FINAL REPORT

GEOTECHNICAL INVESTIGATION

Proposed MAB Building, Cisco Campus, Ottawa, Ontario

Submitted to:

CBRE Limited

Attention to Dom Seipp
340 Albert Street, Suite 1900
Ottawa, Ontario, K1R 7Y6

Submitted by:

WSP Canada Inc.

1931 Robertson Road Buildings A and B
Ottawa, Ontario
K2H 5B7 Canada

(613) 592-9600

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by CBRE Limited (herein as the Client) to conduct a geotechnical investigation for the proposed MAB Building at the Cisco Ottawa Development Centre in Ottawa, Ontario. The work was carried out in general conformance with the WSP Change Order # 3 for Project CA0058422.0115, dated August 13, 2025. The approximate location of the site is shown on the Key Map on the attached Site Plan (Figure 1).

The purpose of the investigation was to assess subsurface soil and groundwater conditions at selected locations within the Site, by means of two boreholes, and associated laboratory testing. The subsurface conditions obtained from the current investigation and available project details were used to prepare geotechnical recommendations for the associated design aspects of the project, including construction considerations which could influence design decisions.

This report should be read in conjunction with the attached "*Important Information and Limitations of This Report*" which follows the text but 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.

2 DESCRIPTION OF PROJECT

The proposed MAB building is located north of 2000 Innovation Drive in Ottawa, ON, and will be constructed within the existing parking lot. The building will have an L-shaped configuration, consisting of two wings: the primary wing (MAB-ELEC) measures approximately 50 m in length and 15.8 m in width, while the secondary wing (MAB-MECH) extends 25.2 m from the main wing with a width of 10.9 m. The gross floor area of MAB-ELEC and MAB-MECH buildings will be approximately 800 m^2 and 275 m^2, respectively. It is understood that the building will not have any basement level and is currently proposed to be founded on a slab-on-grade foundation at an elevation of about 86.25 m.

Golder Associates (now a member of WSP Canada Inc. and herein referred to as WSP), previously completed several geotechnical investigations at the Cisco Campus site. Most recently, WSP carried out a geotechnical investigation in September 2025 in support of the proposed renovations to nearby parts of the Cisco Campus. As part of that investigation, nine boreholes (BH25-01 to BH25-09) were drilled at approximately the locations shown on Figure 1.

The results of previous geotechnical investigations at the site are documented in the reports listed below.

- WSP Report No. CA0058422.0115 titled: "Geotechnical Investigation, Proposed renovations to Cisco Campus, 2000 and 3000 Innovation Drive", dated December 11, 2025.
- Golder Report No. 08-1121-0122 titled: "Geotechnical Investigation, Proposed Generator Building, 5050 Innovation Drive, Ottawa, Ontario", dated January 2011.
- Golder Report No. 001-2129A titled: "Geotechnical Investigation, Proposed Cisco Systems, Buildings 4, 5 and Parking Garage, Northtech Park, Kanata, Ontario", dated August 2002.
- Golder Report No. 001-2129 titled: "Geotechnical Investigation, Proposed Cisco Systems, Building 3, Northtech Park, Kanata, Ontario", dated August 2000.
- Golder Report No. 001-2075 titled: "Geotechnical Investigation, Proposed Cisco Systems, Building 2, Northtech Park, Kanata, Ontario", dated June 2000.
- Golder Report No. 991-2238 titled: "Geotechnical Investigation, Proposed Cisco Systems Development, Northtech Park, Kanata, Ontario", dated January 2000.

For the purposes of the current scope of work, WSP reviewed relevant borehole information from these previous investigations. The locations of boreholes from the previous investigations are shown on Figure 1, and the corresponding borehole logs are provided in Appendix G.

2.1 Physiography

Published surficial geology mapping of the study area from Geological Survey of Canada (2019) was reviewed for the desktop assessment. The map sources indicates that the site lies within the physiographic unit of Great Lakes – St. Lawrence Lowlands[1].

2.2 Published Geological Information

Based on the surficial geology maps of Southern Ontario published by the Ontario Geological Survey (as well as previous investigations) the Site is expected to be underlain by fine-textured glaciomarine deposits (silt and clay, with minor sand and gravel).

Based on the published bedrock geology mapping, the Cisco Campus site lies on the boundary between the Beekmantown sandstone and dolostone and Precambrian crystalline basement metamorphic bedrock.

3 GEOTECHNICAL INVESTIGATION PROCEDURE

3.1 Drilling Investigation

The drilling program for the current geotechnical investigation was carried out on December 19 and 22, 2025 and included advancing two boreholes (BH25-10 to BH25-11). The approximate borehole locations are shown on the site plan attached as Figure 1.

Given the significant number of buried services within the Site, hydrovac excavation was required at the borehole locations to confirm the absence of buried utilities at the proposed drilling location. The hydrovac excavation was carried out before the day of drilling to a depth of about 3 m. At the end of the hydrovac excavation, the boreholes were backfilled with imported engineered fill (sand and gravel). Borehole BH25-10 was drilled just beside the hydrovac excavation, while borehole BH25-11 was drilled through the hydrovac excavation.

The boreholes were advanced with a MI 3 track-mounted drill rig supplied and operated by Strata Drilling Group, Ottawa. Soil samples were obtained during drilling using a 35 mm inside diameter split-spoon sampler driven using a 63.5 kg hammer, dropped from a height of 760 mm, in general accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). Soil samples were obtained at regular depth intervals where possible. In-situ vane testing was carried out within the cohesive strata.

Boreholes BH25-10 and BH25-11 were advanced to refusal depths of 12.3 m (~El. 74.4 m) and 10.7 m (~ El. 75.7 m), respectively. Both boreholes were extended into the bedrock to depths of about 13.8 m (~El. 72.9 m) and 13.9 m (~El. 72.5 m), respectively, using rotary diamond drilling technique while retrieving HQ-sized bedrock core samples.

The borehole drilling was supervised by WSP's geotechnical staff who logged the boreholes, directed in-situ testing, and collected soil and rock samples retrieved in the boreholes. On completion of the drilling operations,

[1] Geological Survey of Canada, 2019. The Atlas of Canada – Physiographic Regions. <**Physiographic Regions | Natural Resources Canada**>. Accessed October 14, 2025.

the soil and core samples were transported to WSP's Ottawa laboratory for further examination, and for selective laboratory testing. A soil sample was submitted to Eurofins Environment Testing for basic chemical analyses.

The borehole coordinates and existing ground surface elevations were measured using a Trimble R10 GPS survey unit. The geodetic elevation reference system used for the survey is the North American datum of 1983 (NAD83-CSRS). The borehole coordinates are based on the Universal Transverse Mercator (UTM Zone 18) coordinate system.

3.2 Laboratory Testing

The following laboratory tests were carried out on selected soil samples from the boreholes (BH25-10 and BH25-11); tests are conducted in general accordance with applicable ASTM standards.

- Natural water content (8 tests) - ASTM D2216
- Grain size distribution (1 test) - ASTM D422
- Atterberg Limits (2 tests) - ASTM D4318

In addition, chemical analyses of corrosivity parameters in a single soil sample was performed. Analytes included soluble sulphate, chloride, Electrical Conductivity, Resistivity, and pH.

The geotechnical laboratory test reports are provided on the borehole logs in Appendix A and also included in Appendix C. Basic chemical analysis report is included in Appendix D.

4 SUBSURFACE CONDITIONS

4.1 General

The Record of Borehole sheets in Appendix A describes the subsurface conditions at the borehole locations only. The stratigraphic boundaries shown on the borehole records are inferred from non-continuous sampling, observations of drilling progress and, therefore, represent transitions between soil types rather than exact planes of geological change. Furthermore, subsurface soil, bedrock, and groundwater conditions will vary between and beyond the borehole locations.

4.2 Summary of Subsurface Stratigraphy

Based on the results of the current borehole investigation, the general subsurface stratigraphy at the project site consists of topsoil or asphalt, underlain by granular fill over weathered crust, overlying grey clay, thin layer of glacial till, over bedrock.

The boreholes previously drilled across the Cisco Campus site also shows similar subsurface stratigraphy.

Further descriptions of the soil and bedrock layers encountered in boreholes BH25-07 (which was drilled previously but is close to the proposed MAB building), BH25-10, and BH25-11 are provided in the subsections below.

4.2.1 Topsoil

A layer of 150 mm and 70 mm thick topsoil was encountered at the ground surface of boreholes BH25-07 and BH25-10, respectively.

4.2.2 Granular Fill

Fill consisting of silty sand to sandy silt and poorly graded gravel with sand was encountered below the topsoil at boreholes BH25-07 and BH25-10. The fill at these borehole locations extended to a depth of about 0.6 m and 0.8 m (~El. 86.1 m) below the existing ground surface. SPT 'N' value in the fill was 10 blows per 0.3 m of penetration, indicating a compact state of packing.

The natural moisture content measured in a single sample of the fill was 34%.

4.2.3 Lean to Fat Clay (Weathered Crust)

A layer of lean to fat clay with medium to high plasticity clayey fines was encountered below the granular fill at the location of boreholes BH25-07 and BH25-10 (similar clay may be present at borehole BH25-11 but was not observed or sampled due to the hydrovacing and backfilling of the borehole prior to drilling). The weathered crust was grey-brown in colour and extended to a depth of about 3.7 m (~El. 83.3 m) and 3.0 m (~El. 83.6 m) at boreholes BH25-07 and BH25-10, respectively. The SPT 'N' values recorded in this layer ranged from 1 to 10 blows per 0.3 m of penetration. Field shear strength within the weathered crust was not measured during the current investigation, as the shear strength of the weathered crust typically exceeds the limits of the test. Based on our experience in the area, the weathered crust typically has an undrained shear strength in excess of 100 kPa (which has been assumed in the subsequent analyses).

The natural moisture content measured on five samples of the weathered crust ranged from 34% to 55%. The results of Atterberg limits testing completed on a single sample of this material indicated Liquid Limit of 64, Plastic Limit of 24, and a Plasticity Index of 40. Atterberg limits test results indicate weathered crust of high plasticity (CH).

Table 1: Results of Atterberg Limits Testing on Lean to Fat Clay (Weathered Crust)

Borehole ID	Sample No.	Sampling Depth (m)	Moisture Content (%)	Atterberg Limits			
				W_L	W_P	PI	LI
BH25-10	4	2.3 - 2.9	54.5	64	24	40	0.76

4.2.4 Fat Clay (Unweathered Clay)

A fat clay was encountered below the upper weathered crust clay at all borehole locations. It was generally grey in colour and of high plasticity. At these borehole locations, the layer of unweathered clay extended to a depth of about 10.7 m to 12.2 m (~El. 74.5 m to 75.8 m). SPT 'N' values recorded in this layer ranged from weight of hammer to 2 blows per 0.3 m of penetration. Field shear vane testing performed in this fat clay deposit indicated undrained shear strength values ranging from 50 kPa to 114 kPa, indicating a firm to stiff consistency.

Remoulded undrained shear strength values ranged from 4 kPa to 54 kPa and the evaluation of the sensitivity of the fat clay (i.e., ratio of intact to remoulded undrained shear strength) yields values ranging from 1.6 to 16.0. According to the classification of typical sensitivity values (Canadian Foundation Engineering Manual, 2023), these values indicates that the cohesive soils encountered in the boreholes are classified as low to medium sensitive.

The natural moisture content measured on 12 samples of the fat clay ranged from 44% to 62%. The results of Atterberg limits testing completed on three samples of this material indicated Liquid Limit ranged from 53 to 61, Plastic Limit ranged from 21 to 23, and a Plasticity Index ranged from 32 to 38. Atterberg limits test results indicate clay of high plasticity (CH).

Table 2: Results of Atterberg Limits Testing on Fat Clay (Unweathered Clay)

Borehole ID	Sample No.	Sampling Depth (m)	Moisture Content (%)	Atterberg Limits			
				W_L	W_P	PI	LI
BH25-07	8	4.5 - 5.2	62.3	61	23	38	1.03
BH25-07	12	7.6 – 8.2	52.1	53	21	32	0.97
BH25-10	7	7.6 – 8.2	52.1	56	22	34	0.89

4.2.5 Glacial Till

The glacial till consists of a heterogeneous mixture of sand, silt, clay, and gravel with potential cobbles and boulders was encountered below the fat clay at a depth of about 11.8 m (~ El. 75.2 m) and 12.2 m (~El. 74.5 m) at the location of boreholes BH25-07 and BH25-10, respectively. A layer of glacial till was also inferred at a depth of about 10.7 m (~El. 75.8 m) at borehole BH25-11. Borehole BH25-07 was ended within glacial till deposit at a depth of 11.8 m (~El. 75.1 m). In boreholes BH25-10 and BH25-11, the thickness of glacial till layer was less than 0.1 m and 0.3 m, respectively SPT 'N' values in this layer were 50 blows/ 0.03 m, 51 blows/ 0.07 m and 65 blows/ 0.07 m, suggesting a very dense state of packing. It is, however, likely that these SPT 'N' values are the result of presence of cobbles and boulders within the glacial till deposit, as well as the bedrock immediately below the glacial till rather than the consistency of the soil matrix.

The natural moisture content measured on a selected single sample of glacial till was 17% based on laboratory test. The results of grain size distribution testing carried out on a single sample of the glacial till are provided in Appendix C.

Table 3: Results of Grain Size Distribution Test for the Glacial Till

Borehole ID	Sample No.	Sampling Depth (m)	Grain Size Distribution			
			% Gravel	% Sand	% Silt	% Clay
BH25-10	9	12.2-12.3	42.4	31.3	26.3	

4.2.6 Bedrock

Boreholes BH25-07, BH25-10 and BH25-11 were advanced to refusal at depths of about 10.8 m to 12.3 m (~El. 74.4 m to 75.6 m). Boreholes BH25-10 and BH25-11 were then cored using rotary diamond drilling to confirm bedrock. The bedrock coring was extended to a depth of about 13.8 m (~El. 72.9 m) and 13.9 m (~El. 72.5) while retrieving HQ sized core.

Table 4 below summarizes ground surface elevations and the depth and elevation of the bedrock.

Table 4: Summary of Depths/Elevations to Bedrock

Borehole ID	Ground Surface Elevation (m)	Depth to Top of Bedrock (m)	Elevation to Top of Bedrock (m)	Core Length (m)	Depth to Bottom of Borehole (m)	Elevation to Bottom of Borehole (m)
BH25-10	86.7	12.3	74.4	1.52	13.8	72.9
BH25-11	86.4	11.0	75.4	2.9	13.9	73.5

The bedrock encountered in the cored boreholes was described as fresh to slightly weathered, thickly to thickly bedded, medium to coarse grained, slightly porous, reddish to grey granite. Photographs of the recovered bedrock cores are presented on Figures B1 to B4 of Appendix B.

Total Core Recovery (TCR) was 100%. Solid Core Recovery (SCR) ranged from about 82% to 100%. Rock Quality Designation (RQD) ranged from 89% to 95%, indicating good to excellent rock quality.

4.3 Groundwater

A monitoring well was installed at borehole BH25-07 during the geotechnical investigation conducted in September 2025.

The groundwater level in the monitoring well installed within borehole BH25-07 was taken on October 24, 2025, and is summarized in Table 5 below.

Table 5: Summary of Groundwater Level in Monitoring Well

Borehole ID	Screened Zone	Date	Groundwater Depth (m)	Groundwater Elevation (m)
BH25-07	Clay	October 24, 2025	2.6	84.3

It should be noted that groundwater levels are expected to fluctuate seasonally. Higher groundwater levels or shallow perched water are expected during wet periods of the year, such as spring and fall.

4.4 Basic Chemical Analyses

A single sample of soil from Borehole BH25-10 was submitted to Eurofins Environmental testing for basic chemical analysis related to potential sulphate attack on buried concrete elements, corrosion of buried ferrous elements. The results of this testing are provided in Appendix D and are summarized below in Table 6.

Table 6: Summary of Basic Chemical Analyses Results on Soil Samples

Borehole ID	Sample Number	Depth Intervals (m)	Chlorides (%)	Sulphates (%)	pH	Resistivity (Ohm-cm)	Electrical Conductivity (mS/cm)
BH25-10	3	1.5 – 2.1	0.012	0.10	8.96	1587	0.63

4.5 Geophysical Surveys

Geophysical surveys, including soil resistivity surveys and Multichannel Analysis of Surface Waves (MASW), were conducted on Cisco campus site by WSP personnel on September 5, 2025, as part of the previous investigation. The results of the survey are provided in Appendix E and F of this report.

5 GEOTECHNICAL DISCUSSION

This section of the report provides geotechnical recommendations and comments for the design of the proposed MAB building addition to the Cisco campus based on our interpretation of the subsurface information and the project requirements.

The information in this portion of the report is provided for the geotechnical planning and design purposes by the design engineers. 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 the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the factual information for construction, and make their own interpretation of the factual data as it affects their proposed construction techniques, costs, sequences, schedules, equipment and other resource requirements, and safety.

The geotechnical recommendations herein are provided in general conformance with the requirements of the National Building Code of Canada 2020 (NBCC 2020) and excerpts of the Ontario Building Code (OBC 2024) where relevant.

It is understood that significant grade changes are not required, and that basements are not currently envisioned for the proposed works. It is understood that the structure is currently proposed to be founded on a slab-on-grade foundation at an elevation of about 86.25 m.

5.1 Frost Protection

5.1.1 Frost Penetration Depth

The frost penetration depth at the project site is estimated to be 1.8 m below ground surface based on Ontario Provincial Standard Drawing (OPSD) 3090.101.

5.1.2 Frost cover Requirements

The upper existing fill and native clay layers at the project site are considered to be frost susceptible. All unheated and partially heated foundation elements (including exterior side slabs and footings) should be protected against frost heave by providing a minimum of 1.8 m soil cover or by the use of rigid insulation.

5.1.3 Insulation for Footings

If insulation is used in place of frost cover, insulated footings should have a minimum depth of 0.76 m below the finished exterior grade, in accordance with Canadian Foundation Engineering Manual (CFEM) 2023. A minimum of 75 mm of rigid insulation should be used to insulate the foundation wall extending from 0.3 m above the ground surface to the top of the footing pad and then extending horizontally to a minimum length of 1.2 m for footings supporting heated structures and 2.4 m for footings supporting unheated structures.

For footing depths deeper than 0.76 m, the horizontal extent of insulation may be reduced in linear interpolation so that insulation will not be required at depth of 1.8 m. For example, if the footing depth is 1.28 m (halfway between 0.76 m and 1.8 m), then the insulation should extend horizontally to a minimum length of 0.6 m and 1.2 m for heated and unheated structures, respectively. Any horizontally extended insulation should have a minimum soil cover of 0.3 m (or in accordance with the manufacturer's recommendations).

5.1.4 Insulation for Slabs-On-Grade

Based on CFEM (2023), insulation of slab on grade should consist of a minimum of 100 mm rigid insulation placed underneath the slab to cover the entire slab footprint and extending horizontally at least 1.8 m beyond the edges of the slab.

The rigid insulation should be placed on a minimum of 200 mm thick, clean well graded granular engineered fill of max particle size 26 mm (such as OPSS Granular A). The rigid insulation extending outside the slab footprint should have a minimum soil cover of 300 mm (or in accordance with the manufacturer's recommendations).

In addition, the rigid insulation should be designed to resist the compressive stress applied from the slab. The selected rigid insulation should also have the required compressive strength and stiffness to resist any loading from the slab.

5.1.5 Insulation for Underground Utilities

Proposed underground utilities that will be affected by freezing such as watermain, sanitary and sewers should also be provided with a minimum of 75 mm thick rigid insulation if they are placed above the estimated frost depth of 1.8 m below the finished grade. The rigid insulation should extend horizontally over the utility pipe and vertically on both sides of the pipe. The vertical side insulations should extend to the depth of 1.8 m below the finished grade. The horizontal insulation over the pipe should have a minimum soil cover of 300 mm.

5.2 Seismic Site Classification

MASW test was carried out at the site to evaluate the average wave velocity of the upper 30 m of soil/bedrock at the site. The shear wave velocities measured at the site are presented in a technical memorandum, provided in Appendix E. The results indicate that the average shear wave velocity in the upper 30 m of the subsurface at the MASW location was about 386 m/s, and according to NBCC 2020 site classification for seismic site response, this site can be assigned a Site Class C.

5.3 Site Preparation and Grading

The general subsurface stratigraphy at the project site consists of topsoil or asphalt, underlain by granular fill over weathered crust, grey clay, thin layer of glacial till, over bedrock.

All the topsoil, existing fills containing organics and rootlets, and other unsuitable materials should be removed from the site. The exposed subgrade should be protected from disturbance of construction traffic and graded to quickly drain away surficial runoff from the project site.

Public and private utility owners should be notified prior to the commencement of any construction activities. Existing underground utilities in the vicinity of the proposed excavation should be reviewed before commencing any excavation works to identify potential damage hazards due to the proposed excavation. Existing utilities that are excavated or exposed as part of the construction will need to be supported and rerouted during the construction.

No site grade raise is anticipated for the proposed upgrades. If more than 0.5 m of site grade raise is required, it should be assessed for settlement of the underlying clay deposit.

5.4 Foundation Design Considerations

Based on the encountered subsurface conditions and available project details, the following foundation options are considered feasible at this stage of design:

- Shallow spread or strip footings bearing on the weathered crust, in conjunction with slab-on-grade construction;
- Slab-on-grade foundations with or without thickened edges to support structural loads.

It is understood that the structure is currently proposed to be founded on a slab-on-grade foundation at an elevation of about 86.25 m. In general, the native clay soil at this site is firm to stiff in strength. The clay soil was found to be medium to highly plastic, with groundwater level around 2.6 m.

5.4.1 Geotechnical Design Parameters

Geotechnical conditions may vary between and beyond borehole locations. WSP reviewed available information to assess the geotechnical conditions and parameters that are considered suitable for carrying out analyses and developing engineering comments and recommendations for the proposed building. The review incorporated available results of the geotechnical investigation (including the previous investigations completed nearby), laboratory test results, and WSP’s experience with similar soils and geological conditions.

