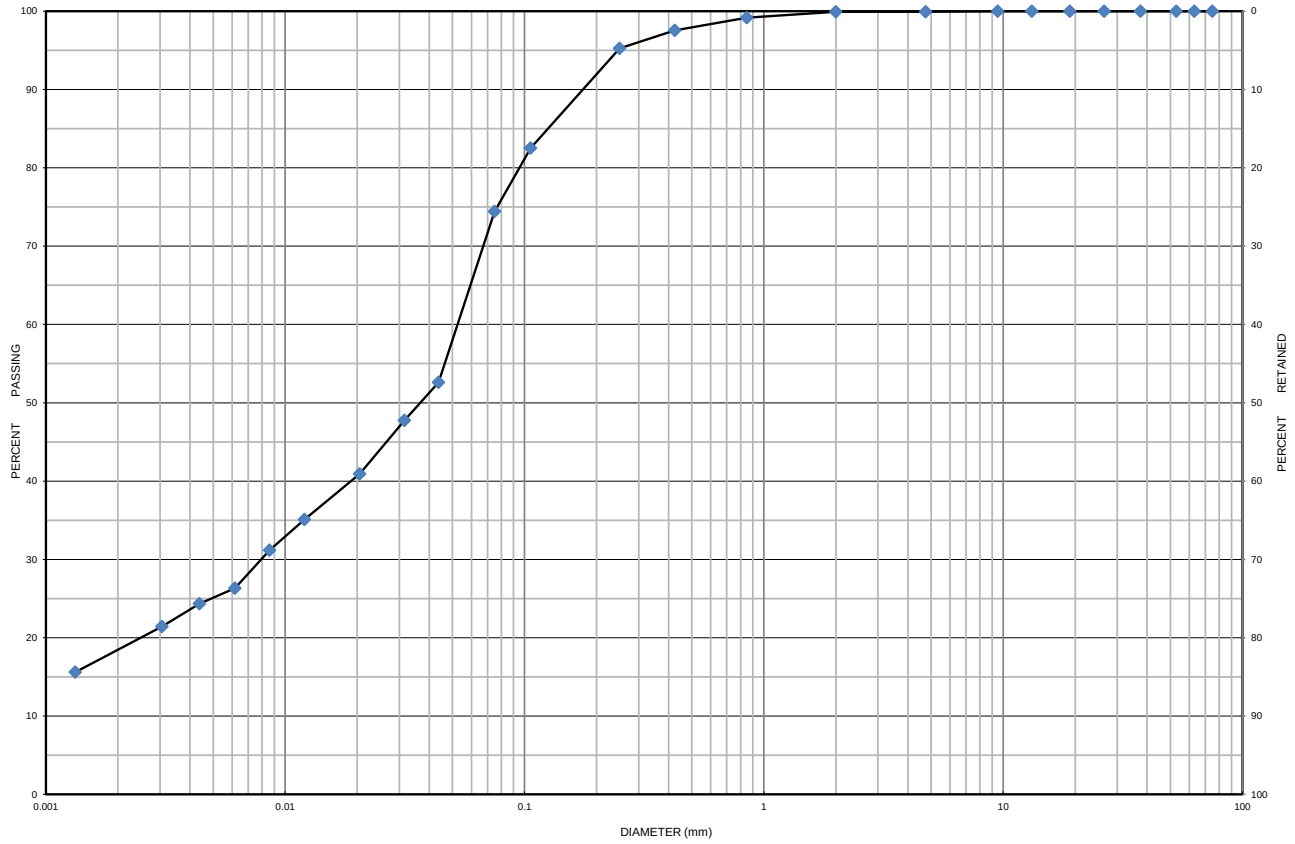
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sample Date: *March 7-8, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 104-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-0477*

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



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

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 104-23	SS 4	2.3 m to 2.9 m	0	25	57	18	18.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt some Clay	ML	0.053	0.008	-	-	-