Preliminary soil parameters for the design of the proposed MAB building are shown in Table 7. It should be noted that many soil parameters are not intrinsic characteristics of the soils themselves, but depend upon the loading conditions, imposed stresses, mechanisms under consideration, etc. The designer should review and adjust these parameters as appropriate based on the actual detailed design considerations.

Table 7: Summary of In-Situ Geotechnical Properties

Soil Type	Bulk Unit Weight Above Water Table (kN/m^3)	Bulk Unit Weight Below Water Table (kN/m^3)	Drained Conditions		Undrained Conditions (1)		Coefficient of Friction between Concrete and Soil (2)
			C' (kPa)	Φ (Deg)	S_u (kPa)	Φ (Deg)	
Existing Fill	19 - 21	9.2 – 11.2	0	30	-	32	-
Fat Clay (Weathered Crust)	18 – 18.5	8.2 - 8.7	5 – 8	25	>100	-	0.3
Fat Clay (Unweathered clay)	17 – 17.5	7.2 – 7.7	2 - 12	26	50 - 95	-	0.3
Glacial Till	20 - 22	10.2 – 12.2	0	33 - 35	-	33 - 35	0.40-0.45
Granular "A" (OPSS 1010)	21	12.2	-	36	-	36	0.45
Granular "B" Type II (OPSS 1010)	22	13.2	-	34	-	34	0.42

Notes:

(1) The undrained shear strengths have not been corrected for plasticity.
(2) These are friction angle values based on CFEM 2023 and WSP's experience on similar soils
(3) Engineered fill as specified as OPSS 1010 specifications

5.4.2 Shallow Spread and Strip Footings on Undisturbed Weathered Crust

As discussed above, the medium to high plastic native clay deposit is firm to stiff in consistency and option of shallow spread or strip footing may be considered for the proposed MAB building. The footings should be extended to the minimum depths required for frost soil cover, or they must be protected with rigid insulation. Factored ultimate and serviceability geotechnical resistances are dependent on the footing width and depth (founding elevation).

The recommended bearing resistances for the design of shallow footings supported on the undisturbed weathered crust deposit are provided in Table 8, based on foundation sizes.

Table 8: Recommended Bearing Resistances for Shallow Foundations

Footing Type	Assumed Founding Depth (m)	Footing Width (m)	Allowable Bearing Pressure at SLS (kPa) (2)	Factored Resistance ULS (kPa) (3)
Isolated Spread (Square) Footing	1.8	1	300	275
		1.5	275	275
		2	250	275
		2.5	200	275
		3	175	275
Strip Footing	1.8	0.9	300	225
		1.2	275	225
		1.5	225	225
		1.8	200	225

Notes:

(1) Footings should be placed on competent, undisturbed weathered crust deposit; however, footings shall not be placed shallower than 1.8 m for bearing capacity requirement and to extend through the upper potential fill layer. Insulation should be provided if footings are placed above frost depth as specified in section 5.1.3

(2) The SLS bearing resistance was calculated for the corresponding estimated footing settlement of less than 25 mm.

(3) A resistance factor of 0.5 was used to calculate the factored ultimate bearing resistance at ULS.

The post construction total and differential settlements of footings supported on soil and sized using the above maximum allowable bearing pressure (SLS) should be less than 25 mm and 15 mm, respectively, provided that the soil at or below founding level is not disturbed before or during construction.

5.4.2.1 Horizontal (sliding) Resistance of Footings

For cast-in-place concrete footings, resistance to horizontal loads (sliding resistance) can be calculated by considering the sliding friction resistance between the concrete footing base and the bearing stratum. The recommended interfacial adhesion strength (Ca) and recommended interface friction coefficient (tan δ) between cast-in-place footing concrete and native clay soil and granular engineered fill bearing strata are provided below:

- Cast-in-place concrete footing to native clay soil: c_a = 75 kPa (undrained loading condition).
- Cast-in-place concrete footing to native clay soil: tan δ=0.45 (drained loading condition).
- Cast-in-place concrete footing to granular engineered fill: tan δ = 0.45.

The calculated sliding resistances using the above interface adhesion strength will be the ultimate value.
A geotechnical resistance factor of 0.8 should be used to calculate the factored ultimate sliding resistance.

5.4.3 Slab-On-Grade

5.4.3.1 Subgrade Preparation

All unsuitable materials such as topsoil, organics, existing fill, boulders, cobbles, and any wet, weak, or disturbed native clay soil should be stripped off from the proposed slab-on-grade footprints. The exposed subgrades after excavation should be thoroughly cleaned of debris and loose materials. The excavated subgrade should also be visually inspected and approved by a qualified geotechnical consultant prior to placement of engineered fill or slab-on-grade construction.

The exposed native clay stratum should be carefully reviewed to determine if compaction of the granular engineered fill will further disturb the native clay soil.

Any required grade raising of the excavated subgrade to the design slab subgrade level should consist of structural granular engineered fill recommended in Section 5.6. The structural granular engineered fills should extend laterally and connected to side drainage system to reduce local ponding of water inside the granular engineered fills.

5.4.3.2 Granular Bedding

A minimum of 200 mm thick, clean well-graded crushed stone granular bedding (grain size distribution satisfying OPSS.MUNI 1010 Granular A with less than 5% of fine particles passing 75μm sieve) should be installed on the prepared subgrade for the purpose of levelling and draining. The granular bedding should be installed in a single lift and compacted to 100% of SPMDD at ±2% of OMC.

5.4.3.3 Vertical Modulus of Subgrade Reaction

The geotechnical design of a slab-on-grade is typically not governed by bearing resistance, but by maintaining settlement and deformation (particularly differential) of the slab under loading within acceptable limits.

The localized differential settlements (i.e., slab deflections) will depend upon the relative stiffness between the footing and the underlying subgrade. The deflections and the resulting forces and bending moments in the slab to be used in its structural design could be determined by structural analysis using a modulus of subgrade reaction, ks, for the subgrade.

The modulus of subgrade reaction is not a fundamental soil property, and its value depends, in part, on the size and shape of the loaded area. For the analysis of the contact stress distribution beneath a slab, its value would depend on the size of the areas over which increased/concentrated contact stresses are anticipated (analogous to equivalent footings beneath the columns); the size of these areas is in turn related to the value of the modulus of subgrade reaction, i.e., they are inter-related.

Accordingly, the analysis of the foundation slab should ideally involve an iterative analysis between the determination of the contact stress distribution by the structural engineer and the geotechnical determination of the modulus of subgrade reaction value, until the two are consistent with each other. For a 0.3 m by 0.3 m unit section of the concrete slab, the modulus of subgrade reaction ($K_{0.3}$) may be assumed as 10 MPa/m for concrete slab overlying the existing clayey soil. Where B (in meters) is the shortest dimension of the loaded area on slab-on-grade.

The design modulus should be adjusted based on the loaded area as outlined in Section 5.4.9.1 of CFEM (2023).

For cohesive soil,

$$K_B = \frac{K_{0.3} * 0.3}{B}$$

K_B = modulus of subgrade reaction for a footing width of B
$K_{0.3}$ = modulus of subgrade reaction for a footing width of 0.3 m
B = foundation width

5.4.3.4 Permanent Drainage

It is understood that the proposed MAB building will not include a below grade level (or basement).

As previously discussed, the measured groundwater level at the site was 2.6 m (~El. 84.3 m) in late 2025. The proposed ground floor slab and foundation walls are anticipated to be above the groundwater level.

However, the prepared subgrade within and around the proposed building footprint may consist of different soil materials including existing fill, native clay soil, and granular engineered fill. Thus, the different subgrade soil conditions may block the free movement of water for draining and cause local ponding of water beneath the building's footprint.

If feasible, a perimeter weeping tile subdrain system should be provided around the buildings footprint to facilitate drainage of surface water infiltration and perched water away from the building foundations and ground slabs. The weeping tile subdrain system may consist of perforated pipes surrounded by free drain granular material (OPSS.MUNI 1004 19 mm Clear Stone or approved equivalent) and wrapped up with OPSS.MUNI 1860 Class II non-woven geotextile (Terrafix 360R or approved equivalent). The subdrains should be connected to the site drainage system or catch basins. Alternately, they can be drained into a sump and pump out. Inspection and maintenance of the subdrain system are recommended to ensure that the drainage system does not become blocked.

Due to the shallow groundwater table, the slab-on-grade should be provided with impermeable damp-proof membranes, such as a minimum 150 μm thick polyethylene sheet vapor barrier.

The perimeter subdrain systems should be properly designed by the Civil Design Consultant of the project. The above recommendations are provided for general guidelines only.

5.5 Earthworks

5.5.1 Temporary Excavations in Overburden

Existing deleterious fill material containing organics and debris should be removed from beneath and beyond the structure footprints. Should any additional buried organics become evident during excavation, WSP must be called to review the conditions and confirm sub-excavation requirements, including lateral / slope support if required.

Excavations of overburden materials are anticipated to be handled using conventional hydraulic excavating equipment.

As a minimum requirement, all side slopes of temporary open-cut excavations should conform to the Occupational Health and Safety Act (OHSA) – Regulation for Construction Projects (O. Reg. 213/91). The existing fill soil and native soils would be classified as Type 4 soils, and excavations in these materials should be sloped no steeper than 3H:1V based on OSHA requirements. Excavations 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, side slopes should be flattened to maintain safe working conditions. Stockpiling and equipment operating should be avoided from excavation edge to a distance at least equal to the excavation depth to reduce instability of unsupported excavation slopes.

Where the available space limits the above cutback slopes, the temporary excavations can be advanced at steeper slopes and protected by temporary shoring systems designed and installed by the contractor. All permanent excavations should be properly designed by a geotechnical consultant.

Site soils below the anticipated founding elevations are susceptible to strength loss or deformation when saturated and/or disturbed by construction traffic. The Contractor shall be responsible for the techniques and methods they utilize, including temporary shoring and erosion control, and subgrade preparation and protection. The Contractor and Designer should assess exposed subgrade soils and prevailing climatic conditions at the time of construction and decide whether an application of a lean concrete mud mat or other protection strategies are warranted.

5.5.2 Temporary Dewatering

Groundwater level measured in a monitoring well BH25-07, located southeast of the proposed MAB building and installed in September 2025, indicate that excavations extending approximately 2.6 m below ground surface (~ El. 84.3 m) may be at or below groundwater, depending on the timing of construction.

The rate of groundwater inflow into the excavations will depend on many factors including the contractor's schedule and rate of excavation, the size of the excavation, the number of working areas being excavated at one time, and the time of year at which the excavation is made. Also, there may be instances where precipitation collects in an open excavation following rainfall and must be rapidly pumped out.

According to O.Reg 63/16 and O.Reg 387/04, if the volume of water to be pumped from excavations for the purpose of construction dewatering is greater than 50,000 litres per day and less than 400,000 litres per day, the water taking will need to be registered as a prescribed activity in the Environmental Activity and Sector Registry (EASR) and requires the completion of a "Water Taking Plan". A Permit to Take Water (PTTW) is required from the Ministry of the Environment Conservation and Parks (MECP) if a volume of water greater than 400,000 litres per day is to be pumped out from an excavation.

Temporary dewatering systems are the Contractor's responsibility, and the rate and volume required for dewatering is dependent on the construction methods and staging chosen by the contractor. A groundwater management plan should be submitted by the Contractor along with the study to determine the need of EASR registry and PTTW by MECP.

5.5.3 Engineered Fill

Structural engineered fill should be used for grade raise underneath load supporting structures such as footings and ground slabs. OPSS 1010 Granular A material (or approved alternate) may be considered as structural engineered fill. The granular structural engineered fill should be placed in maximum loose lifts of 200 mm and compacted to minimum 98% of SPMDD for the first lift, and minimum 100% of SPMDD for the remaining lifts, at ±2% of Optimum Moisture Content (OMC). Engineered fill should extend laterally beyond the edge of load supporting structures, such as footings and slabs, to a minimum distance equal to the fill thickness or 1 m, whichever is greater.

For utility trench backfill, Unshrinkable Fill (U-Fill) as per OPSS.MUNI 1359 may be used in lieu of engineered backfill.

General engineered fill should be used for grade raising outside of the load supporting structures, such as roads and foundation areas. The general engineered fill is not recommended to consist of the excavated existing fill soils containing organics and topsoil, nor native clayey soils. Existing soils consisting of substantial silt content should also be avoided to reduce frost heave issues. Well graded granular fill such as Granular A or B Type I & II as per OPSS 1010, or approved granular borrow, should be considered. The imported fill should be free from topsoil, organics, debris, boulders, cobbles, rootlets and other unsuitable materials. A qualified person shall confirm that imported fill is acceptable for the site, according to Provincial regulations. The general engineered fill should be placed in maximum loose lifts of 200 mm and compacted to minimum 95% of SPMDD for the first lift and minimum 98% of SPMDD for the remaining lifts, at ±2% of OMC.

The exposed subgrade should be inspected to confirm stiffness and that the bearing surfaces have been adequately prepared and cleaned prior to the placement of the engineered fill. The prepared subgrade should be protected from disturbance of construction traffic, excessive wetting or drying.

5.6 Reuse of Existing Soils

From a geotechnical perspective, the existing soils at the project site are not compactable and are classified as frost-susceptible; therefore, they are unlikely to be suitable for reuse as backfill material for foundations, pavements, grade raises, etc. Consideration could be given to re-using existing soils for landscaping applications where future settlement or frost heave are not a concern.

The reuse of any excavated existing soils for construction backfilling is also subjected to environmental assessment.

If at the time of construction, more than 2,000 m^3 of soil is removed from the Site as excess, a Notice must be filled in the RRPA Excess Soil database along with the completion of all the applicable planning documents (i.e. Assessment of Past Uses/Phase One ESA, Soil Characterisation Report, Excess Soil Destination Assessment Report). This would include collection of additional samples at the required density based on the anticipated volume of excess soil from within the two APECs. Additional testing may be required by any potential reuse site, at their discretion.

5.7 Corrosion and Cement Type

A single soil sample was submitted to Eurofins Environment Testing for corrosivity analyses related to the potential corrosion of exposed buried steel and potential sulphate attack on buried concrete elements (corrosion and sulphate attack). The sample was analysed for chloride, sulphate and sulphide concentrations, pH, conductivity/resistivity, and redox potential. The results of these testing are provided in Appendix D and are summarized in Table 6.

Based on ASTM STP1013 (Chaker and Palmer, 1989), a soil with a resistivity of less than 2,000 Ohm-centimetre is considered very corrosive, a soil with a resistivity between 2,000 and 5,000 Ohm-centimetre is considered corrosive, and a soil with a resistivity between 5,000 and 10,000 Ohm-centimetre is considered moderately corrosive.

The pH, resistivity and chloride concentration give an indication of the degree of corrosiveness of the sub-surface environment. Generally, the test results indicate a high potential for corrosion of exposed ferrous metal respectively for the project site, which should be considered in the design of substructures.

The concentration of soluble sulphate provides an indication of the degree of sulphate attack that is expected for concrete in contact with soil and groundwater at the site. The sulphate results were compared with Table 3 of Canadian Standards Association (CSA A23.1-24) and indicated a moderate degree of sulphate attack potential on concrete structures at this site. Accordingly, Type MS cement or equivalent can be considered for buried concrete substructures in contact with native soils. All imported soils should be tested for soluble sulphate contents.

Tables 1 to 4 of CSA-A23.1-24 should be referenced for additional requirements and further information regarding concrete in contact with sulphates.

6 ADDITIONAL CONSIDERATIONS

The soils at this site are sensitive to disturbance from construction traffic, and frost.

All subgrade areas should be inspected by a qualified geotechnical consultant prior to backfilling to confirm that the correct/expected strata exist and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill should be inspected to ensure that the materials used conform to the specifications from both grading and compaction requirements.

WSP should review the final drawings and specifications for this project prior to tendering to confirm that the recommendations in this report have been adequately interpreted.

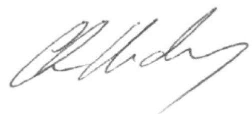
7 CLOSURE

We trust that this geotechnical report provided sufficient information to support the design and construction of the proposed building. WSP should be contacted if any of the assumptions made about the sign change. We remain available for any questions or concerns about the report.

Signature Page

WSP Canada Inc.

Kinjal Gajjar, P.Eng.
Geotechnical Engineer



Chris Hendry, P.Eng.
Senior Geotechnical Engineer

KG/CH/kj

https://wsponlinecan.sharepoint.com/sites/ca-ca0058422.0115/shared documents/06. deliverables/geotechnical/final/rev 0 - mab buildings/ca0058422.0115_r_rev0_geotechnical investigation mab_2026'04'08.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: WSP Canada Inc. (WSP) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to WSP by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. WSP cannot be responsible for use of this report, or portions thereof, unless WSP is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without WSP's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, WSP may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to WSP. The report, all plans, data, drawings and other documents as well as all electronic media prepared by WSP are considered its professional work product and shall remain the copyright property of WSP, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of WSP. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of WSP's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to WSP by the Client, communications between WSP and the Client, and to any other reports prepared by WSP for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. WSP can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, WSP does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that WSP interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: WSP will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of WSP's report. WSP should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of WSP's report.

During construction, WSP should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of WSP's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in WSP's report. Adequate field review, observation and testing during construction are necessary for WSP to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, WSP's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

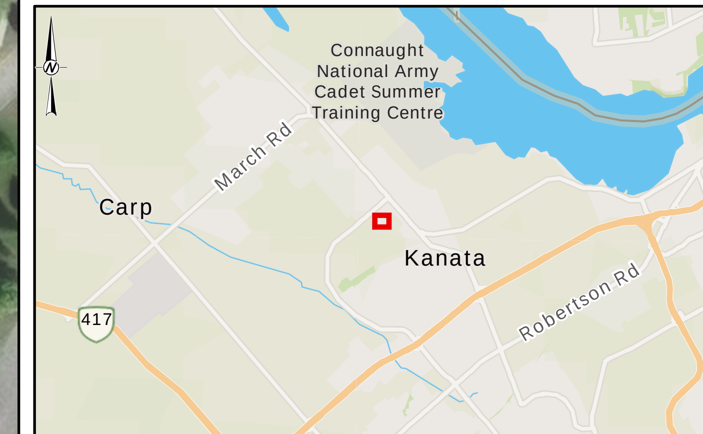
Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that WSP be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that WSP be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. WSP takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

FIGURE

Figure 1 – Site Plan

KEY MAP



SCALE: 1:250,000

LEGEND

- BOREHOLE LOCATION (WSP, SEP 2025)
- BOREHOLE LOCATION (WSP, DEC 2025)
- TEST HOLE LOCATION (PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO'S 961-2237, 762234, 760265A)
- BOREHOLE LOCATION (PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 991-2238)
- BOREHOLE LOCATION (PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 001-2129)
- BOREHOLE LOCATION (PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 001-2129A)
- BOREHOLE LOCATION (PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 981-2030)
- BOREHOLE LOCATION (PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 001-2075)
- MASW SURVEY (WSP, SEPT 2025)
- VES SURVEY (WSP, SEPT 2025)
- MAB SCOPE OF WORK
- PROPOSED BUILDINGS

0 15 30 60

1:1,500 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENCE - ONTARIO
2. BASE MAP: MICROSOFT, VANTOR, SOURCES: ESRI, TOMTOM, GARMIN, FAO, NOAA, USGS, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18N

CLIENT

CBRE LIMITED

PROJECT

GEOTECHNICAL INVESTIGATION FOR PROPOSED RENOVATIONS TO CISCO CAMPUS
2000 AND 3000 INNOVATION DRIVE, KANATA, ONTARIO

TITLE

SITE PLAN

CONSULTANT

wsp

YYYY-MM-DD	2026-03-13
DESIGNED	----
PREPARED	GU
REVIEWED	AKP
APPROVED	CH

PROJECT NO.	CONTROL	REV.	FIGURE
CA0058422.0115	0001	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

APPENDIX A

Record of Borehole Logs (Current Investigation)

METHOD OF SOIL CLASSIFICATION

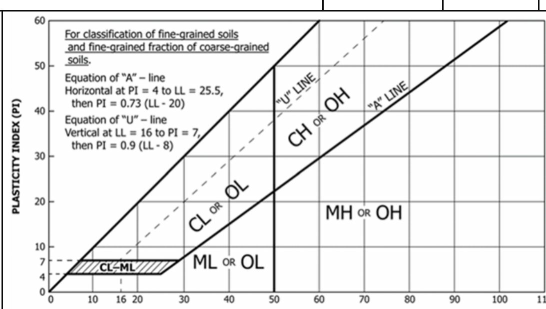
The WSP Canada Soil Classification[1] System is based on the Unified Soil Classification System (USCS) (after ASTM D2487)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content [6,9]	USCS Group Symbol [3,5,7]	Primary Group Name [2]
INORGANIC (Organic Content <30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Clean Gravels with <5% fines [3] (by mass)	Well Graded	≥4 (and)	≥1 to ≤3	≤30%	GW	Well-graded GRAVEL [4,6]
				Poorly Graded	<4 (and/or)	<1 or >3		GP	Poorly graded GRAVEL [4,6]
			Gravels with >12% fines [3] (by mass)	Below A Line	n/a			GM	SILTY GRAVEL [4,6]
				Above A Line	n/a			GC	CLAYEY GRAVEL [4,5,6]
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Clean Sands with <5% fines [7] (by mass)	Well Graded	≥6 (and)	≥1 to ≤3		SW	Well-graded SAND [6,8]
				Poorly Graded	<6 (and/or)	<1 or >3		SP	Poorly graded SAND [6,8]
			Sands with >12% fines [7] (by mass)	Below A Line	n/a			SM	SILTY SAND [6,8]
				Above A Line	n/a			SC	CLAYEY SAND [5,6,8]

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators: Dilatancy	Dry Strength	Shine Test	Thread Diameter (mm)	Toughness (of 3 mm thread)	Organic Content [B,H]	USCS Group Symbol [A]	Primary Group Name [A]
INORGANIC (Organic Content <30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Nonplastic or PI and LL plot **below A-Line** on Plasticity Chart below) [C]	Liquid Limit <50 [D]	Rapid	None to Low	Dull to None	3 to >6	Low/can't roll 3 mm	<15%	ML	SILT [H]
				None to Slow	Low to Medium	Dull to Slight	3 to 6	Low	15% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50 [D]	None to V.Slow	Low to Medium	Slight	3 to 6	Low to Medium	<15%	MH	ELASTIC SILT[H]
				None	Medium to High	Dull to Slight	1 to 3	Low to Medium	15% to <30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot **above A-Line** on Plasticity Chart below) [A]	Liquid Limit <50 [D]	None to Medium Slow	Medium to High	Slight to Shiny	1 to 3	Medium	<15%	CL	LEAN CLAY [A,E,F,G,H]
				None to V.Slow	Medium to High	Slight to Shiny	1 to 3	Medium	15% to <30%	OL	ORGANIC CLAY [E,F,G]
			Liquid Limit ≥50 [D]	None	High to V.High	Shiny	<1	High	<15%	CH	FAT CLAY [E,F,G,H]
				None	High	Shiny	<1 to 1	High	15% to <30%	OH	ORGANIC CLAY [E,F,G]
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures	Relatively lightweight, possibly spongy. Some water may squeeze from sample. Some shrinkage may occur on air drying. Sand fraction may be visible. Low to high dilatancy. Thread weak near plastic limit. Low to medium dry strength.						30% to <75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat	Lightweight, spongy. Much water squeezes from sample. Shrinks considerably on air drying (i.e., very high water content). Plant structure identiable to altered.						75% to 100%		PEAT

Coarse-Grained Soil Note(s):

1. Based on the material passing the 75 mm sieve.
2. If field sample contains or drilling observations indicate cobbles or boulders or both, add, "with cobbles" or "with cobbles and boulders". Include notes on the depth(s) encountered, and sizes if possible.
3. Gravels with 5% to 12% fines require dual symbols:
   (GW-GM) Well-graded GRAVEL with silt,
   (GW-GC) Well-graded GRAVEL with clay,
   (GP-GM) Poorly graded GRAVEL with silt,
   (GP-GC) Poorly graded GRAVEL with clay.
4. If soil contains ≥15% sand, add "with sand" to Group Name.
5. If fines classify as CL-ML, use dual symbol (GC-GM) or (SC-SM) for Group Symbol.
6. If the soil has an organic content (OC) 15%≤OC<30% the prefix "Organic" should be added before the Group Name. If the soil has an organic content 3%≤OC<15% add "with organic fines" to Group Name. If the soil contains >0% to ≤3% organics, the descriptor "trace organics" may be added to the Group Name.
7. Sands with 5% to 12% fines require dual symbols:
   (SW-SM) Well-graded SAND with silt,
   (SW-SC) Well-graded SAND with clay,
   (SP-SM) Poorly graded SAND with silt,
   (SP-SC) Poorly graded SAND with clay.
8. If soil contains ≥15% gravel, add "with gravel" to Group Name.



Fine-Grained Soil Note(s):

A. If Atterberg limits plot above the A-line but in the 'hatched' area on the plasticity chart, soil is a (CL-ML) SILTY CLAY.
B. If the soil contains >0% to ≤3% organics, the descriptor "trace organics" may be added to the Group Name.
C. If fine-grained materials are nonplastic (i.e., a plastic limit (PL) cannot be measured), soil is a (ML) SILT.
D. If soil has a liquid limit (LL) >30% to <50%, the term 'medium plasticity' may be included in the description, but the Group Name/Symbol is not changed.
E. If soil contains 15% to <30% +No.200, add "with sand" or "with gravel".
F. If soil contains ≥30% +No.200 mainly sand, add "Sandy" to Group Name.
G. If soil contains ≥30% +No.200 mainly gravel, add "Gravelly" to Group Name.
H. If the soil has an organic content (OC) 3%≤OC<15% add "with organic fines" to Group Name.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

GRADATIONAL COMPONENT TERMS

% (by mass)	Term
< 5	Use “trace”
≥ 5 to ≤ 12	Use “few”
> 12 to <30	Use “little”
≥ 30 to <50	Use “some”
≥ 50	Use “mostly”

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)
An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

ROCK

RDQ (Rock Quality Designation)

Quality Designation	RQD (%)
Very poor quality	< 25
Poor quality	25 – 50
Fair quality	50 – 75
Good quality	75 – 90
Excellent quality	> 90

USUAL SAMPLES

AS	Auger sample
DD	Diamond Drilling
GS	Grab Sample
RC	Rock core
SC	Soil core
SS	Split-spoon sampler (50 mm OD); larger sizes use MC
TP	Thin-walled, piston – note size (Shelby tube)
TT	Seamless open ended, driven, pushed tube sampler, or geoprobe macro-core – note size (transparent tubing)

OTHER SAMPLES

BS	Block sample
DS	Denison type sample
EX-F	Floor sample
EX-P	Wall sample
MC	Modified California Samples – note sample diameter and hammer weight
MS	Modified Shelby (for frozen soil)
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
WS	Wash sample

STATE

Disturbed ☒ Lost ■ Undisturbed ▨ Cored

CALIBER

Calibre (SS)	Interior diameter (mm)	Caliber (core barrel)	Interior diameter (mm)
P	75.9	PQ	85.0
H	63.2	HQ	63.5
N	50.5	NQ	47.6
B	37.8	BQ	36.4

WELL INSTALLATION

GROUNDWATER LEVEL AND DATE OF SURVEY

LEVEL OF LIQUID IN NON-AQUEOUS PHASE AND DATE OF SURVEY

MAT.	Material for well construction
DIA.	Well diameter
OP.	Opening of the slotted screen
PVC	Polyvinyl chlorid
SCH	Schedule (width of the PVC wall)
SS	Stainless steel

OBSERVATIONS[1]

Odours		Visual	
L	Low	D	Disseminated
M	Medium	S	Saturated
P	Strong	-	-

1 The odours reported were perceived incidentally during fieldwork. No sample has been deliberately smelled.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in general accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

SOIL TESTS

GSA	grain size analysis
w_N	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
PI	plastic index
LI	liquidity index
C	consolidation (oedometer) test
σ'_P	consolidation pressure
C_c	compression index
C_{cr}	recompression index
e_0	initial void ratio
k	hydraulic conductivity
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
c_u	Undrained shear strength on undisturbed soil using a fall cone penetrometer
c_r	Undrained shear strength on remolded soil using a fall cone penetrometer
s_u	Undrained shear strength on undisturbed soil - field
s_r	Undrained shear strength on remoulded soil - field
R	Refusal
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in general accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w_N < PL	Material is estimated to be drier than the Plastic Limit.
w_N ~ PL	Material is estimated to be close to the Plastic Limit.
w_N > PL	Material is estimated to be wetter than the Plastic Limit.

Plasticity

Term	Liquid Limit (LL)
Low	< 30%
Medium	30 – 50%
High	> 50%

Sensitivity (CFEM, 2023)

Term	Sensitivity, S_t
Low	< 8
Medium	8 – 30
High	> 30

ROCK TESTS

UCS (σ_c)	uniaxial compressive strength
γ	Unit weight
ν	Poisson's ratio
E	Linear deformation modulus
E_D	Dilatometer modulus
E_M	Pressuremeter modulus

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows.

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation
w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = ($w_l - w_p$)
NP	nonplastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = $\tan\delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

1. $\tau = c' + \sigma' \tan\phi'$
2. shear strength = (compressive strength)/2

RECORD OF BOREHOLE: BH25-10

PROJECT: CA0058422.0115
LOCATION: N 5021463.39; E 427381.92
BORING DATE: Dec. 22, 2025
DATUM:
SPT/DCPT HAMMER: MASS, 63.5kg DROP, 760mm
DRILL RIG: MI 3 Track Mount
HAMMER TYPE: AUTOMATIC

BORING METHOD: Wash Boring, 100 mm O.D. Casing

SOIL PROFILE

DESCRIPTION	ELEV. / DEPTH (m)
GROUND SURFACE	86.68
TOPSOIL (70 mm)	0.00 / 0.07
FILL - (SM/ML) SILTY SAND to Sandy SILT with gravel, mostly sand and silt, little gravel, few rootlets; brown, frozen; non-cohesive, compact	86.07 / 0.61
(CL/CH) LEAN CLAY to FAT CLAY, medium to high plasticity; grey brown, mottled; cohesive, w>PL, stiff to very stiff (Weathered Crust)	83.63 / 3.05
(CH) FAT CLAY, high plasticity clayey fines; grey; cohesive, w>PL, stiff	

SAMPLES

NUMBER	TYPE	BLOWS/0.3m
1A		
1B	SS	10
2	SS	10
3	SS	7
4	SS	1
5	SS	WH
6	SS	WH
7	SS	WH

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80
HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
WATER CONTENT PERCENT: Wp ⊢○W⊣ Wl : 10 20 30 40
ADDITIONAL LAB. TESTING
PIEZOMETER OR STANDPIPE INSTALLATION
GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

Plotted values: 64, 54.5 (sample 4); 52.7 (sample 5); 114.6; 56, 52.1 (sample 7); 101.1

Depth scale (metres): 0 1 2 3 4 5 6 7 8 9 10

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

wsp

LOGGED: KG
CHECKED: AKP

RECORD OF BOREHOLE: BH25-10

PROJECT: CA0058422.0115

LOCATION: N 5021463.39; E 427381.92

BORING DATE: Dec. 22, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 63.5kg DROP, 760mm

DRILL RIG: MI 3 Track Mount

HAMMER TYPE: AUTOMATIC

--- CONTINUED FROM PREVIOUS PAGE ---

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	WATER CONTENT PERCENT	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
10	Wash Boring, 100 mm O.D. Casing	(CH) FAT CLAY, high plasticity clayey fines; grey; cohesive, w>PL, stiff							
11				8	SS	1		54.1	
							rem V. ⊕, nat V. +		
							rem V. ⊕, nat V. +		
12			74.49 / 12.19						
		(GM) SILTY GRAVEL with sand, some gravel, some sand, little non-plastic silty fines; grey (GLACIAL TILL); non-cohesive, wet	12.27	9	SS	65/ 0.07		○	43 31 (26)
		END OF BOREHOLE							
13		Refer to Record of Drillhole BH25-10							

DEPTH SCALE 1 : 50

LOGGED: KG

CHECKED: AKP

RECORD OF DRILLHOLE: BH25-10

PROJECT: CA0058422.0115

LOCATION: N 5021463.39 ;E 427381.92

INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: Dec. 22, 2025

DRILL RIG: MI 3 Track Mount

DRILLING CONTRACTOR: Strata

SHEET 1 OF 1

DATUM:

NOTE: For abbreviations, symbols and descriptions refer to **LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY**

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE % / SOLID CORE %	R.Q.D. %	FRACT. INDEX PER	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS / TYPE AND SURFACE DESCRIPTION / Jr / Ja / Jcon	WEATHERING INDEX	Diametral Point Load Index (MPa)	FEATURES	PIEZOMETER
		Continued from Record of Borehole BH25-10		74.41										
13		GRANITE, slightly weathered, thinly to thickly bedded; reddish to grey; medium to coarse grained, slightly porous, very strong		12.27 … 72.89	1								BC BC BC	
14		END OF DRILLHOLE		13.79										

Depth scale ticks: 15, 16, 17, 18, 19, 20, 21, 22

GTA-RCK 046 S:\CLIENTS\CBRE_LIMITED\2000_&_3000_INNOVATION_ROAD\02_DATA\GINT\2000_&_3000_INNOVATION_ROAD.GPJ GAL-MISS.GDT 3/13/26

DEPTH SCALE 1 : 50

LOGGED: KG

CHECKED: AKP

RECORD OF BOREHOLE: BH25-11

PROJECT: CA0058422.0115
LOCATION: N 5021441.42; E 427356.84
SPT/DCPT HAMMER: MASS, 63.5kg DROP, 760mm

BORING DATE: Dec. 19, 2025
DRILL RIG: Track Mount

DATUM:
HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m
		GROUND SURFACE		86.42			
0	Wash Boring; 100 mm O.D. Casing	Previous hydrovaced and backfilled with granular material		0.00			
3		(CH) FAT CLAY, high plasticity clayey fines; grey; cohesive, w>PL, stiff	hatched	83.37 / 3.05	1	SS	1
4					2	SS	2
5–6					3	SS	WH
7					4	SS	WH
10					5	SS	WH

Chart columns:
- DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20, 40, 60, 80
- SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○; scale 20, 40, 60, 80
- HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}
- WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl; scale 10, 20, 30, 40
- ADDITIONAL LAB. TESTING
- PIEZOMETER OR STANDPIPE INSTALLATION
- GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

wsp

LOGGED: KG
CHECKED: AKP

RECORD OF BOREHOLE: BH25-11

PROJECT: CA0058422.0115

LOCATION: N 5021441.42; E 427356.84

BORING DATE: Dec. 19, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 63.5kg DROP, 760mm

DRILL RIG: Track Mount

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES – NUMBER	SAMPLES – TYPE	SAMPLES – BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		--- CONTINUED FROM PREVIOUS PAGE ---									
10		(CH) FAT CLAY, high plasticity clayey fines; grey; cohesive, w>PL, stiff			5	SS	WH				
		Glacial Till (Inferred)		75.75 / 10.67	6	SS	51/ 0.07				
		END OF BOREHOLE		10.76							
11		Refer to Record of Drillhole BH25-11									
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

wsp

LOGGED: KG

CHECKED: AKP

RECORD OF DRILLHOLE: BH25-11

PROJECT: CA0058422.0115

SHEET 1 OF 1

LOCATION: N 5021441.42 ;E 427356.84

DRILLING DATE: Dec. 19, 2025

DATUM:

DRILL RIG: Track Mount

INCLINATION: -90° AZIMUTH: ---

DRILLING CONTRACTOR: Strata

NOTE: For abbreviations, symbols and descriptions refer to **LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY**

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jcon	WEATHERING INDEX	Diametral Point Load Index (MPa)	FEATURES	PIEZOMETER
		Continued from Record of Borehole BH25-11		75.66															
		Cobbles and Boulders		10.76															
11		Granite, fresh, thinly bedded, grey, medium to coarse grained, slightly porous, very strong		75.43 10.99	1														
12																			
13					2														
14				72.48 13.94															
		END OF DRILLHOLE																	
15																			
16																			
17																			
18																			
19																			
20																			

Scale ticks: TOTAL CORE % 80 60 40 20; SOLID CORE % 80 60 40 20; R.Q.D. % 80 60 40 20; FRACT. INDEX PER 5 10 15 20; DIP w.r.t. CORE AXIS 0 30 60 90; WEATHERING INDEX W1 W2 W3 W4 W5 W6; Point Load Index 2 4 6

DEPTH SCALE
1 : 50

wsp

LOGGED: KG
CHECKED: AKP

APPENDIX B

Rock Core Photographs

BH-25-10 (DRY)
Core Box 1 of 1
From 12.3 m (ELEV. 74.4 m) to 13.8 m (ELEV. 72.9 m)

Top of Rock
at ELEV. 74.4 m

Elevation 72.9 m
End of Drillhole

wsp	**Geotechnical Investigation**	Project No. CA0058422.0115	**Figure B1**
	Proposed MAB Building	Photo Taken AKP	
	Cisco Campus, Ottawa, Ontario	Date 2025-10-21	
		Drawn KG	
		Checked CH	

BH-25-10 (WET)
Core Box 1 of 1
From 12.3 m (ELEV. 74.4 m) to 13.8 m (ELEV. 72.9 m)

Top of Rock
at ELEV. 74.4 m

Elevation 72.9 m
End of Drillhole

	Geotechnical Investigation	Project No. CA0058422.0115	**Figure B2**
	Proposed MAB Building	Photo Taken AKP	
	Cisco Campus, Ottawa, Ontario	Date 2025-10-21	
		Drawn KG	
		Checked CH	

BH-25-11 (DRY)
Core Box 1 to 2 of 2
From 11.0 m (ELEV. 75.4 m) to 13.9 m (ELEV. 72.5 m)

Top of Rock
at ELEV. 75.4 m

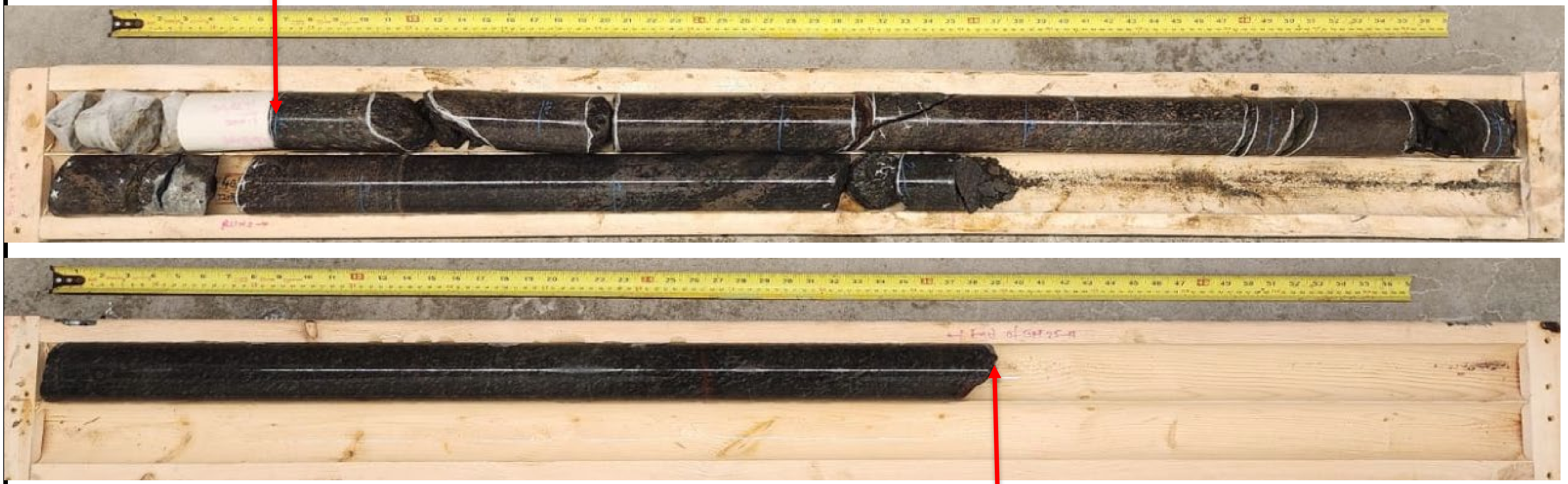
Elevation 72.5 m
End of Drillhole

Geotechnical Investigation	Project No. CA0058422.0115
Proposed MAB Building	Photo Taken AKP
Cisco Campus, Ottawa, Ontario	Date 2025-10-21
	Drawn KG
	Checked CH

Figure B3

BH-25-11 (WET)
Core Box 1 to 2 of 2
From 11.0 m (ELEV. 75.4 m) to 13.9 m (ELEV. 72.5 m)

Top of Rock
at ELEV. 75.4 m



Elevation 72.5 m
End of Drillhole

wsp	**Geotechnical Investigation**	Project No. CA0058422.0115	**Figure B4**
	Proposed MAB Building	Photo Taken AKP	
	Cisco Campus, Ottawa, Ontario	Date 2025-10-21	
		Drawn KG	
		Checked CH	

APPENDIX C

Geotechnical Laboratory Test Results

WSP Canada Inc.
1931 Robertson Road
Bells Corners, K2H 5B7
613-592-9600

11/06/2025

Water (Moisture) Content of Soils

Testing Standard: MTO LS-701 (Rev. 33)

Testing Program #:	051102	Project Number:	CA0058422.0115
Client:	Robert Construction Services Corp	Project Location:	
Project Name:	CA-CBRE/Cisco Ottawa Campus/Innovation Dr.	Report Number:	BLC01172-25

Sample Location	Sample				Soil Description	Water Content (%)	WSP Lab Number	Tested By	Remarks
	Sample Number	Top (m)	Base (m)	Type					
25-07	4	1.80	2.10	SS		37.3	BLC25-01711	Melanie Ireland	
25-07	5	2.30	2.90	SS		46.3	BLC25-01712		
25-07	6	3.00	3.60	SS		47.4	BLC25-01713		
25-07	7	3.80	4.40	SS		50.2	BLC25-01714		
25-07	8	4.50	5.20	SS		62.3	BLC25-01715		
25-07	9	5.30	5.90	SS		59.2	BLC25-01716		
25-07	10	6.10	6.70	SS		51.5	BLC25-01717		
25-07	11	6.80	7.40	SS		61.9	BLC25-01718		
25-07	12	7.60	8.20	SS		52.1	BLC25-01719		
25-07	13	9.10	9.70	SS		56.0	BLC25-01720		
25-07	14	10.60	11.20	SS		43.8	BLC25-01721		