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Plasticity Chart

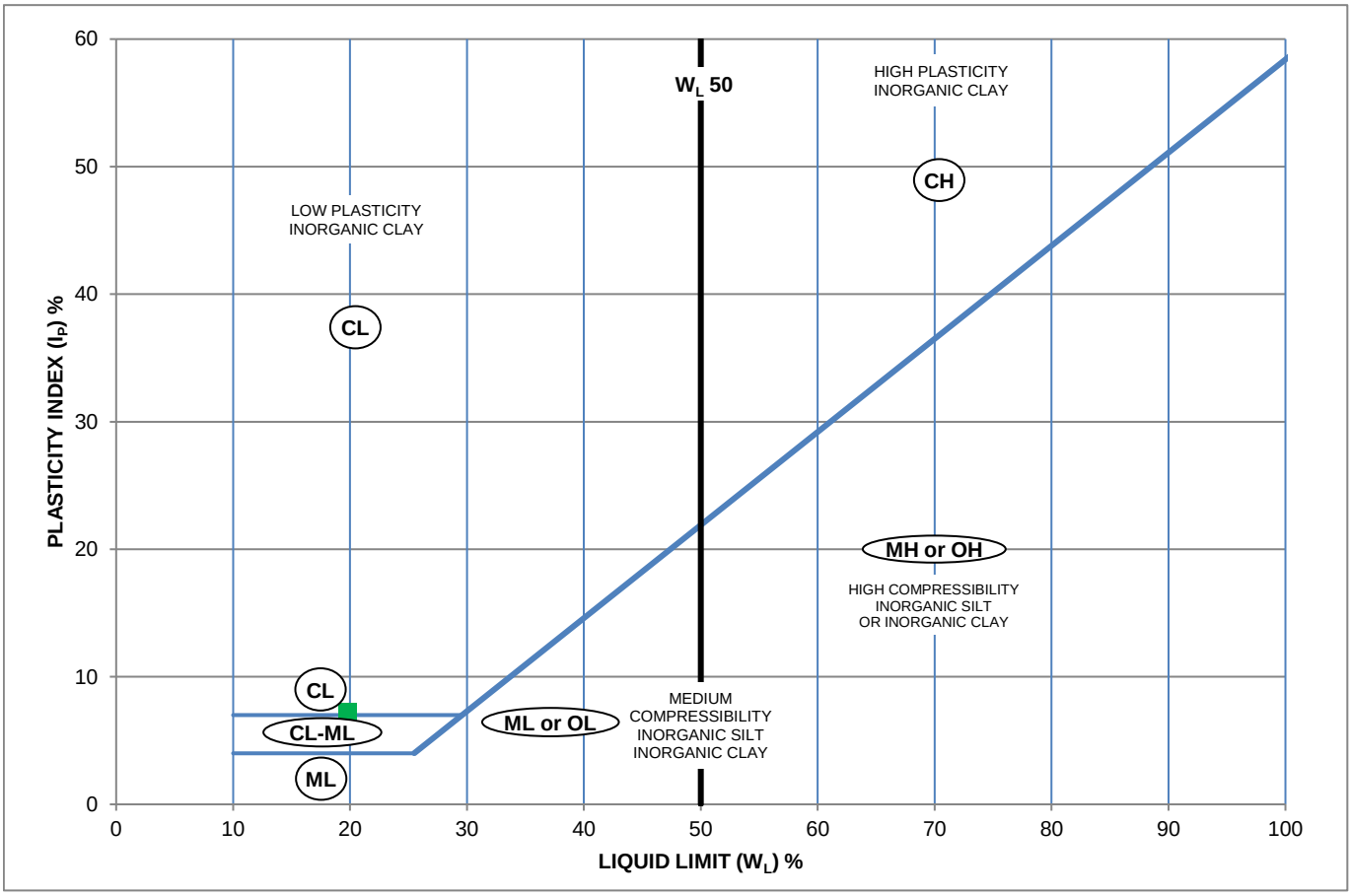
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sampled By: *Farhan Imtiaz - Cambium Inc.* **Sample Date:** *March 7-8, 2023*

Hole No.: *BH 101-23 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-23-0475*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 101-23	SS 3	1.5 m to 2.1 m	Low Plasticity Clay