Reviewed By:	Chelsea Ward	Title:	Laboratory Technician
Signature:	Chelsea Ward		

CERTIFIED BY CCIL

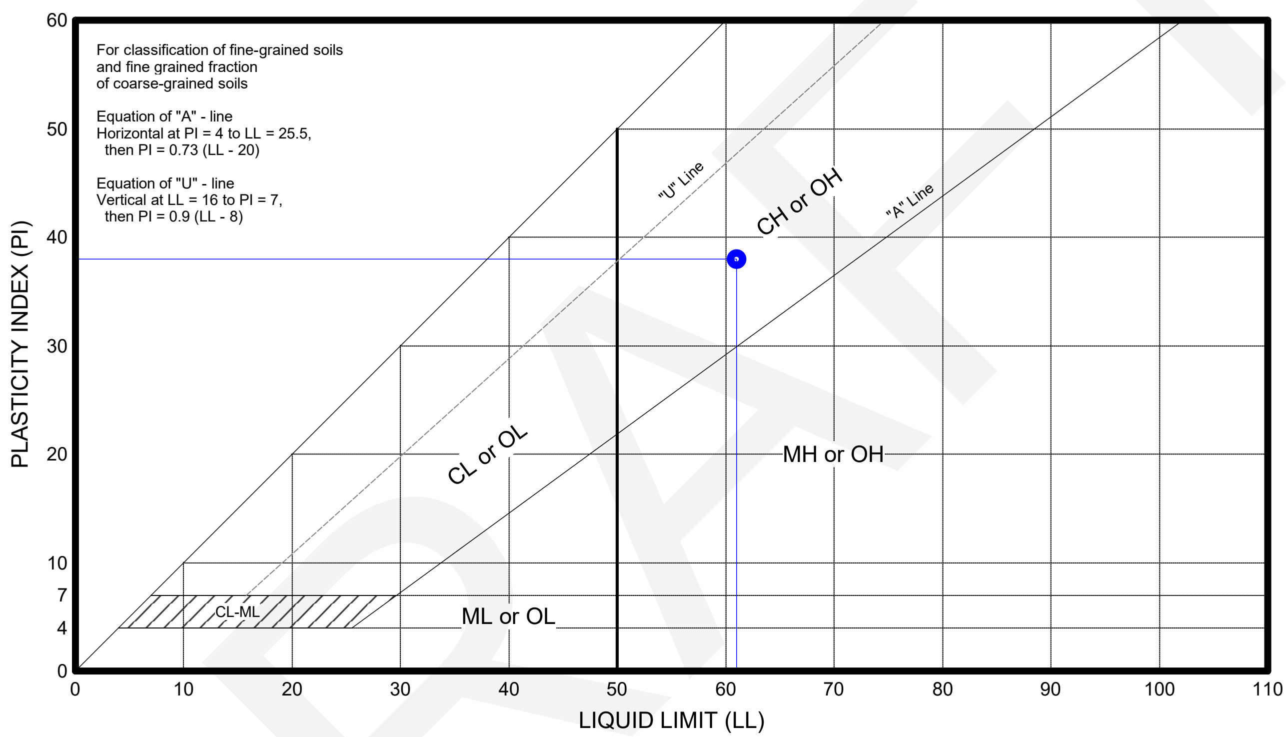
WSP Canada Inc.
1931 Robertson Road
Bells Corners, K2H 5B7
613-592-9600

11/06/2025

Liquid Limit, Plastic Limit and Plasticity Index

Testing Standard: MTO LS-703/704 (Rev. 36)

Testing Program #:	051102	Project Number:	CA0058422.0115
Client:	Robert Construction Services Corp	Project Location:	
Project Name:	CA-CBRE/Cisco Ottawa Campus/Innovation Dr.	Sample Location	25-07
Source:		Borehole Type:	SS
Report Number:	BLC01172-25	Borehole Depth (m):	1.8 - 11.2
Sample Number:	8	WSP Lab Number:	BLC25-01715
Soil Description:	Fat clay	Specimen Depth (m):	4.5 - 5.2
Soil Classification:	CH	Date of Test:	11/03/2025
		Tested By:	Melanie Ireland



Sample Location	Sample Number	Top Depth (m)	Base Depth (m)	Percent Passing 425um Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
25-07	8	4.50	5.20		62.3	61	23	38	1.03

NP = Non-Plastic
ND = Not Determined

Test Preparation Dry Preparation Tested After >425um Removed
Lab Testing Comments / Deviations:
General Comments:

Reviewed By:	Chelsea Ward	Title:	Laboratory Technician
Signature:	Chelsea Ward		

CERTIFIED BY CCIL

Notice: The test data given herein pertain to the sample provided and may not be applicable to other samples or to material from earlier or subsequent production. Reporting of these results constitutes a testing service only. Engineering interpretation and advice may be provided upon written request.

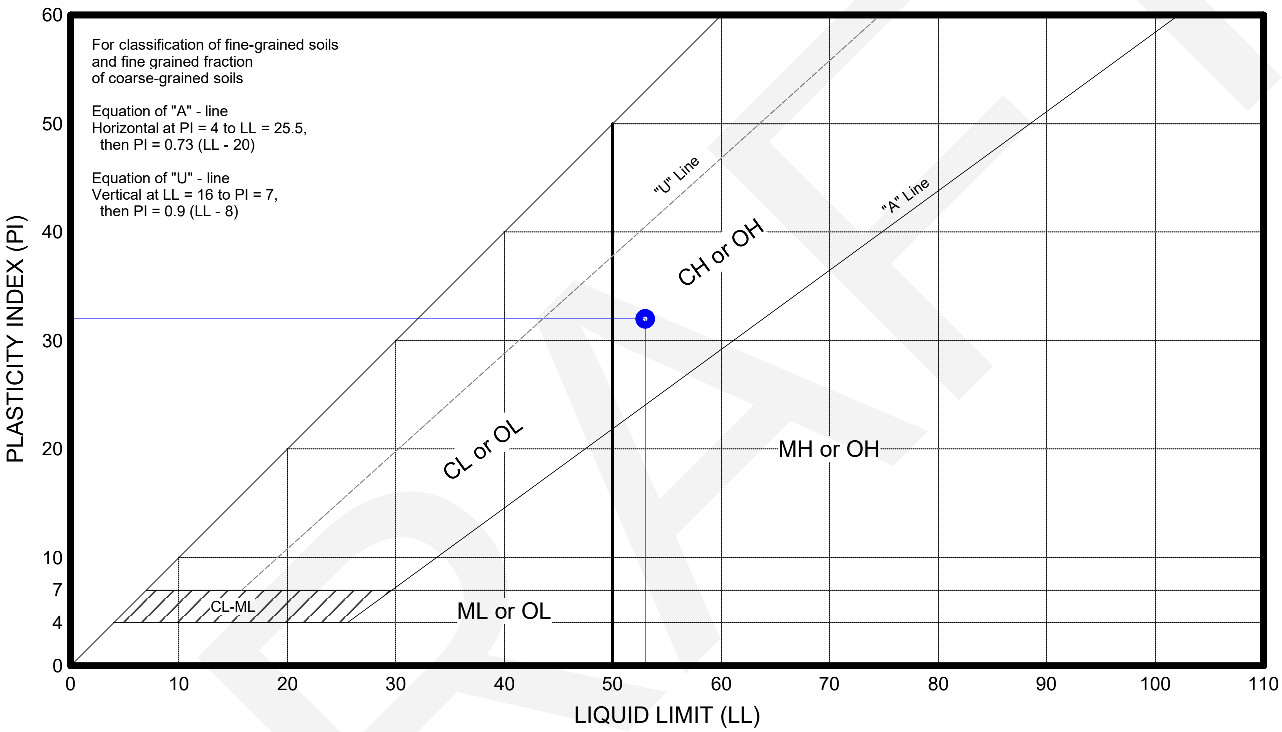
WSP Canada Inc.
1931 Robertson Road
Bells Corners, K2H 5B7
613-592-9600

11/06/2025

Liquid Limit, Plastic Limit and Plasticity Index

Testing Standard: MTO LS-703/704 (Rev. 36)

Testing Program #:	051102	Project Number:	CA0058422.0115
Client:	Robert Construction Services Corp	Project Location:	
Project Name:	CA-CBRE/Cisco Ottawa Campus/Innovation Dr.	Sample Location	25-07
Source:		Borehole Type:	SS
Report Number:	BLC01172-25	Borehole Depth (m):	1.8 - 11.2
Sample Number:	12	WSP Lab Number:	BLC25-01719
Soil Description:	Fat clay	Specimen Depth (m):	7.6 - 8.2
Soil Classification:	CH	Date of Test:	11/04/2025
		Tested By:	Melanie Ireland



Sample Location	Sample Number	Top Depth (m)	Base Depth (m)	Percent Passing 425um Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
25-07	12	7.60	8.20		52.1	53	21	32	0.97

NP = Non-Plastic
ND = Not Determined

Test Preparation Dry Preparation Tested After >425um Removed
Lab Testing Comments / Deviations:
General Comments:

Reviewed By:	Chelsea Ward	Title:	Laboratory Technician
Signature:	Chelsea Ward		

CERTIFIED BY CCIL

WSP Canada Inc.
1931 Robertson Road
Bells Corners, K2H 5B7
613-592-9600

01/22/2026

Water (Moisture) Content of Soils

Testing Standard: MTO LS-701 (Rev. 33)

Testing Program #:	055778	Project Number:	CA0058422.0115
Client:	Robert Construction Services Corp	Project Location:	
Project Name:	CA-CBRE/Cisco Ottawa Campus/Innovation Dr.	Report Number:	BLC00051-26

Sample Location	Sample				Soil Description	Water Content (%)	WSP Lab Number	Tested By	Remarks
	Sample Number	Top (m)	Base (m)	Type					
25-10	1B	0.07	0.60	SS		34.4	BLC26-00059	Melanie Ireland	
25-10	2	0.70	1.30	SS		34.3	BLC26-00060		
25-10	4	2.30	2.90	SS		54.5	BLC26-00061		
25-10	5	3.00	3.60	SS		52.7	BLC26-00062		
25-10	6	4.50	5.20	SS		47.1	BLC26-00063		
25-10	7	7.60	8.20	SS		52.1	BLC26-00064		
25-10	8	10.70	11.30	SS		54.1	BLC26-00065		
25-10	9	12.20	12.30	SS		16.8	BLC26-00066		

Reviewed By:	Chelsea Ward	Title:	Laboratory Technician
Signature:	Chelsea Ward		

CERTIFIED BY CCIL

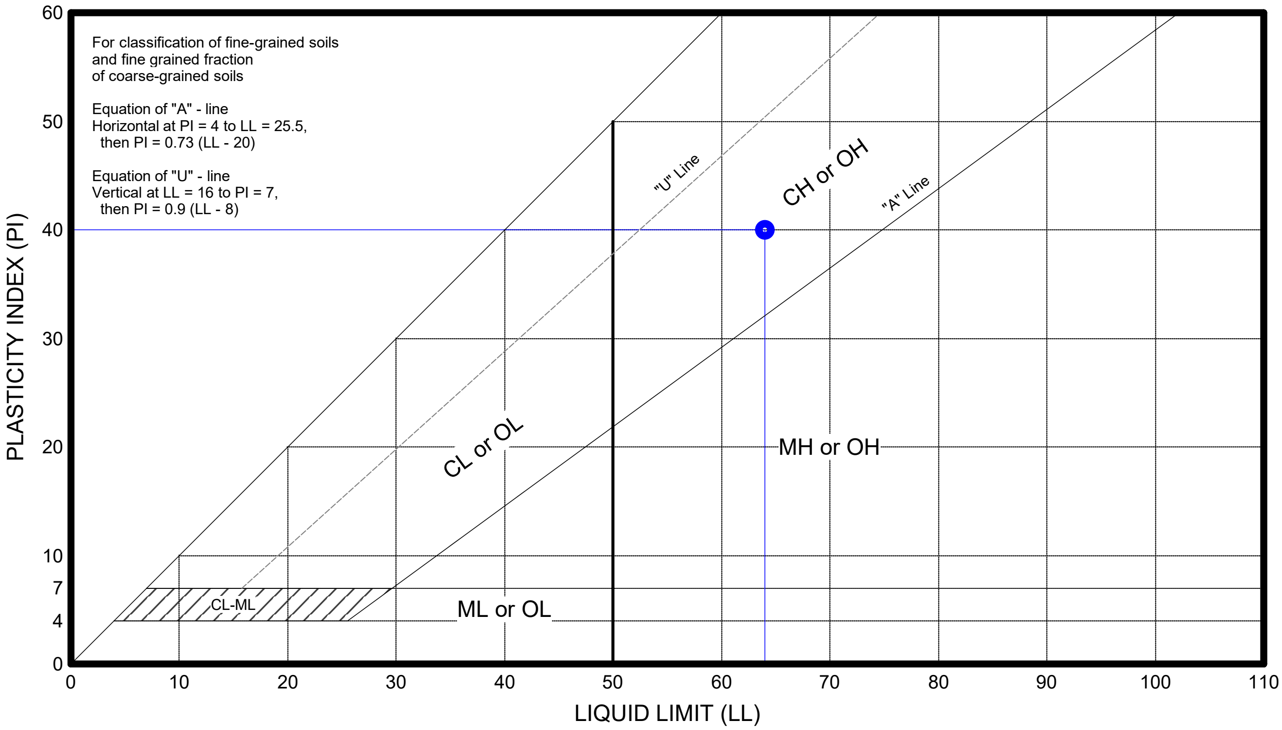
WSP Canada Inc.
1931 Robertson Road
Bells Corners, K2H 5B7
613-592-9600

01/22/2026

Liquid Limit, Plastic Limit and Plasticity Index

Testing Standard: MTO LS-703/704 (Rev. 36)

Testing Program #:	055778	Project Number:	CA0058422.0115
Client:	Robert Construction Services Corp	Project Location:	
Project Name:	CA-CBRE/Cisco Ottawa Campus/Innovation Dr.	Sample Location	25-10
Source:		Borehole Type:	SS
Report Number:	BLC00051-26	Borehole Depth (m):	0.07 - 12.3
Sample Number:	4	WSP Lab Number:	BLC26-00061
Soil Description:		Specimen Depth (m):	2.3 - 2.9
Soil Classification:		Date of Test:	01/19/2026
		Tested By:	Melanie Ireland



Sample Location	Sample Number	Top Depth (m)	Base Depth (m)	Percent Passing 425um Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
25-10	4	2.30	2.90		54.5	64	24	40	0.76

NP = Non-Plastic
ND = Not Determined

Test Preparation
Wet Preparation

Lab Testing Comments / Deviations:

General Comments:

Reviewed By:	Chelsea Ward	Title:	Laboratory Technician
Signature:	Chelsea Ward		

CERTIFIED BY CCIL

Notice: The test data given herein pertain to the sample provided and may not be applicable to other samples or to material from earlier or subsequent production. Reporting of these results constitutes a testing service only. Engineering interpretation and advice may be provided upon written request.

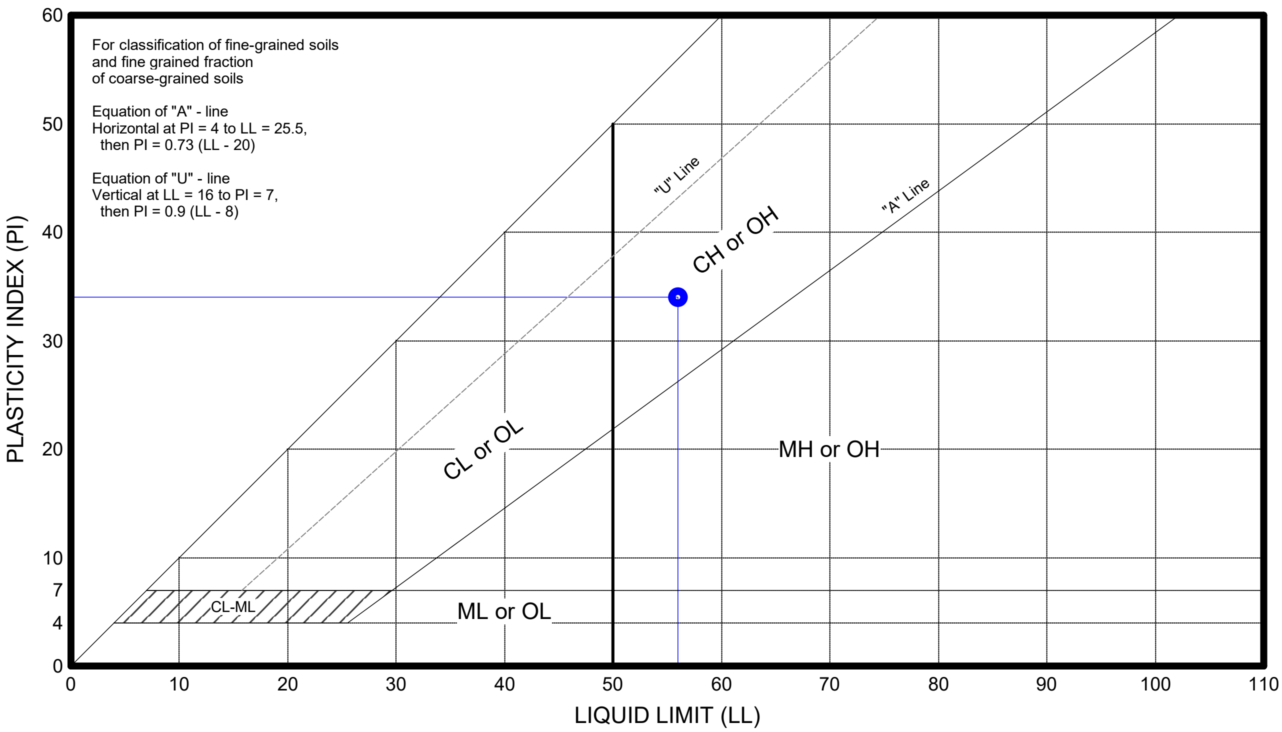
WSP Canada Inc.
1931 Robertson Road
Bells Corners, K2H 5B7
613-592-9600

01/22/2026

Liquid Limit, Plastic Limit and Plasticity Index

Testing Standard: MTO LS-703/704 (Rev. 36)

Testing Program #:	055778	Project Number:	CA0058422.0115
Client:	Robert Construction Services Corp	Project Location:	
Project Name:	CA-CBRE/Cisco Ottawa Campus/Innovation Dr.	Sample Location	25-10
Source:		Borehole Type:	SS
Report Number:	BLC00051-26	Borehole Depth (m):	0.07 - 12.3
Sample Number:	7	WSP Lab Number:	BLC26-00064
Soil Description:		Specimen Depth (m):	7.6 - 8.2
Soil Classification:		Date of Test:	01/19/2026
		Tested By:	Melanie Ireland



Sample Location	Sample Number	Top Depth (m)	Base Depth (m)	Percent Passing 425um Sieve	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
25-10	7	7.60	8.20		52.1	56	22	34	0.89

NP = Non-Plastic
ND = Not Determined

Test Preparation
Wet Preparation

Lab Testing Comments / Deviations:

General Comments:

Reviewed By:	Chelsea Ward	Title:	Laboratory Technician
Signature:	Chelsea Ward		

CERTIFIED BY CCIL

Notice: The test data given herein pertain to the sample provided and may not be applicable to other samples or to material from earlier or subsequent production. Reporting of these results constitutes a testing service only. Engineering interpretation and advice may be provided upon written request.

WSP Canada Inc.
1931 Robertson Road
Bells Corners, K2H 5B7
613-592-9600

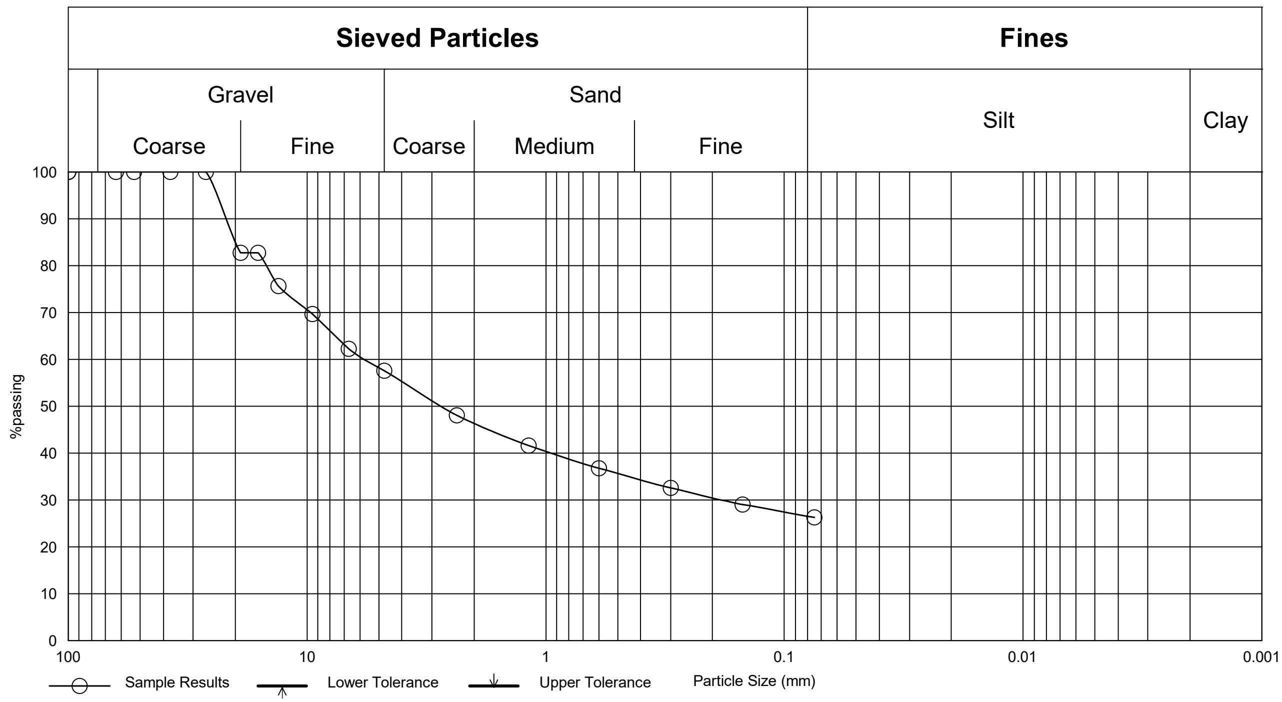
01/22/2026

Particle Size Distribution of Soils

Testing Standard: MTO LS-602 (Rev. 39)

Testing Program #:	055778	Project Number:	CA0058422.0115
Client:	Robert Construction Services Corp	Project Location:	
Project Name:	CA-CBRE/Cisco Ottawa Campus/Innovation Dr.	Sample Location:	25-10
Source:		Borehole Type:	SS
Report Number:	BLC00051-26	Borehole Depth (m):	0.07 - 12.3
Sample Number:	9	WSP Lab Number:	BLC26-00066
Soil Description:		Specimen Depth (m):	12.2 - 12.3
Soil Classification:		Date of Test:	01/16/2026
Specification:		Tested By:	Ireland, Melanie

Grain Size Distribution	Gravel	Sand	Silt / Clay
	42.4	31.3	26.3



Sieve		Hydrometer Sedimentation	
Sieve Size (mm)	% Passing	Particle Size mm	% Passing
63.0			
53.0			
37.5			
26.5	100.0		
19.0	82.8		
16.0	82.8		
13.2	75.6		
9.5	69.6		
6.7	62.2		
4.75	57.6		
2.36	48.0		
1.18	41.6		
0.600	36.7		
0.300	32.6		
0.150	29.0	0.005mm	
0.075	26.3	0.002mm	
		D60	5.761
		D30	0.186
		D10	NA
		Cu	NA
		Cc	NA

Notes:

Disclaimer:

Notice: The test data given herein pertain to the sample provided and may not be applicable to other samples or to material from earlier or subsequent production. Reporting of these results constitutes a testing service only. Engineering interpretation and advice may be provided upon written request.

Reviewed By:	Chelsea Ward	Title:	Laboratory Technician
Signature:	Chelsea Ward		

CERTIFIED BY CCIL

APPENDIX D

Basic Chemical Analyses

Certificate of Analysis

eurofins | Environment Testing

Client:	WSP Canada Inc. (Ottawa) 1931 Robertson Road Ottawa, Ontario K2H 5B7	Report Number:	3022400
Attention:	Mr. Arthur Kuitchoua Petke	Date Submitted:	2026-01-13
PO#:		Date Reported:	2026-01-20
Invoice to:	WSP Canada Inc.	Project:	CA0058422.0115, Task 1000
		COC #:	126880

Dear Arthur Kuitchoua Petke:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: ______________________________

Emma-Dawn Ferguson, Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: https://directory.cala.ca/.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

eurofins | Environment Testing

Certificate of Analysis

Client:	WSP Canada Inc. (Ottawa) 1931 Robertson Road Ottawa, Ontario K2H 5B7	Report Number:	3022400
Attention:	Mr. Arthur Kuitchoua Petke	Date Submitted:	2026-01-13
PO#:		Date Reported:	2026-01-20
Invoice to:	WSP Canada Inc.	Project:	CA0058422.0115, Task 1000
		COC #:	126880

Group	Analyte	MRL	Units	Guideline	Lab I.D. 1793274 Sample Matrix Soil Sample Type Sampling Date 2025-12-22 Sample I.D. BH25-10 SA3 (1.5-2.1)
Anions	Cl	0.002	%		0.012
	SO4	0.01	%		0.10
General Chemistry	Electrical Conductivity	0.05	mS/cm		0.63
	pH	2.00			8.96
	Resistivity	1	ohm-cm		1587

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client:	WSP Canada Inc. (Ottawa) 1931 Robertson Road Ottawa, Ontario K2H 5B7	Report Number:	3022400
Attention:	Mr. Arthur Kuitchoua Petke	Date Submitted:	2026-01-13
PO#:		Date Reported:	2026-01-20
Invoice to:	WSP Canada Inc.	Project:	CA0058422.0115, Task 1000
		COC #:	126880

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 487332 **Analysis/Extraction Date** 2026-01-16 **Analyst** IP **Method** Cond-Soil			
Electrical Conductivity	<0.05 mS/cm	100	90-110
pH	6.37	100	90-110
Resistivity			
Run No 487343 **Analysis/Extraction Date** 2026-01-16 **Analyst** IP **Method** AG SOIL			
SO4	<0.01 %	106	70-130
Run No 487421 **Analysis/Extraction Date** 2026-01-20 **Analyst** AsA **Method** C CSA A23.2-4B			
Chloride	<0.002 %	98	75-125

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

APPENDIX E

Geophysical Memorandum (MASW)

TECHNICAL MEMORANDUM

DATE September 27, 2025 **Project No.** CA0058422.0115

TO Arup Canada Inc

FROM Alex Bilson Darko, Jon Crawford **EMAIL alex.bilson.dark@wsp.com; jonathan.crawford@wsp.com**

2D MASW AND VES SURVEY RESULTS – CISCO OTTAWA DEVELOPMENT CENTRE

This technical memorandum presents the results of the 2D MASW and Vertical Electric Sounding survey carried out by WSP on September 5, 2025, at the Cisco Ottawa Development Centre in Ottawa, Ontario. The objective of the geophysical survey was to conduct an MASW to evaluate shear wave velocities of the subsurface and a soil resistivity test using the 4-electrode Wenner method. The alignment of the surveys are shown in Figure 1.

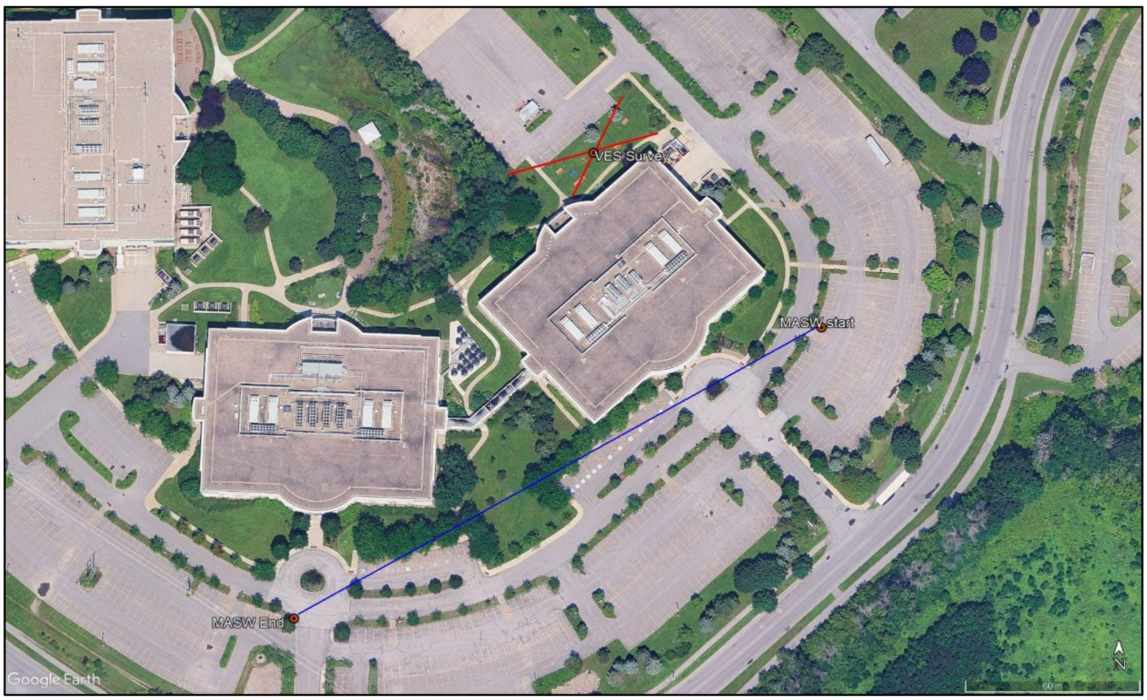


Figure 1: MASW (blue) and VES (red) Survey lines

Methodology

Vertical Electrical Sounding (VES)

The 4-electrode Wenner method, also known as vertical electric resistivity sounding (VES), is described by ASTM G57-06 and ANSI/IEEE Standard 81-1983 standards. Four evenly spaced steel electrodes are inserted into the soil in a straight line and a DC or AC test current is applied to the outer two electrodes. The associated potential difference V is measured between the inner pair of potential electrodes. The effective resistance R of subsurface material, measured in units of Ohms, follows from Ohms' law, $R=V/I$. Finally, to account for the influence of a specific electrode configuration and spacing between the four electrodes, an appropriate geometrical correction factor γ is applied to obtain the corresponding intrinsic parameter, apparent resistivity $\rho = \gamma R$, with units of ohm-metres (ohm-m). True resistivity of the ground with respect to depth is then modelled by applying an inversion process to the measured apparent resistivity data (Zohdy, 1989).

To test for vertical changes in the resistivity of the subsurface, the Wenner array is kept centered at a specific location, while the a-spacing between the current electrodes (C1 and C2) and potential electrodes (P1 and P2) is increased stepwise in order to achieve greater depth penetration (see Figure 1 below). Effective investigation depth increases with increasing electrode separation to yield a vertical electrical sounding of the subsurface. This approach highlights any significant vertical stratification in electrical properties of the ground. Additionally, the array is laid out and expanded in two orthogonal spreads about a common midpoint to investigate the possibility of planar anisotropy in the ground.

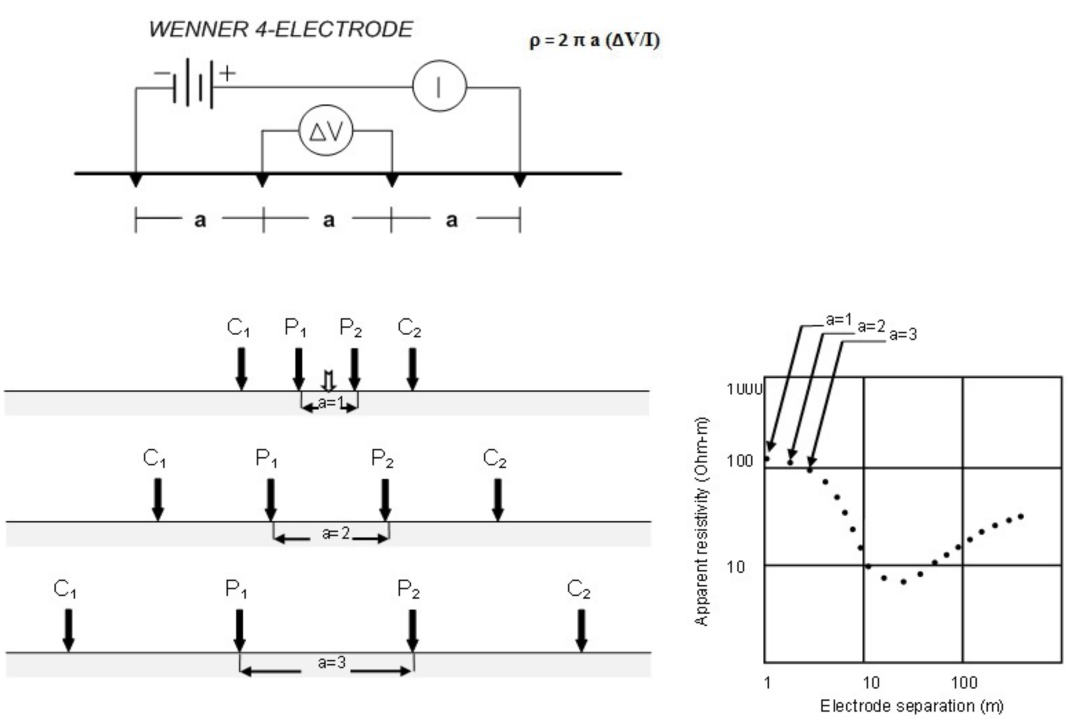


Figure 2: Typical Wenner Array Configuration

The data were acquired with the following standards as guidelines.

- Zohdy, A.A.A., 1989, A New Method for Automated Interpretation of Schlumberger and Wenner Sounding Curves, *GEOPHYSICS*, 54, 2, 245-253.
- ASTM Standard G 57, 2006, "Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method," ASTM International, West Conshohocken, PA.
- ANSI/IEEE Standard 81, 1983, "Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System," The Institute of Electrical and Electronics Engineers, Inc., New York, NY, USA.

Multichannel Analysis of Surface Waves (MASW)

The MASW method measures variations in surface-wave velocity with increasing distance and wavelength and can be used to infer the rock/soil types, stratigraphy and soil conditions.

A typical MASW survey requires a seismic source, to generate surface-waves, and a minimum of two geophone receivers, to measure the ground response at some distance from the source. Surface-waves are a special type of seismic wave whose propagation is confined to the near surface medium.

The depth of penetration of a surface-wave into a medium is directly proportional to its wavelength. In a non-homogeneous medium surface-waves are dispersive, i.e., each wavelength has a characteristic velocity owing to the subsurface heterogeneities within the depth interval that wavelength of surface-wave propagates through. The relationship between surface-wave velocity and wavelength is used to obtain the shear-wave velocity and attenuation profile of the medium with increasing depth.

The seismic source used can be either active or passive, depending on the application and location of the survey. Examples of active sources include explosives, weight-drops, sledgehammer and vibrating pads. Examples of passive sources are road traffic, micro-tremors and water-wave action (in near-shore environments).

The geophone receivers measure the wave-train associated with the surface-wave travelling from a seismic source at different distances from the source.

The participation of surface-waves with different wavelengths can be determined from the wave-train by transforming the wave-train results into the frequency domain. The surface-wave velocity profile with respect to wavelength (called the 'dispersion curve') is determined by the delay in wave propagation measured between the geophone receivers. The dispersion curve is then matched to a theoretical dispersion curve using an iterative forward-modelling procedure. The result is a shear-wave velocity profile of the tested medium with depth.

Field Work

VES

The work area was in the construction area at 9608 Carter Road which was a dirt covered area. The location of the survey lines are shown in Figure 2. The length and orientation were controlled by the work area available for this survey. A total of two VES lines were collected. The VES data were acquired using a Syscal R1+ soil resistivity meter (Iris Instruments) using the 4-electrode Wenner survey. Electrode '*a*'-spacings of 0.2, 0.3, 0.5, 1, 1.5, 2, 3, 4, 6, 8,10,12,14,16, and 18 m were employed. The data were stacked using a minimum of 5 readings to increase the signal to noise ratio.

MASW

The MASW data were acquired using a Geometrics Geode 24 channel seismograph and 24 low frequency (4.5 Hz) geophones with a geophone spacing of 3 metres for a total spread length 69 m. As acquisition progressed the spread was shifted along the alignment until then end of the planned line. At this site it was determined that a source offset of 3 metres and a grouping of 12 geophones provided good quality data for interpretation. An 8-kilogram (kg) sledgehammer striking a metal plate was used as the seismic source. The source was activated every 6m along the MASW alignments. Data was recorded with a 0.5 ms sampling rate.

Results

VES

Tables 1 and 2 show the measurements taken on site and Figure 3 presents the graphical results of the VES data for both lines. Line 2 shows slightly higher apparent resistivity along the line. Tables 3 and 4 provide information of site conditions and survey set up.

Table 1: Measured Data of VES Line 1

Electrode '*a*'-Spacing (m)	Voltage (mV)	Current (mAmps)	Apparent Resistivity (ohm-m)
0.2	3238.75	144.49	28.17
0.3	3244.67	175.9	34.77
0.5	3363.56	335.93	31.46
1	3487.47	606.35	36.14
1.5	3341.20	885.75	35.55
2	2581.25	903.24	35.91
3	1679.60	877.84	36.07
4	1350.35	904.24	37.53
6	1026.68	917.43	42.19
8	794.48	889.60	44.89
10	634.27	855.82	46.57
12	613.18	968.35	47.74
14	449.07	811.56	48.68

Table 2: Measured Data of VES Line 2

Electrode '*a*'-Spacing (m)	Voltage (mV)	Current (mAmps)	Apparent Resistivity (ohm-m)
0.2	3303.44	210.68	19.7
0.3	3336.99	260.32	24.16
0.5	3369.67	386.82	27.37
1	3361.66	740.85	28.51
1.5	1995.38	723.06	26.01

Electrode ‘*a*’-Spacing (m)	Voltage (mV)	Current (mAmps)	Apparent Resistivity (ohm-m)
2	1476.67	797.74	23.26
3	1072.75	822.33	24.59
4	888.71	797.81	28
6	697.27	841.29	31.25
8	583.73	947.81	30.96
10	457.66	917.83	31.33
12	359.02	839.14	32.26
14	332.98	917.27	31.93
16	296.58	951.65	31.33
20	198.41	805.71	30.95
22	168.66	766.81	30.4

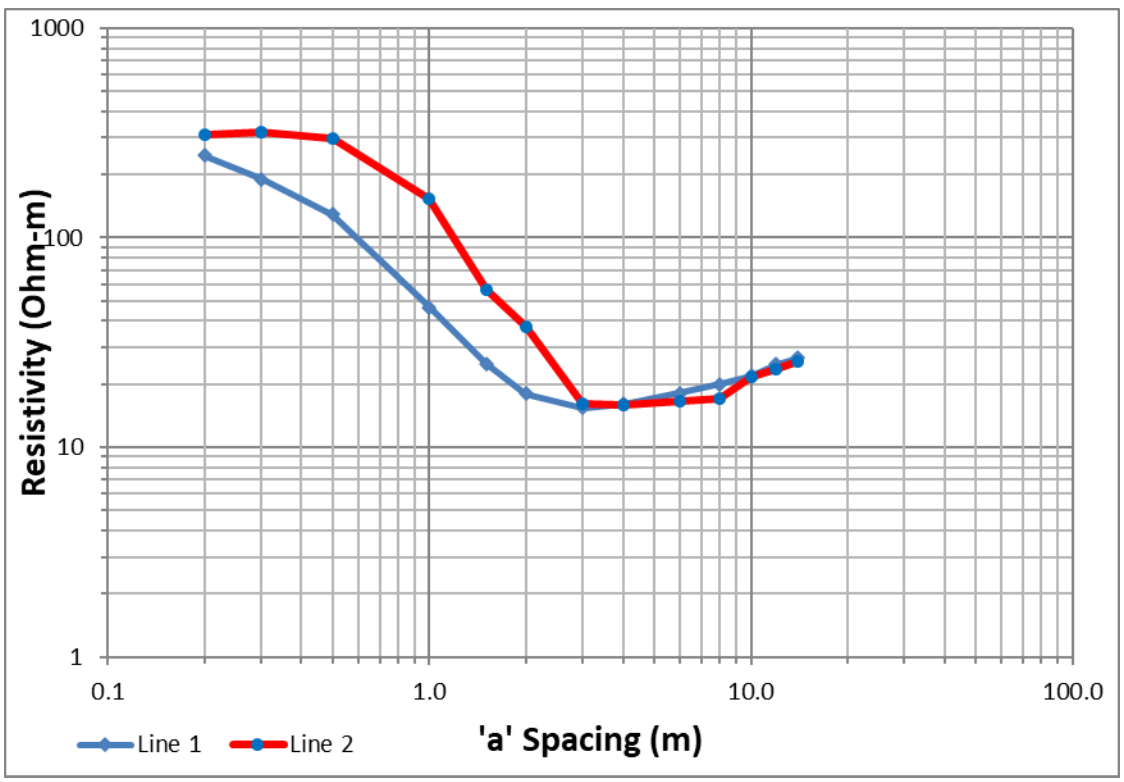


Figure 3: Graphical Presentation of Measured VES Data for both Lines.

Table 3: Line 1 Site Information

Date:	September 5, 2025	**Sounding Size:**	18m a spacing
Start Time:	12pm	**Equipment:**	Iris Syscal R1+
Location:	Cisco Ottawa Campus	**Weather:**	sunny
Sounding Orientation:	NW-SE	**Temp.:**	21 degrees
Line:	Line 1	**Datum:**	NAD83
Electrode Array:	Wenner	**Zone:**	18N
Comment:	50 cm long electrodes used	**Mid point:**	Easting: 427407.23m
Surface Soil Type:	Grass area		Northing: 5021418.29m
Surface Soil Condition:	Moist from rain previous night		

Table 4: Line 2 Site Information

Date:	September 5, 2025	**Sounding Size:**	14m a spacing
Start Time:	1pm	**Equipment:**	Iris Syscal R1+
Location:	Cisco Ottawa Campus	**Weather:**	sunny
Sounding Orientation:	SW-NE	**Temp.:**	21 degrees
Line:	Line 2	**Datum:**	NAD83
Electrode Array:	Wenner	**Zone:**	18N
Comment:	50 cm long electrodes used	**Mid point:**	Easting: 427407.23m
Surface Soil Type:	Grass area		Northing: 5021418.29m
Surface Soil Condition:	Moist from rain previous night		

MASW

The MASW data was processed using the Geometrics SeisImager S/W software package. The first step was to analyse the MASW data to determine the most suitable source offset and grouping of geophones to use for data processing. At this site it was determined that a source offset of 3 metres and a grouping of 12 geophones provided good quality data for interpretation. The source was activated every 6m along the MASW alignments. For each geophone grouping of 12 geophones, the data was analyzed to generate a dispersion curve (Figure 4) and then, using inverse modelling, to create a 1D shear wave velocity profile with depth. The midpoint of the geophone grouping was used to assign a location along the survey line. The 1D profiles were then imported into Surfer Mapping System and gridded using the Kriging method to create a 2D profile along the alignment. The 2D profile with interpreted bedrock is seen in the attached Figure 4.

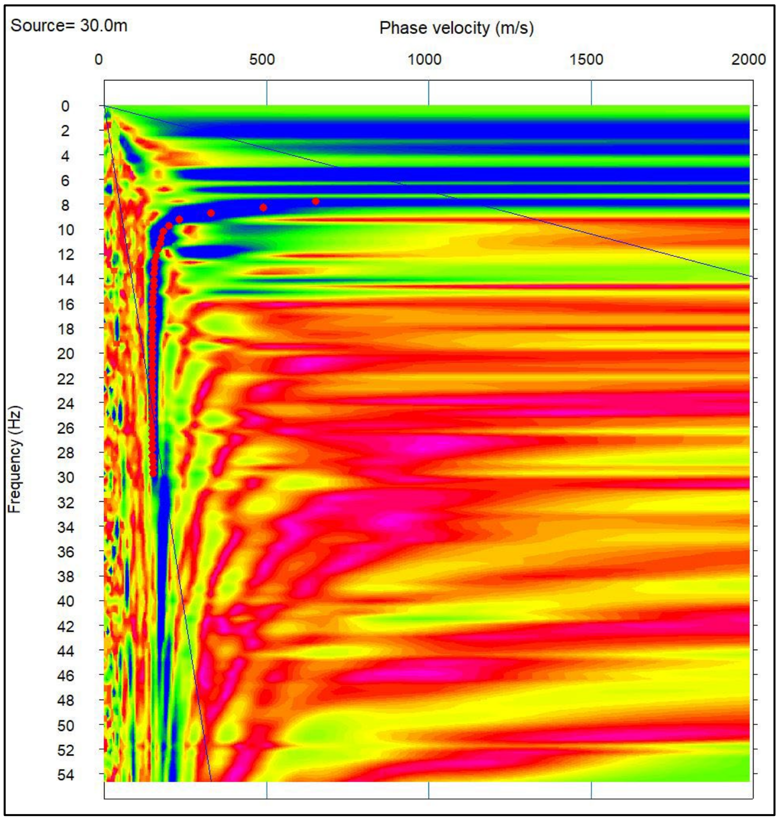


Figure 4: Example MASW Dispersion Curve Showing Picks (red dots).