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
19.8	***12.5***	***7.2***

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Plasticity Chart

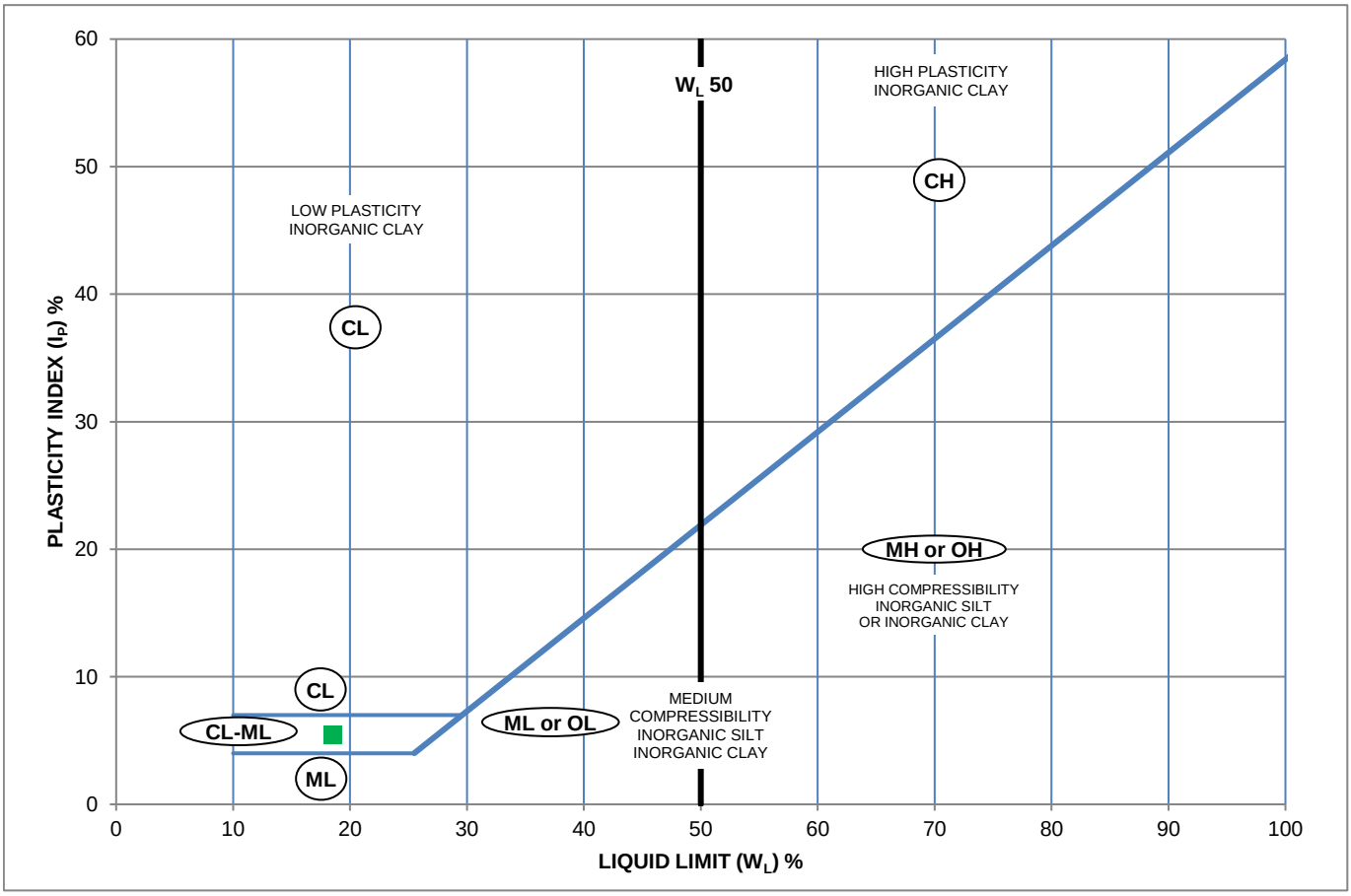
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sampled By: *Farhan Imtiaz - Cambium Inc.* **Sample Date:** *March 7-8, 2023*

Hole No.: *BH 104-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-0477*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 104-23	SS 4	2.3 m to 2.9 m	CL-ML

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
18.5	***13.1***	***5.4***

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Grain Size Distribution Chart