Table 5: Representative Shear-Wave Velocity Profile along the MASW Line

Model Layer (mbgs)		Layer Thickness (m)	Shear Wave Velocity (m/s)	Shear Wave Travel Time Through Layer (s)
Top	Bottom			
0	1.1	1.1	123	0.008943
1.1	2.3	1.2	118	0.010169
2.3	3.7	1.4	150	0.009333
3.7	5.3	1.6	222	0.007207
5.3	7.0	1.7	327	0.005199
7.0	8.9	1.9	427	0.004450
8.9	11.0	2.1	435	0.004828
11.0	13.2	2.2	550	0.004000
13.2	15.6	2.4	619	0.003877

Model Layer (mbgs)		Layer Thickness (m)	Shear Wave Velocity (m/s)	Shear Wave Travel Time Through Layer (s)
Top	Bottom			
15.6	18.1	2.5	609	0.004269
18.1	20.9	2.8	600	0.004500
20.9	23.7	2.8	756	0.003704
23.7	26.8	3.1	875	0.003543
26.8	30.0	3.2	875	0.003657
Vs Average to 30 mbgs (m/s)				**386**

To calculate the average shear-wave velocity as required by Seismic Site Classification, the results were modelled to 30 metres below ground surface (mbgs). The location chosen for the seismic site class was in the profile in the middle of the 2D MASW line at 90m.

The time-averaged shear-wave velocity (Vs30) for the MASW Line was found to be 386 m/s, as seen in **Table 5**. Based on the National Building Code of Canada (2020), this Vs30 values corresponds to seismic site class C.

The seismic site class provided is based solely on the average shear wave velocity derived from this study. There are site specific conditions that may be present, such as liquefiable soils, clay layers with certain properties that have thicknesses of greater than 3 m, etc. that could change this seismic site classification. For more information on these potential conditions the reader should review section 4.1.8.4 of the National Building Code of Canada (2020).

Limitations of Use

The geophysical interpretation presented in this report is based on the use of geophysical surveying techniques. As with any geophysical method, interpretation presented in this report should be confirmed by intrusive methods (boreholes, test pits, etc.).

Assumptions made in the geophysical interpretation have been stated, where applicable, throughout the report.

This geophysical survey was carried out in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services provided. This report provides a professional opinion and therefore no warranty is either expressed, implied, or made as to the conclusions, advice, and recommendations offered.

Any use of the information within this report made by a third party, or any reliance on, or decisions to be made based on it, are the sole responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this letter.

Closure

We trust that this technical memorandum meets your needs at the present time. If you have any questions or require clarification, please contact the undersigned at your convenience.

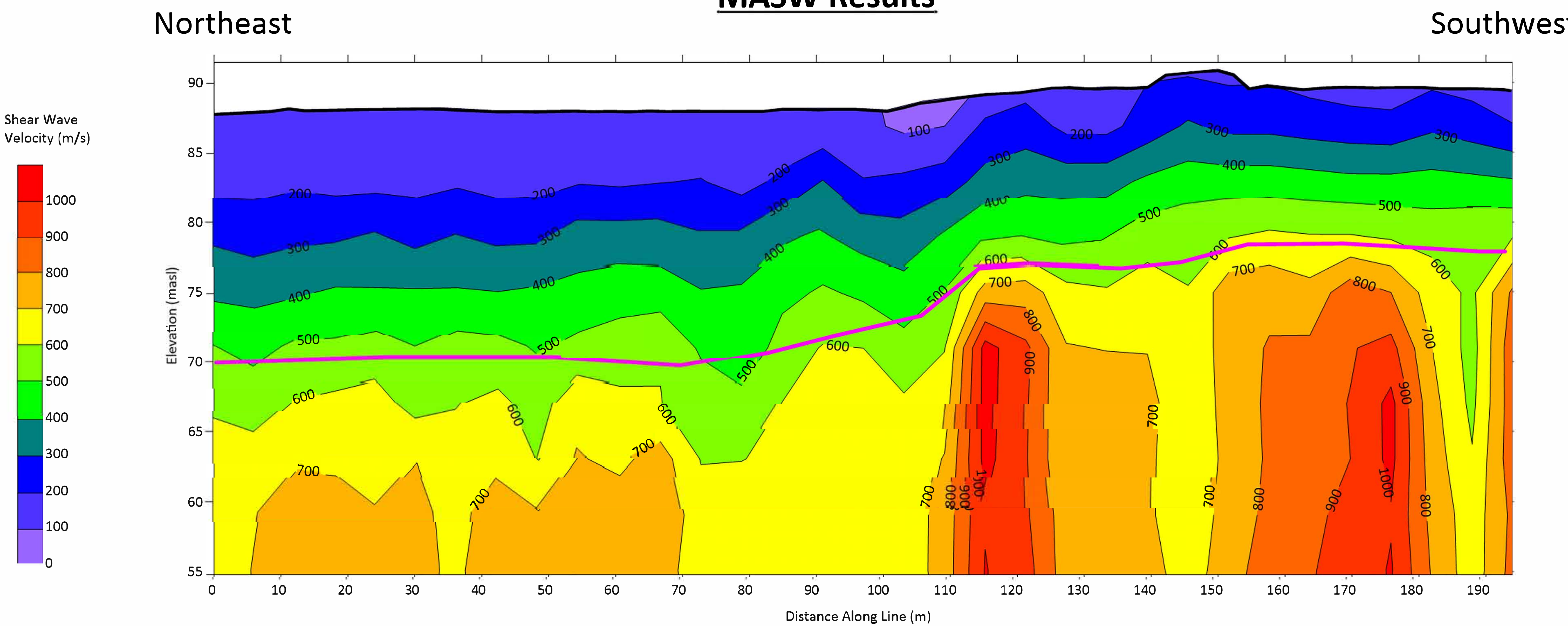
WSP Canada Inc.

Alex Bilson Darko, MSc
Geophysicist

Jon Crawford, MSc, PGeo
Geophysicist, Senior Principal

JC/ABD/jc

MASW Results



Legend

- Ground Surface
- Interpreted Bedrock

NOTES

1. This figure is to be analyzed in conjunction with the accompanying report
2. Survey data collected September, 2025
3. Scale as shown

CLIENT
Arup Canada Inc.

PROJECT
Geophysical Investigation - Cisco Ottawa Development Centre

CONSULTANT

YYYY-MM-DD	2025-09-23
PREPARED	JC
DESIGN	JC
REVIEW	ABD
APPROVED	ABD

TITLE
MASW Survey Results

PROJECT No.	PHASE	Rev.	FIGURE
CA0058422.0115		0	3

APPENDIX F

Geophysical Memorandum (Soil Resistivity and Grounding)

TECHNICAL MEMORANDUM

DATE October 09, 2025 **Project No.** CA0058422.0115

TO Arup Canada Inc

FROM Alex Bilson Darko, Jon Crawford **EMAIL alex.bilson.dark@wsp.com; jonathan.crawford@wsp.com**

VES SURVEY RESULTS – CISCO OTTAWA DEVELOPMENT CENTRE

This technical memorandum presents the results of the Vertical Electric Sounding survey carried out by WSP on September 5, 2025, at the Cisco Ottawa Development Centre in Ottawa, Ontario. The objective of the geophysical survey was to conduct a soil resistivity test using the 4-electrode Wenner method. The alignment of the surveys are shown in Figure 1.

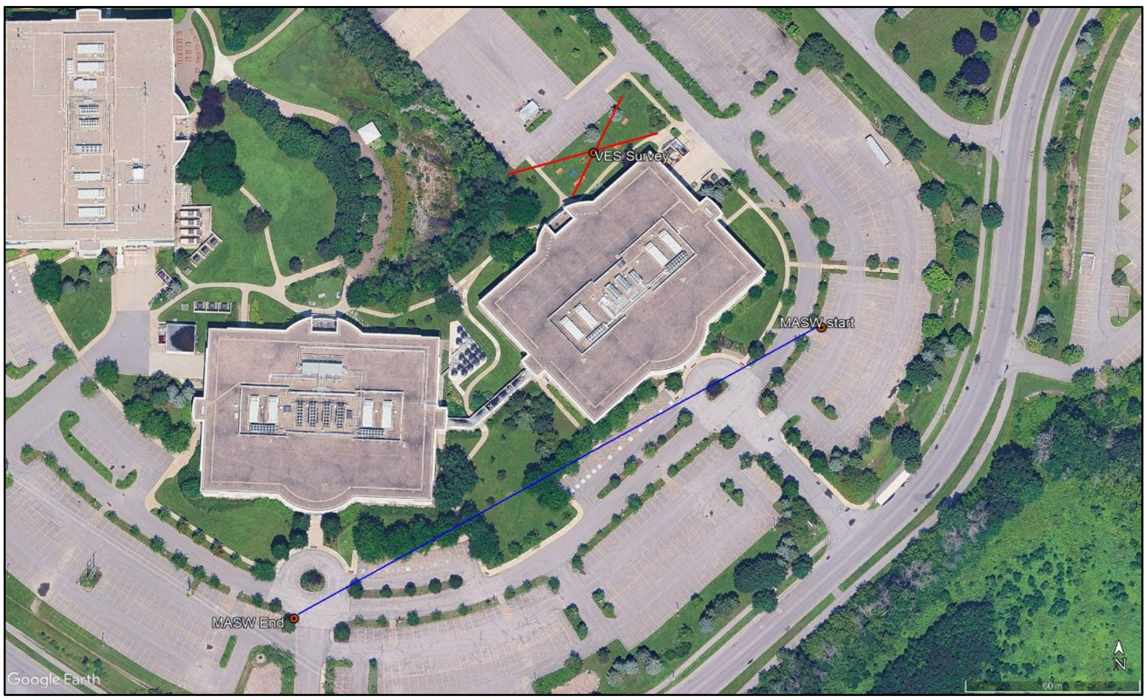


Figure 1: VES (red) Survey lines.

Methodology

The 4-electrode Wenner method, also known as vertical electric resistivity sounding (VES), is described by ASTM G57-06 and ANSI/IEEE Standard 81-1983 standards. Four evenly spaced steel electrodes are inserted into the soil in a straight line and a DC or AC test current is applied to the outer two electrodes. The associated potential difference V is measured between the inner pair of potential electrodes. The effective resistance R of subsurface material, measured in units of Ohms, follows from Ohms' law, $R=V/I$. Finally, to account for the influence of a specific electrode configuration and spacing between the four electrodes, an appropriate geometrical correction factor γ is applied to obtain the corresponding intrinsic parameter, apparent resistivity $\rho = \gamma R$, with units of ohm-metres (ohm-m). True resistivity of the ground with respect to depth is then modelled by applying an inversion process to the measured apparent resistivity data (Zohdy, 1989).

To test for vertical changes in the resistivity of the subsurface, the Wenner array is kept centered at a specific location, while the a-spacing between the current electrodes (C1 and C2) and potential electrodes (P1 and P2) is increased stepwise in order to achieve greater depth penetration (see Figure 2 below). Effective investigation depth increases with increasing electrode separation to yield a vertical electrical sounding of the subsurface. This approach highlights any significant vertical stratification in electrical properties of the ground. Additionally, the array is laid out and expanded in two orthogonal spreads about a common midpoint to investigate the possibility of planar anisotropy in the ground.

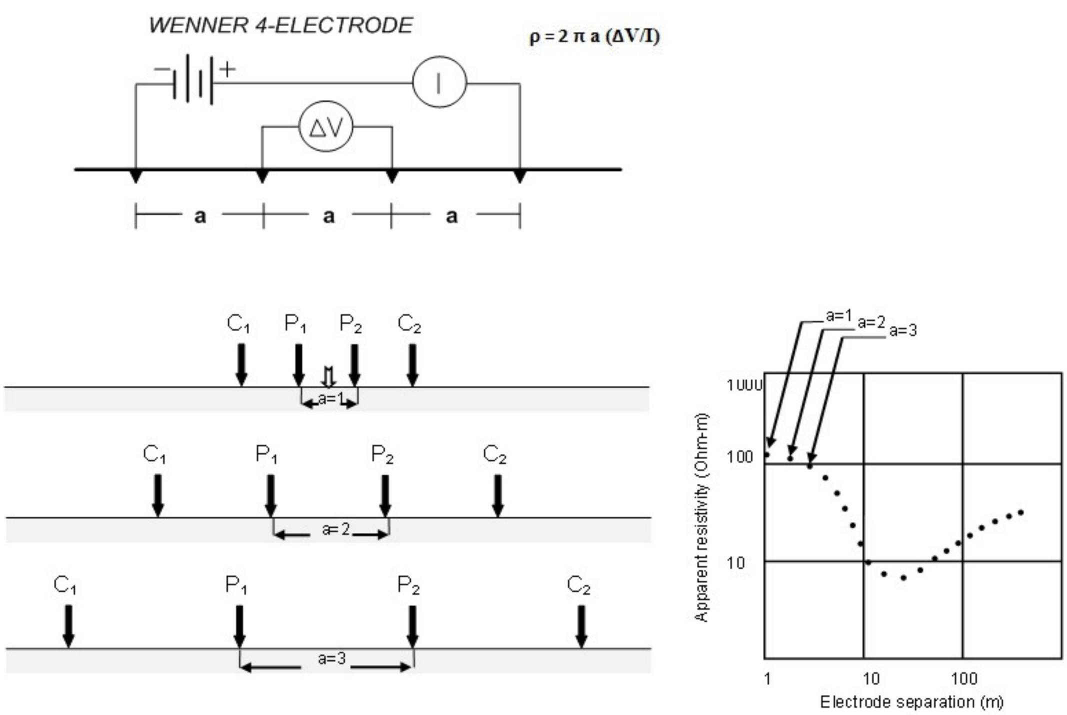


Figure 2: Typical Wenner Array Configuration

The data were acquired with the following standards as guidelines.

- Zohdy, A.A.A., 1989, A New Method for Automated Interpretation of Schlumberger and Wenner Sounding Curves, *GEOPHYSICS*, 54, 2, 245-253.
- ASTM Standard G 57, 2006, “Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method,” ASTM International, West Conshohocken, PA.
- ANSI/IEEE Standard 81, 1983, “Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System,” The Institute of Electrical and Electronics Engineers, Inc., New York, NY, USA.

Field Work

The work area was in the construction area at 9608 Carter Road which was a dirt covered area. The location of the survey lines are shown in Figure 1. The length and orientation were controlled by the work area available for this survey. A total of two VES lines were collected. The VES data were acquired using a Syscal R1+ soil resistivity meter (Iris Instruments) using the 4-electrode Wenner survey. Electrode ‘*a*’-spacings of 0.2, 0.3, 0.5, 1, 1.5, 2, 3, 4, 6, 8,10,12,14,16, and 18 m were employed. The data were stacked using a minimum of 5 readings to increase the signal to noise ratio.

Results

Tables 1 and 2 show the measurements taken on site and Figure 3 presents the graphical results of the VES data for both lines. Line 2 shows slightly higher apparent resistivity along the line. Tables 3 and 4 provide information of site conditions and survey set up.

Table 1: Measured Data of VES Line 1

Electrode ‘*a*’-Spacing (m)	Voltage (mV)	Current (mAmps)	Apparent Resistivity (ohm-m)
0.2	3238.75	144.49	28.17
0.3	3244.67	175.9	34.77
0.5	3363.56	335.93	31.46
1	3487.47	606.35	36.14
1.5	3341.20	885.75	35.55
2	2581.25	903.24	35.91
3	1679.60	877.84	36.07
4	1350.35	904.24	37.53
6	1026.68	917.43	42.19
8	794.48	889.60	44.89
10	634.27	855.82	46.57
12	613.18	968.35	47.74
14	449.07	811.56	48.68

Table 2: Measured Data of VES Line 2

Electrode '*a*'-Spacing (m)	Voltage (mV)	Current (mAmps)	Apparent Resistivity (ohm-m)
0.2	3303.44	210.68	19.7
0.3	3336.99	260.32	24.16
0.5	3369.67	386.82	27.37
1	3361.66	740.85	28.51
1.5	1995.38	723.06	26.01
2	1476.67	797.74	23.26
3	1072.75	822.33	24.59
4	888.71	797.81	28
6	697.27	841.29	31.25
8	583.73	947.81	30.96
10	457.66	917.83	31.33
12	359.02	839.14	32.26
14	332.98	917.27	31.93
16	296.58	951.65	31.33
20	198.41	805.71	30.95
22	168.66	766.81	30.4

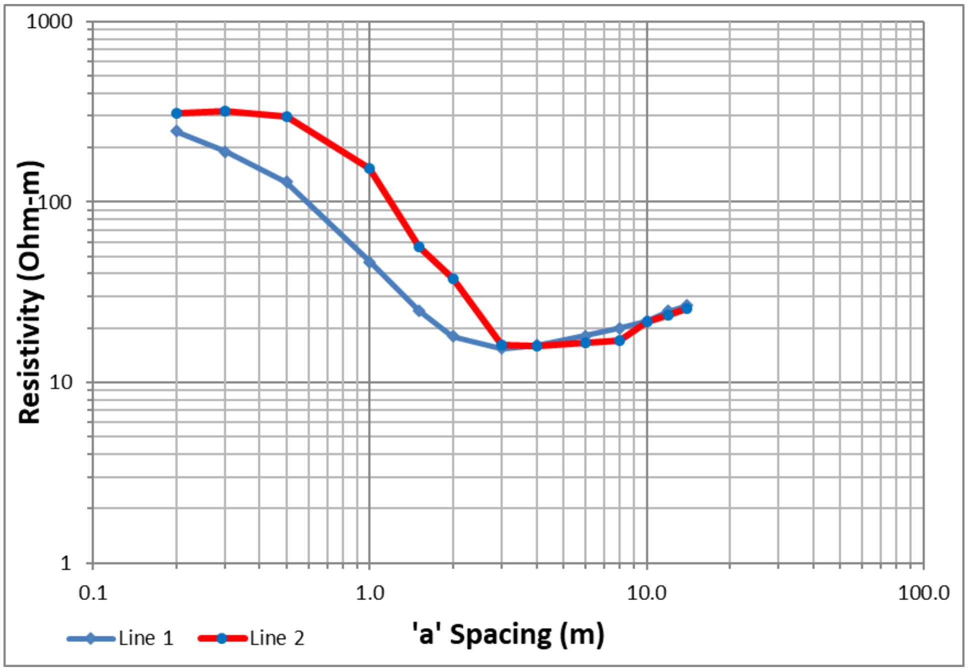


Figure 3: Graphical Presentation of Measured VES Data for both Lines.