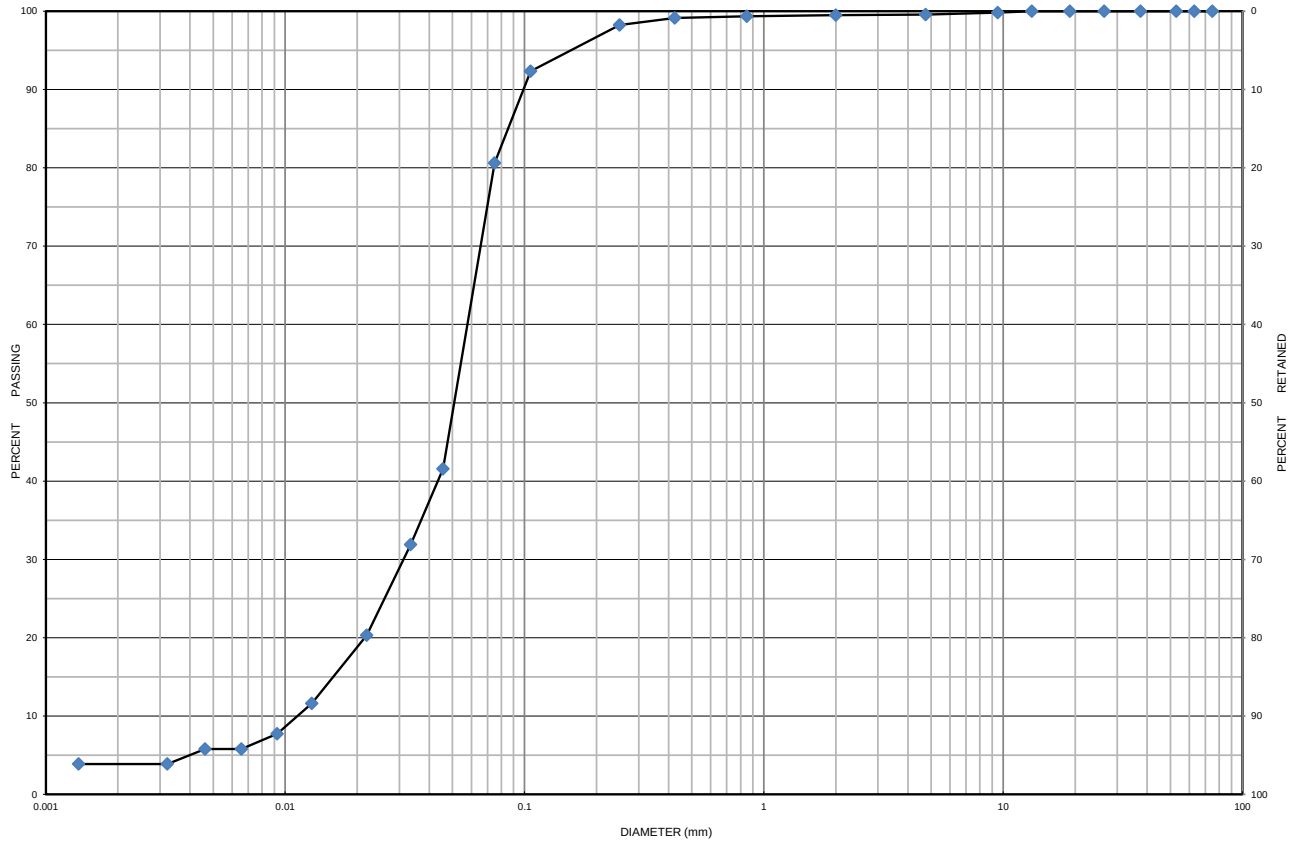
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sample Date: *March 7-8, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 101-23 SS 6* **Depth:** *3.8 m to 4.4 m* **Lab Sample No:** *S-23-0476*

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 101-23	SS 6	3.8 m to 4.4 m	0	19	77	4	13.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt some Sand trace Clay	ML	0.057	0.032	0.012	4.75	1.50

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Grain Size Distribution Chart

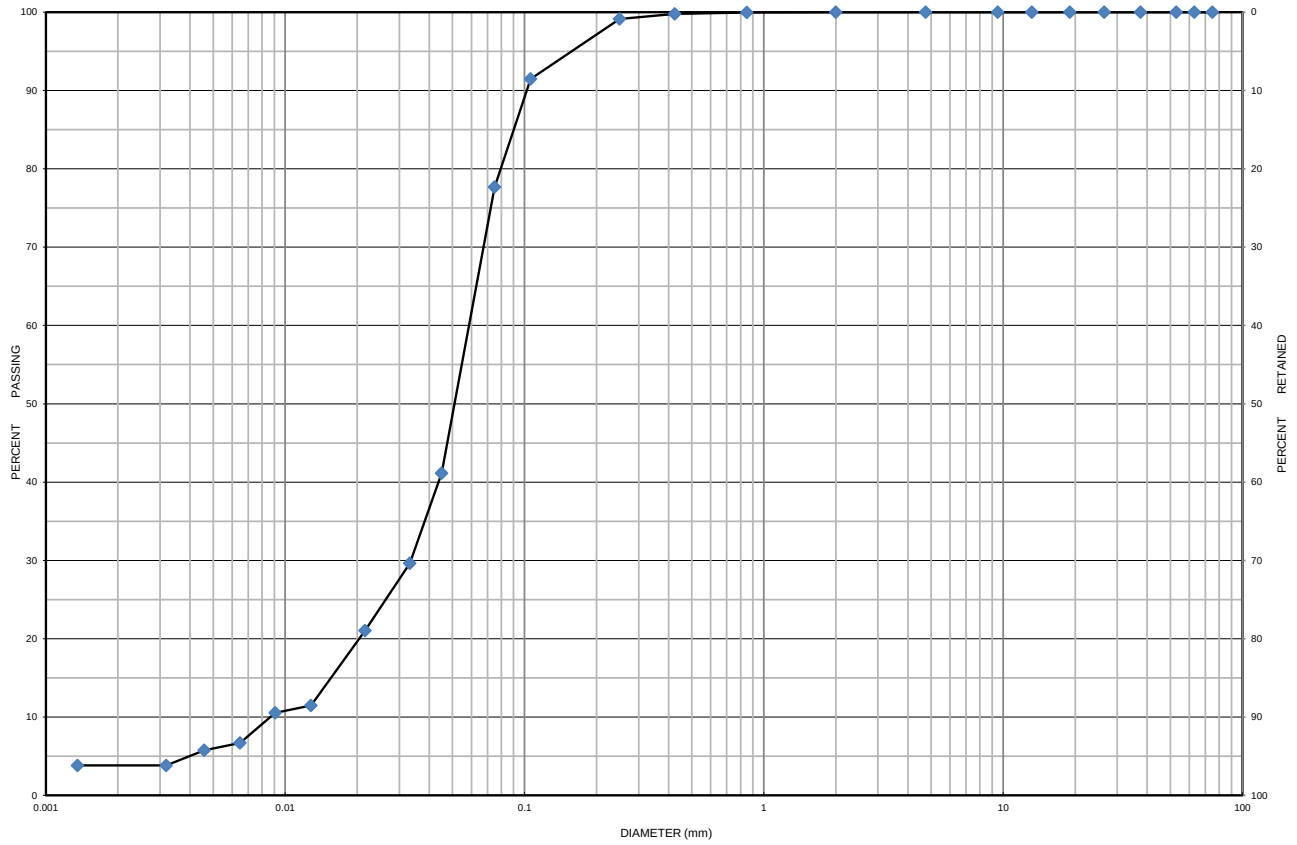
Project Number: *17281-001* **Client:** *Cassidy EW Construction Consultant Ltd*

Project Name: *Phase II ESA & GEO - 1386 & 1394 Greely Lane, Ottawa*

Sample Date: *March 7-8, 2023* **Sampled By:** *Farhan Imtiaz - Cambium Inc.*

Location: *BH 104-23 SS 6* **Depth:** *3.8 m to 4.4 m* **Lab Sample No:** *S-23-0478*

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



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

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 104-23	SS 6	3.8 m to 4.4 m	0	22	74	4	14.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt trace Clay	ML	0.0590	0.0340	0.0087	6.78	2.25

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