Table 3: Line 1 Site Information

Date:	September 5, 2025	**Sounding Size:**	18m a spacing
Start Time:	12pm	**Equipment:**	Iris Syscal R1+
Location:	Cisco Ottawa Campus	**Weather:**	sunny
Sounding Orientation:	NW-SE	**Temp.:**	21 degrees
Line:	Line 1	**Datum:**	NAD83
Electrode Array:	Wenner	**Zone:**	18N
Comment:	50 cm long electrodes used	**Mid point:**	Easting: 427407.23m
Surface Soil Type:	Grass area		Northing: 5021418.29m
Surface Soil Condition:	Moist from rain previous night		

Table 4: Line 2 Site Information

Date:	September 5, 2025	**Sounding Size:**	14m a spacing
Start Time:	1pm	**Equipment:**	Iris Syscal R1+
Location:	Cisco Ottawa Campus	**Weather:**	sunny
Sounding Orientation:	SW-NE	**Temp.:**	21 degrees
Line:	Line 2	**Datum:**	NAD83
Electrode Array:	Wenner	**Zone:**	18N
Comment:	50 cm long electrodes used	**Mid point:**	Easting: 427407.23m
Surface Soil Type:	Grass area		Northing: 5021418.29m
Surface Soil Condition:	Moist from rain previous night		

The soil resistivity data collected on site and presented in Tables 1 & 2 have been used in the RESAP software to create the summer soil resistivity models shown below:

RESAP (Job ID: CISCO_OTT_Line1)
Metric/Logarithmic X and Y

22-septembre-2025 16:27:06

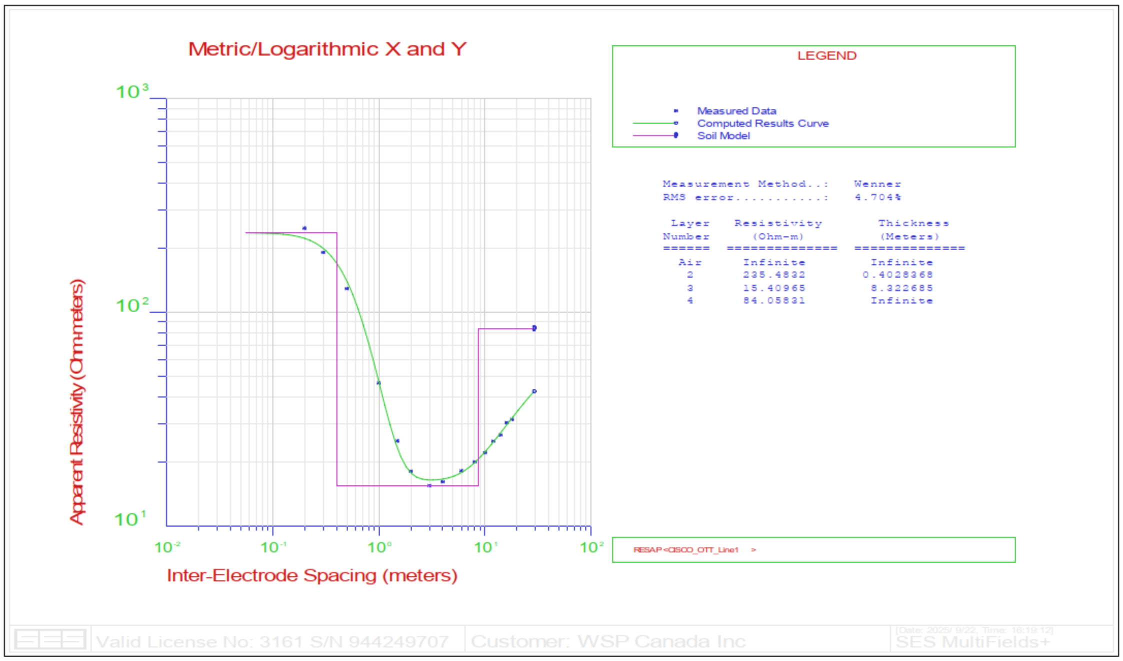


Figure 4: Soil Electrical Resistivity Model Based On Measured Data of VES Line 1

RESAP (Job ID: CISCO_OTT_Line2)
Metric/Logarithmic X and Y

22-septembre-2025 16:27:58

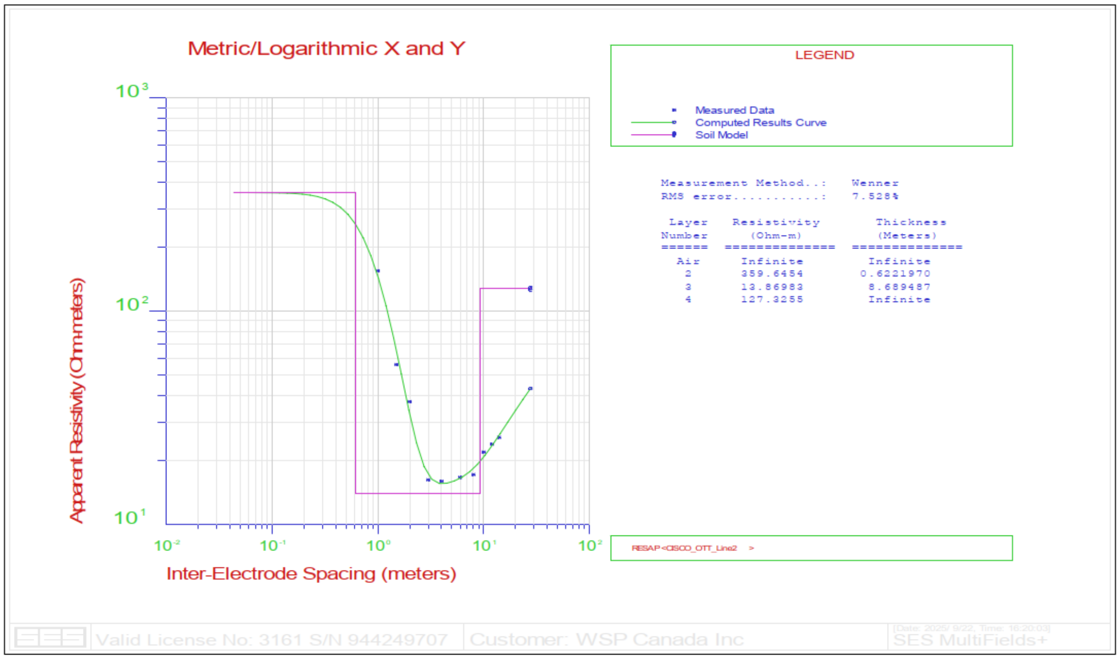


Figure 5: Soil Electrical Resistivity Model Based On Measured Data of VES Line 2

RESAP (Job ID: CISCO_OTT_Lineboth)
Metric/Logarithmic X and Y

22-septembre-2025 16:28:26

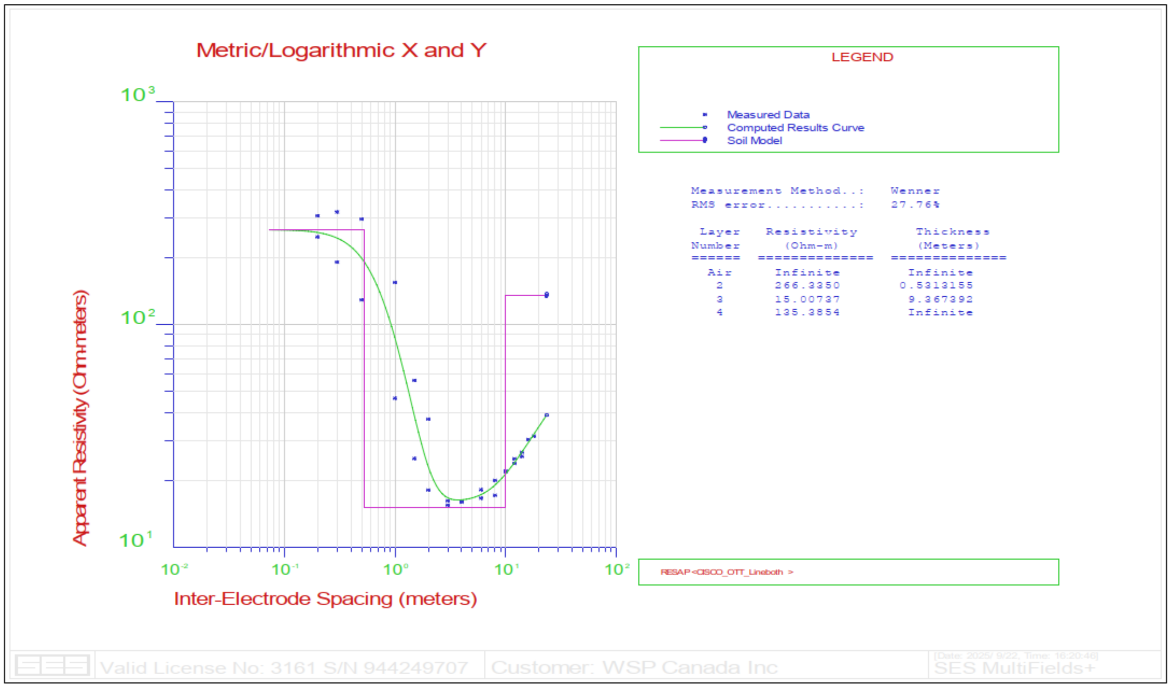


Figure 6: Soil Electrical Resistivity Model Based On Combined Measured Data of VES Line 1 and Line 2

The winter and spring soil resistivity models, shown below, were also generated using RESAP considering a frost penetration depth of 1.8 mbgs:

Winter Soil Model

Layer Number	Resistivity (Ω·m)	Thickness (m)	Factor
1 (Top)	1829,97	0,402837	7,77115
2	105,865	1,39716	6,87005
3	15,4096	6,92553	1
4 (Bottom)	84,0583	Infinite	1

Figure 7: Winter Soil Electrical Resistivity Model for VES Line 1

Spring Soil Model

Layer Number	Resistivity (Ω·m)	Thickness (m)	Factor
1 (Top)	241,458	0,15	1,02537
2	406,492	0,252837	1,72621
3	105,865	1,39716	6,87005
4	15,4096	6,92553	1
5 (Bottom)	84,0583	Infinite	1

Figure 8: Spring Soil Electrical Resistivity Model for VES Line 1

Winter Soil Model

Layer Number	Resistivity (Ω·m)	Thickness (m)	Factor
1 (Top)	2350,75	0,622197	6,53632
2	70,552	1,1778	5,08674
3	13,8698	7,51169	1
4 (Bottom)	127,326	Infinite	1

Figure 9: Winter Soil Electrical Resistivity Model for VES Line 2

Spring Soil Model

Layer Number	Resistivity (Ω·m)	Thickness (m)	Factor
1 (Top)	368,771	0,15	1,02537
2	827,912	0,472197	2,30203
3	70,552	1,1778	5,08674
4	13,8698	7,51169	1
5 (Bottom)	127,326	Infinite	1

Figure 10: Spring Soil Electrical Resistivity Model for VES Line 2

Winter Soil Model

Layer Number	Resistivity (Ω·m)	Thickness (m)	Factor
1 (Top)	1844,75	0,531316	6,92642
2	87,2883	1,26868	5,81635
3	15,0074	8,09871	1
4 (Bottom)	135,385	Infinite	1

Figure 11: Winter Soil Electrical Resistivity Model for VES Line 1 And Line 2 Combined

Spring Soil Model

Layer Number	Resistivity (Ω·m)	Thickness (m)	Factor
1 (Top)	273,093	0,15	1,02537
2	556,007	0,381316	2,08762
3	87,2883	1,26868	5,81635
4	15,0074	8,09871	1
5 (Bottom)	135,385	Infinite	1

Figure 12: Spring Soil Electrical Resistivity Model for VES Line 1 And Line 2 Combined

WSP recommends using the soil models presented for both VES Line 1 and Line 2 combined in the grounding design of the project.

Limitations of Use

The geophysical interpretation presented in this report is based on the use of geophysical surveying techniques. As with any geophysical method, interpretation presented in this report should be confirmed by intrusive methods (boreholes, test pits, etc.).

Assumptions made in the geophysical interpretation have been stated, where applicable, throughout the report.

This geophysical survey was carried out in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services provided. This report provides a professional opinion and therefore no warranty is either expressed, implied, or made as to the conclusions, advice, and recommendations offered.

Any use of the information within this report made by a third party, or any reliance on, or decisions to be made based on it, are the sole responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this letter.

Closure

We trust that this technical memorandum meets your needs at the present time. If you have any questions or require clarification, please contact the undersigned at your convenience.

WSP Canada Inc.

Alex Bilson Darko, MSc
Geophysicist

Jon Crawford, MSc, PGeo
Geophysicist, Senior Principal

JC/ABD/jc

Robin Richard, P.Eng.
Electrical Engineer

Guillaume Marcon, P.Eng.
Electrical Engineer

APPENDIX G

Records of Borehole Logs (Previous investigation)

PROJECT: CA0058422.0115

LOCATION: N 5021358.62; E 427287.19

RECORD OF BOREHOLE: BH25-01

BORING DATE: September 22, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 140kg DROP, mm

DRILL RIG: CME 55 LC/Track

HAMMER TYPE: AUTOMATIC

BORING METHOD: Power Auger — 200 mm O.D; 108 mm I.D Hollow Stem Auger

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa (nat V. + / rem V. ⊕)	WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	GROUND SURFACE	89.06							
0	TOPSOIL - (SM) SILTY SAND; dark brown, few rootlets, trace wood fragments; non-cohesive, moist, compact	0.00 / 88.86	1A	SS					
	Fill - (GP) mostly GRAVEL with sand, trace silt; grey; non-cohesive, moist, compact	0.20	1B	SS	11				
1	(CL/CH) LEAN CLAY to FAT CLAY, weathered crust; grey-brown; cohesive, w<PL to W~PL, firm to stiff	88.37 / 0.69	2	SS	8				3 27 (70)
2			3	SS	5			CHEM	
			4	SS	6		Wl 58		
3			5	SS	3		52.7		
4	(CH) FAT CLAY; grey; cohesive, w>PL, medium plasticity clayey, stiff	85.25 / 3.81	6	SS	WH		59.3		
5			7	SS	WH				
			8	SS	WH		56 / 58.7		
6	(CH) FAT CLAY; grey; cohesive, W>PL, stiff to firm	83.26 / 5.80	9	SS	WH		59.4		
7			10	SS	WH		57.2		
8			11	SS	WH		60.8		
9			12	SS	WH		57.8		
			13	SS	WH		59 / 65		
10			14	SS	WH				

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH nat V. + Q - ● ; rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT Wp —○W— Wl: 10 20 30 40

PIEZOMETER OR STANDPIPE INSTALLATION

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

wsp

LOGGED: IUK

CHECKED: AKP

RECORD OF BOREHOLE: BH25-01

PROJECT: CA0058422.0115
LOCATION: N 5021358.62; E 427287.19
BORING DATE: September 22, 2025
DATUM:
SPT/DCPT HAMMER: MASS, 140kg DROP, mm
DRILL RIG: CME 55 LC/Track
HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE / SHEAR STRENGTH Cu, kPa	HYDRAULIC CONDUCTIVITY k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		--- *CONTINUED FROM PREVIOUS PAGE* ---								
10	Power Auger	(CH) FAT CLAY; grey; cohesive, W>PL, stiff to firm	78.70 / 10.36	14	SS	WH				
11	Power Auger	(SM) SILTY SAND, some gravel, mostly silt, some clay, some sand; grey (GLACIAL TILL); non-cohesive, wet, very loose to very dense		15A / 15B	SS	2				12 51 (37)
	Power Auger		77.48 / 11.58	16	SS	>50				
12		END OF BOREHOLE Auger refusal on inferred possible bedrock or boulder								
13										
14										
15										
16										
17										
18										
19										
20										

DEPTH SCALE
1 : 50

LOGGED: IUK
CHECKED: AKP

RECORD OF BOREHOLE: BH25-02

PROJECT: CA0058422.0115

LOCATION: N 5021292.60; E 427261.73

SPT/DCPT HAMMER: MASS, 140kg DROP, mm

BORING DATE: September 29, 2025

DRILL RIG: CME 55 LC/Track

DATUM:

HAMMER TYPE: AUTOMATIC

Column headings: DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE (DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m)) | SAMPLES (NUMBER, TYPE, BLOWS/0.3m) | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○ (20, 40, 60, 80) | HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp —○W— Wl (10, 20, 30, 40) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Boring method: 0 – 1.8 m: Hydrovac; 1.8 – 8.23 m: Power Auger, 200 mm O.D; 108 mm I.D Hollow Stem Auger

DESCRIPTION	ELEV. / DEPTH (m)
GROUND SURFACE	88.78
TOPSOIL	0.00
(CL/CH) LEAN CLAY to FAT CLAY, weathered crust, medium plasticity clayey fines; grey, brown; cohesive, w~PL, stiff to soft - soft at 3.05 m	88.48 0.30
(CH) FAT CLAY, medium to high plasticity fines; grey, cohesive, w~PL to w>PL, stiff to firm	85.05 3.73
(ML) SANDY SILT, little clay; grey (GLACIAL TILL); non-cohesive, wet, very dense	80.60 8.23
END OF BOREHOLE Spoon and Auger refusal on inferred possible bedrock or boulder	

NUMBER	TYPE	BLOWS/0.3m
1	SS	10
2	SS	5
3	SS	2
4	SS	WH
5	SS	WH
6	SS	WH
7	SS	WH
8	SS	WH
9	SS	WH
10	SS	>50

DEPTH SCALE

1 : 50

wsp

LOGGED: IUK

CHECKED: AKP

GTA-BHS 005 S:\CLIENTS\CBRE_LIMITED\OTTAWA_ON\02_DATA\GINT\OTTAWA_ON.GPJ GAL-MIS.GDT 2/25/26

RECORD OF BOREHOLE: BH25-03

PROJECT: CA0058422.0115
LOCATION: N 5021355.75; E 427351.40
BORING DATE: September 23, 2025
DATUM:
SPT/DCPT HAMMER: MASS, 140kg DROP, mm
DRILL RIG: CME 55 LC/Track
HAMMER TYPE: AUTOMATIC

BORING METHOD: Power Auger; 200 mm O.D; 108 mm I.D Hollow Stem Auger

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20, 40, 60, 80
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● ; rem V. ⊕ U - ○ : 20, 40, 60, 80
HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}
WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl : 10, 20, 30, 40
ADDITIONAL LAB. TESTING
PIEZOMETER OR STANDPIPE INSTALLATION
GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)
	GROUND SURFACE	88.28
0	TOPSOIL. few rootlets and wood fragments, trace gravel; dark brown; non-cohesive, dry, compacted	0.00
	FILL - (SM) SILTY SAND with gravel, rootlets; dark brown mottled, orange; non-cohesive, dry, compact	0.10
	(CL/CH) LEAN CLAY to FAT CLAY; grey mottled, brown (WEATHERED CRUST); cohesive, w<PL to w~PL, stiff to soft	86.83 / 1.45
	- firm from 2.29 m	
	- soft from 3.05	
	(CH) FAT CLAY, medium to highly plasticity fines; grey; cohesive, w>PL, firm to stiff	84.55 / 3.73
10	*CONTINUED NEXT PAGE*	

SAMPLES

NUMBER	TYPE	BLOWS/0.3m	Water content labels
1A			
1B	SS	14	
2	SS	15	
3	SS	10	
4	SS	5	
5	SS	3	65; 52.6
6	SS	WH	55.7
7	SS	1	60.3
8	SS	WH	54; 55.2
9	SS	WH	56.7
10	SS	WH	56.4

DEPTH SCALE
1 : 50
LOGGED: IUK
CHECKED: AKP

RECORD OF BOREHOLE: BH25-03

PROJECT: CA0058422.0115
LOCATION: N 5021355.75; E 427351.40
BORING DATE: September 23, 2025
DATUM:
SPT/DCPT HAMMER: MASS, 140kg DROP, mm
DRILL RIG: CME 55 LC/Track
HAMMER TYPE: AUTOMATIC

Boring method: Power Auger; 200 mm O.D; 108 mm I.D Hollow Stem Auger

--- CONTINUED FROM PREVIOUS PAGE ---

Depth (m)	Description	Elev. / Depth (m)	Sample No.	Type	Blows/0.3m	Water Content (%)	Grain Size Distribution (%) GR SA SI CL
10	(CH) FAT CLAY, medium to highly plasticity fines; grey; cohesive, w>PL, firm to stiff						
	(SM) SILTY SAND with gravel, mostly silt, some clay, some sand, few gravel; grey; non-cohesive, wet, very loose to loose	77.76 / 10.52					
11			11	SS	2	~10	17 42 (41)
12	- few gravel from 12.19 m		12	SS	4	~18	3 46 (51)
14			13	SS	8	~12	
	Dynamic Cone Penetration Test (DCPT)	73.95 / 14.33					
15	END OF BOREHOLE END OF DCPT Auger and DCPT refusal on inferred bedrock or boulder	73.35 / 14.93					

DEPTH SCALE
1 : 50

LOGGED: IUK
CHECKED: AKP

RECORD OF BOREHOLE: BH25-04

PROJECT: CA0058422.0115
LOCATION: N 5021287.07; E 427356.14
SPT/DCPT HAMMER: MASS, 140kg DROP, mm

BORING DATE: September 30, 2025
DRILL RIG: CME 55 LC/Track

SHEET 1 OF 1
DATUM:
HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
		GROUND SURFACE	88.72				
0	Hydro-Vac	TOPSOIL	0.00				
		CLAY, contains cobbles; cohesive, stiff	88.26 / 0.46				
1							
2	Power Auger, 210 mm O.D. Hollow Stem Auger			1	SS	7	
		(CL/CH) LEAN CLAY to FAT CLAY, clayey fines, low to medium plasticity; grey brown (WEATHERED CRUST); cohesive, w<PL to w~PL, firm	86.51 / 2.21	2	SS	7	
3				3	SS	4	CHEM
		(CH) FAT CLAY; grey; cohesive, w~PL to w>PL, firm to stiff	84.99 / 3.73				
4				4	SS	2	
5				5	SS	WH	
6				6	SS	WH	
				7	TP	WH	
7		(SM) SILTY SAND, sand and gravel, mostly silt, some clay, some sand, little gravel; grey (GLACIAL TILL); cohesive, w>PL, very soft	81.94 / 6.78	8	SS	>50	
		END OF BOREHOLE Spoon on auger refusal on inferred bedrock or boulder	81.54 / 7.18				
8							
9							
10							

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl : 10 20 30 40

55.3

PIEZOMETER OR STANDPIPE INSTALLATION
GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

DEPTH SCALE
1 : 50

wsp

LOGGED: IUK
CHECKED: AKP

RECORD OF BOREHOLE: BH25-05

PROJECT: CA0058422.0115
LOCATION: N 5021388.89; E 427376.14
SHEET 1 OF 1
BORING DATE: September 23, 2025
DATUM:
SPT/DCPT HAMMER: MASS, 140kg DROP, mm
DRILL RIG: CME 55 LC/Track
HAMMER TYPE: AUTOMATIC

Boring method: Power Auger, 200 mm O.D; 108 mm I.D Hollow Stem Auger

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
	GROUND SURFACE	87.07				
0	TOPSOIL - (PT) SILTY PEAT; dark brown, little rootlets; dry, compact	0.00	1A			
	FILL - (SM) SILTY SAND with gravel; dark brown with mottled redish orange, grey; non-cohesive, dry, compact	0.11	1B	SS	16	
	(CL/CH) LEAN CLAY, low to medium plasticity clayey fines; grey mottled brown (WEATHERED CRUST); cohesive, w<PL, very stiff to firm	86.46 0.61	2A			
	- pockets of sand		2B	SS	19	
2			3	SS	5	CHEM
	END OF BOREHOLE	84.94 2.13				

NOTE:

1. Stopped borehole above buried grey pipe.

DEPTH SCALE 1 : 50

LOGGED: IUK
CHECKED: AKP

RECORD OF BOREHOLE: BH25-06

PROJECT: CA0058422.0115
LOCATION: N 5021310.61; E 427408.85
SPT/DCPT HAMMER: MASS, 140kg DROP, mm

BORING DATE: September 24, 2025
DRILL RIG: CME 55 LC Track

DATUM:
HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa (nat V. + / rem V. ⊕)	WATER CONTENT PERCENT (Wp / W / Wl)	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE	86.97						
0	Hydro-Vac	ASPHALT	0.00						Sand
		FILL - (GW) well graded GRAVEL with sand; grey; non-cohesive (PAVEMENT STRUCTURE)	0.08	1	GS				Bentonite
		(CL/CH) LEAN CLAY to FAT CLAY, weathered crust; grey mottled brown; cohesive, w~PL, firm to soft	86.42 / 0.55						
1				2	GS				Sand
2	Power Auger, 210 mm O.D. Hollow Stem Auger			3	SS	6			
				4	SS	4		52.4 (Wp–Wl, Wl 52)	October 24, 2025 (water level)
3				5	SS	2		63.1	Screen
		(CH) FAT CLAY; grey; cohesive, w>PL, stiff	83.24 / 3.73						
4				6	SS	WH	⊕ / +	50.9 (Wp–Wl, Wl 52)	
5				7	SS	WH		61.1	Sand
									Hole Plug
				8	SS	WH	⊕ / +	54.1	
6				9	SS	WH		59.3	
7				10	SS	WH	⊕ / +	52.7 (Wp–Wl, Wl 53)	
8									
9		(SM) SILTY SAND with gravel, mostly sand, some silt, little gravel, little clay; grey (GLACIAL TILL); non-cohesive, wet, very dense	77.83 / 9.19	11	SS	50/0.05		○	
		END OF BOREHOLE Refer to Record of Drillhole BH25-06							RQD = 84%
10									

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

LOGGED: IUK
CHECKED: AKP

PROJECT: CA0058422.0115

LOCATION: N 5021310.61; E 427408.85

RECORD OF BOREHOLE: BH25-06

BORING DATE: September 24, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 140kg DROP, mm

DRILL RIG: CME 55 LC Track

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		--- CONTINUED FROM PREVIOUS PAGE ---									
10		NOTE: 1. Groundwater level measured on October 24, 2025 at 2.37 mbgs.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

LOGGED: IUK

CHECKED: AKP

RECORD OF DRILLHOLE: BH25-06

PROJECT: CA0058422.0115
LOCATION: N 5021310.61 ;E 427408.85
INCLINATION: -90° AZIMUTH: ---

DRILLING DATE: September 24, 2025
DRILL RIG: CME 55 LC Track
DRILLING CONTRACTOR: Downing Drilling

DATUM:

NOTE: For abbreviations, symbols and descriptions refer to **LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY**

DEPTH SCALE METRES	DESCRIPTION	ELEV. / DEPTH (m)	RUN No.	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	FEATURES
	GROUND SURFACE	77.78			
	GRANITE, fresh, thickly to very thickly bedded; light greyish pink; medium to coarse grained, non-porous, very strong	9.19	1	BD,PL,SM JN,PL,SM JN,PL,SM,SO JN,UN,RO JN,PL,RO	Broken Core
10	UCS=141 MPa			JN,UN,RO	Broken Core
		76.41			
	GRANITE, slightly weathered, thickly to very thickly bedded; light greyish pink; medium to coarse grained, non-porous, very strong	10.56	2		
11				JN,UN,RO JN,PL,SM,SO JN,PL,SM,PC	
12	UCS=85 MPa	74.88			
	END OF DRILLHOLE	12.09			
13					
14					
15					
16					
17					
18					
19					

Column headings: DRILLING RECORD; SYMBOLIC LOG; FLUSH RETURN; RECOVERY (TOTAL CORE % 80 60 40 20; SOLID CORE % 80 60 40 20); R.Q.D. % 80 60 40 20; FRACT. INDEX PER 5 10 15 20; DIP w.r.t. CORE AXIS 0 30 60 90; Jr; Ja; Jcon; WEATH-ERING INDEX W1 W2 W3 W4 W5 W6; Diametral Point Load Index (MPa) 2 4 6; PIEZOMETER

DEPTH SCALE
1 : 50

wsp

LOGGED: IUK
CHECKED: AKP

RECORD OF BOREHOLE: BH25-07

PROJECT: CA0058422.0115

LOCATION: N 5021422.34; E 427420.81

SHEET 1 OF 2

BORING DATE: September 26, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 140kg DROP, mm

DRILL RIG: Hydrovac/Day/CME 55 LC/Track

HAMMER TYPE: AUTOMATIC

Column headings: DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE (DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m)) | SAMPLES (NUMBER, TYPE, BLOWS/0.3m) | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa, nat V. + Q - ●, rem V. ⊕ U - ○ (20, 40, 60, 80) | HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT, Wp ⊢—○W—⊣ Wl (10, 20, 30, 40) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Soil Profile

Depth (m)	Boring Method	Description	Elev. / Depth (m)
0	Hydro-Vac	GROUND SURFACE	86.94
		TOPSOIL - (ML) SANDY SILT, (PT) SILTY PEAT; dark brown; some rootlets	0.00
		FILL - (GP) poorly graded GRAVEL with SAND; grey, contains cobbles; non-cohesive	0.15
		(CL/CH) LEAN CLAY to FAT CLAY, mostly low plasticity clayey fines; grey mottled brown (WEATHERE CRUST); cohesive, w<PL to w>PL, stiff to soft	86.10 / 0.84
	Power Auger, 210 mm O.D. Hollow Stem Auger	- firm from 2.21	
		- soft from 2.97, w>PL	
		(CH) FAT CLAY, mostly high plasticity, clayey fines; grey; cohesive, w>PL, firm to stiff	83.29 / 3.65
10		*CONTINUED NEXT PAGE*	

Samples and Test Results

Number	Type	Blows/0.3m	Water content (%)
1	GS		
2	GS		
3	GS		
4	SS	9	
5	SS	5	
6	SS	4	
7	SS	2	50.2
8	SS	WH	61; 62.3
9	SS	WH	59.2
10	SS	WH	51.5
11	SS	WH	61.9
12	SS	WH	53; 52.1
13	SS	WH	56

Piezometer / Standpipe Installation

Bentonite

Sand

October 24, 2025 (water level)

Screen

Sand

Bentonite

Backfill

DEPTH SCALE

1 : 50

LOGGED: IUK

CHECKED: AKP

PROJECT: CA0058422.0115

LOCATION: N 5021422.34; E 427420.81

RECORD OF BOREHOLE: BH25-07

BORING DATE: September 26, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 140kg DROP, mm

DRILL RIG: Hydrovac/Day/CME 55 LC/Track

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE / SHEAR STRENGTH Cu, kPa	HYDRAULIC CONDUCTIVITY k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Power Auger, 210 mm O.D. Hollow Stem Auger	(CH) FAT CLAY, mostly high plasticity, clayey fines; grey; cohesive, w>PL, firm to stiff									Backfill
11		- little sand			14	SS	WH				
		(SM) SILTY CLAYEY SAND, mostly fines to medium, little low plasticity, fines, little gravel; grey (GLACIAL TILL); non-cohesive, wet, very dense		75.15 / 11.81	15	SS	50				
12		END OF BOREHOLE									

NOTE:

1. Groundwater level measured on October 24, 2025 at 2.64 mbgs.

Legend: nat V. +, Q - ●, rem V. ⊕, U - ○; Wp —○W— Wl; GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

DEPTH SCALE 1 : 50

LOGGED: IUK

CHECKED: AKP

PROJECT: CA0058422.0115

LOCATION: N 5021335.13; E 427450.54

RECORD OF BOREHOLE: BH25-08

BORING DATE: September 29, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 140kg DROP, mm

DRILL RIG: Hydrovac/Day/CME 55 LC/Track

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		GROUND SURFACE	87.22					
0	Hydro-Vac	ASPHALT	0.00					
		FILL - GRANULAR; grey; non-cohesive	0.11					
1		(CL/CH) LEAN CLAY; grey, weathered crust; cohesive, w<PL to w~PL, stiff to soft	86.46 / 0.76					
2	Power Auger, 200 mm O.D; 108 mm I.D Hollow Stem Auger			1	SS	9		
				2	SS	4		
3		w~PL, soft, trace white shell		3	SS	3		
4				4	SS	2		
5		(CH) FAT CLAY; grey; cohesive, w>PL, stiff	82.65 / 4.57	5	SS	WH		
6				6	SS	WH		
7				7	SS	WH		
				8	SS	WH		
8				9	SS	WH		
9		(SM) SILTY SAND, mostly silt, some clay, little sand, little gravel; grey (GLACIAL TILL); cohesive, w>PL, soft	78.08 / 9.14	10	SS	4		14 45 (41)
10								

Plot headings: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○ (20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp —○W— Wl (10, 20, 30, 40); PIEZOMETER OR STANDPIPE INSTALLATION

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

LOGGED: IUK

CHECKED: AKP

PROJECT: CA0058422.0115

LOCATION: N 5021335.13; E 427450.54

RECORD OF BOREHOLE: BH25-08

BORING DATE: September 29, 2025

DATUM:

SPT/DCPT HAMMER: MASS, 140kg DROP, mm

DRILL RIG: Hydrovac/Day/CME 55 LC/Track

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —o W— Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION; GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Power Auger	(SM) SILTY SAND, mostly silt, some clay, little sand, little gravel; grey (GLACIAL TILL); cohesive, w>PL, soft		76.68							
		END OF BOREHOLE Auger refusal on inferred bedrock or boulder		10.54							
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

wsp

LOGGED: IUK

CHECKED: AKP

RECORD OF BOREHOLE: BH25-09

PROJECT: CA0058422.0115
LOCATION: N 5021372.50; E 427476.12
BORING DATE: September 26, 2025
DATUM:
SPT/DCPT HAMMER: MASS, 140kg DROP, mm
DRILL RIG: Hydrovac/Day/CME 55 LC/Track
HAMMER TYPE: AUTOMATIC

Column headings: DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE (DESCRIPTION, STRATA PLOT, ELEV. DEPTH (m)) | SAMPLES (NUMBER, TYPE, BLOWS/0.3m) | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80) | SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20, 40, 60, 80) | HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}) | WATER CONTENT PERCENT (Wp ⊢ ○W ⊣ Wl) (10, 20, 30, 40) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION | GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Soil Profile

Description	Elev. (m)	Depth (m)
GROUND SURFACE	87.10	
TOPSOIL - (PT) SANDY SILT to SILTY SAND, silty peat, few gravel; dark brown, some think rootlets;	87.10	0.00
FILL - (GP) poorly graded GRAVEL with sand, contains cobbles, little thick rootlets; grey; non-cohesive	86.90	0.20
(CL-ML) CLAYEY SILT with sand, mostly low plasticity clayey fines, little fine sand; grey-brown, contains rootlets; cohesive, w<PL, very stiff	86.69	0.41
(CL/CH) LEAN CLAY, mostly low plasticity clayey fines; grey-brown, weathered crust; cohesive, w<PL to w~PL, stiff to firm	85.22	1.88
(CH/CL) FAT CLAY to LEAN CLAY; grey; cohesive, w~PL to w>PL, stiff to firm	84.13	2.97

Boring Method: Hydro-Vac (0 to 1.88 m); Power Auger, 210 mm O.D. Hollow Stem Auger (1.88 m to 10 m)

Samples

Number	Type	Blows/0.3m	Water Content (%)	Additional Lab. Testing
1	GS	-		
2	GS	-		
3	GS	-		
4	SS	8		
5	SS	4		CHEM
6	SS	1	51.6	
7	SS	2	53.7	
8	SS	WH	59.3	
9	SS	WH	62.7	
10	SS	WH	56	
11	SS	WH	66	
12	SS	WH	51.7	
13	SS	WH	54.1	

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

LOGGED: IUK
CHECKED: AKP

RECORD OF BOREHOLE: BH25-09

PROJECT: CA0058422.0115
LOCATION: N 5021372.50; E 427476.12
SPT/DCPT HAMMER: MASS, 140kg DROP, mm

BORING DATE: September 26, 2025
DRILL RIG: Hydrovac/Day/CME 55 LC/Track

DATUM:
HAMMER TYPE: AUTOMATIC

--- CONTINUED FROM PREVIOUS PAGE ---

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	WATER CONTENT PERCENT	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
10	Power Auger; 210 mm O.D. Hollow Stem Auger	(CH/CL) FAT CLAY to LEAN CLAY; grey; cohesive, w~PL to w>PL, stiff to firm							
11		- Lean clay		14	SS	WH	rem V. / nat V.	50.3	
12		(SM) SILTY SAND with gravel, mostly sand, some silt, little gravel, little clay; grey (GLACIAL TILL); non-cohesive, wet, compact to very dense	74.90 / 12.20	15	SS	5			12 42 (47)
14				16	SS	21		~10	15 51 (34)
15			71.73 / 15.37	17A / 17B	SS	50			
		END OF BOREHOLE Spoon refusal on inferred bedrock or boulder							

DEPTH SCALE
1 : 50

wsp

LOGGED: IUK
CHECKED: AKP

PROJECT: 001-2075

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 00-1

BORING DATE: May 16, 2000

SHEET 1 OF 1

DATUM: Geodetic

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200mm Diam (Hollow Stem)

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface	88.76				
	Brown clayey TOPSOIL	88.64 / 0.12				Bentonite Seal
	Very stiff to stiff brown to grey SILTY CLAY (Weathered Crust)					
2			1	50 DO	6	∇
3.5			2	50 DO	2	Native Backfill
4.3	Firm to stiff grey SILTY CLAY	84.46 / 4.30				
6.85	Very loose grey GLACIAL TILL	81.91 / 6.85	3	50 DO	2	Standpipe; Caved Material
7.46	END OF BOREHOLE	81.30 / 7.46				W.L in Standpipe at Elev.86.68m May 16, 2000

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20, 40, 60, 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ●; rem V. ⊕ U - O; 20, 40, 60, 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—O W—⊣ Wl; 20, 40, 60, 80

ADDITIONAL LAB. TESTING

DEPTH SCALE

1 : 50

LOGGED: S.F.

CHECKED: G.

Golder Associates

BOREHOLE 001-2075.GPJ HYDROGEO.GDT 5 26 00

PROJECT: 001-2075

RECORD OF BOREHOLE: 00-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: May 16, 2000

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O^W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / 200mm Diam (Hollow Stem)	Ground Surface		88.33							
		Black clayey TOPSOIL		0.00							
		Very stiff to stiff brown to grey SILTY CLAY (Weathered Crust)		88.05 0.28							
1											∇
2					1	50 DO	4				
3					2	50 DO	2				
4								⊕ ~17; + ~80			
								⊕ ~16; + ~64			
		Very loose grey GLACIAL TILL		83.91 4.42							
5					3	50 DO	2				
6					4	50 DO	3				
					5	50 DO	4				
7		END OF BOREHOLE SAMPLER REFUSAL		81.12 7.21							
8											W.L in Open Hole at Elev.87.26m on completion of drilling
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: S.F.

CHECKED: ------

BOREHOLE 001-2075.GPJ HYDROGEO.GDT 5 26 00

PROJECT: 001-2075

RECORD OF BOREHOLE: 00-3

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: May 16, 2000

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - O (20, 40, 60, 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}); WATER CONTENT PERCENT Wp —O W— Wl (20, 40, 60, 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		87.95							▽
		Black clayey TOPSOIL		0.00							Bentonite Seal
		Very stiff to stiff brown to grey SILTY CLAY (Weathered Crust)		87.67 / 0.28							
2					1	50 DO	8				
3											Native Backfill
		Firm to stiff grey SILTY CLAY		84.60 / 3.35	2	50 DO	2				
6											Standpipe
		END OF BOREHOLE AUGER REFUSAL		81.47 / 6.48							
7											W.L in Standpipe at Ground Surface on completion of drilling

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: S.F.
CHECKED: [illegible]

BOREHOLE 001-2075.GPJ HYDROGEO.GDT 5 26 00

RECORD OF BOREHOLE: 00-4

PROJECT: 001-2075
SHEET 1 OF 1
LOCATION: See Site Plan
BORING DATE: May 16, 2000
DATUM: Geodetic
SAMPLER HAMMER, 64kg; DROP, 760mm
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		87.90				
		Black clayey TOPSOIL		87.72				
		Very stiff to stiff brown to grey brown SILTY CLAY (Weathered Crust)		0.18				
2					1	50 DO	6	
3					2	50 DO	2	
4.26		Firm to stiff grey SILTY CLAY		83.64 4.26				∇
7.47		END OF BOREHOLE		80.43 7.47				W.L in Open Hole at Elev.83.63m on completion of drilling

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - O; 20 40 60 80
HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
WATER CONTENT PERCENT: Wp —O W— Wl; 20 40 60 80
ADDITIONAL LAB. TESTING

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: S.F.
CHECKED: [signature]

BOREHOLE 001-2075.GPJ HYDROGEO.GDT 5 26 00

PROJECT: 001-2075

RECORD OF BOREHOLE: 00-5

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: May 17, 2000

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —O W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		88.15							
	Power Auger 200mm Diam (Hollow Stem)	Clayey TOPSOIL		0.00							
		Very stiff to stiff brown to grey brown SILTY CLAY, trace fine sand (Weathered Crust)		87.90 / 0.25							
2					1	50 DO	5				
3					2	50 DO	2				
4		Firm to stiff grey SILTY CLAY		83.89 / 4.26							∇
7.62		END OF BOREHOLE		80.53 / 7.62							W.L in Open Hole at Elev.83.58m on completion of drilling

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: D.W.M.

CHECKED: ----------

BOREHOLE 001-2075.GPJ HYDROGEO.GDT 6 15 00

PROJECT: 001-2075

RECORD OF BOREHOLE: 00-6

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: May 17, 2000

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m
		Ground Surface	88.31			
0	Power Auger, 200mm Diam (Hollow Stem)	Clayey TOPSOIL	0.00			
		Very stiff to stiff brown to grey brown SILTY CLAY, trace fine sand (Weathered Crust)	88.06 / 0.25			
				1	50 DO	4
				2	50 DO	1
		Firm grey SILTY CLAY	83.44 / 4.87			
		Dense grey GLACIAL TILL	81.46 / 6.85	3	50 DO	67
		END OF BOREHOLE AUGER REFUSAL	81.05 / 7.26			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ ; 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp —○W— Wl ; 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

W.L in Open Hole at Elev. 87.40m on completion of drilling

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: D.W.M.

CHECKED:

PROJECT: 991-2238

RECORD OF BOREHOLE: 99-200

SHEET 1 OF 1

LOCATION: See Site plan

BORING DATE: December 1, 1999

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Power Auger, 200mm Diam (Hollow Stem)

DESCRIPTION	ELEV. / DEPTH (m)
Ground Surface	86.80
TOPSOIL	86.56 / 0.24
Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)	
Firm to stiff grey SILTY CLAY	82.84 / 3.96
Probably grey Silty Clay	79.79 / 7.01
Probably layered Clay and silt, trace gravel	75.67 / 11.13
Probably Sandy Silt Till, occasional cobble	74.76 / 12.04
End of Borehole Auger Refusal	72.35 / 14.45

SAMPLES

NUMBER	TYPE	BLOWS/0.3m
1	50 DO	3

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ — 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl — 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE METRES: 0–15

BOREHOLE 991-2238.GPJ HYDROGEO.GDT 1/13/00

DEPTH SCALE 1 : 75

Golder Associates

LOGGED: D.J.S.

CHECKED: -----------

PROJECT: 991-2238

RECORD OF BOREHOLE: 99-201

SHEET 1 OF 1

LOCATION: See Site plan

BORING DATE: January 4, 2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface	86.70				
		TOPSOIL	0.12				
		Very stiff to stiff brown to grey brown SILTY CLAY, trace fine sand (Weathered Crust)					∇
1				1	50 DO	6	
2				2	50 DO	4	
3				3	50 DO	2	
4		Firm to stiff grey SILTY CLAY	82.70 4.00				
5				4	50 DO	PM	
6.7		End of Borehole	80.00 6.70				W.L in Open Hole at Elev.85.79m Jan. 4, 2000

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - O; 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—O^W—⊣ Wl; 20 40 60 80

ADDITIONAL LAB. TESTING

BOREHOLE 991-2238.GPJ HYDROGEO.GDT 1/13/00

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: D.W.M.

CHECKED: ----------

PROJECT: 991-2238

RECORD OF BOREHOLE: 99-201A

SHEET 1 OF 1

LOCATION: See Site plan

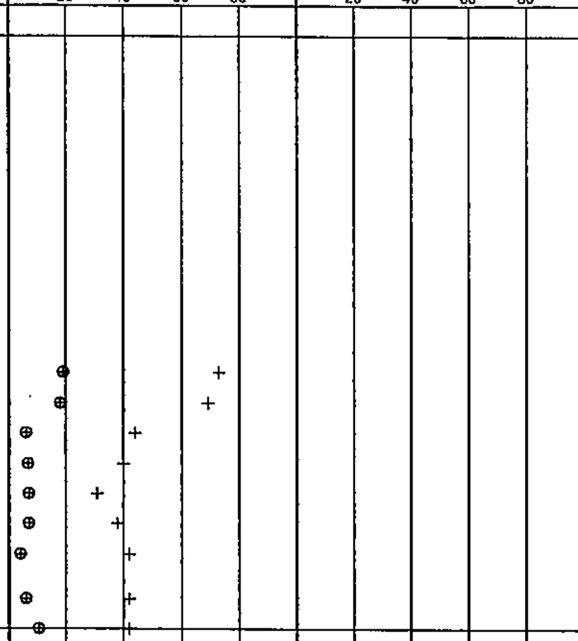
BORING DATE: January 6, 2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)
0		Ground Surface	86.70
	Power Auger, 200mm Diam (Hollow Stem)	Dark brown silty clay TOPSOIL	86.46 / 0.24
		Very stiff to stiff brown to grey brown SILTY CLAY (Weathered Crust)	
4		Firm grey SILTY CLAY	82.74 / 3.96
6		End of Borehole	80.77 / 5.93



Columns: SAMPLES (NUMBER, TYPE, BLOWS/0.3m); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

DEPTH SCALE 1 : 75

Golder Associates

LOGGED: D.W.M.

CHECKED: ----------

PROJECT: 991-2238

RECORD OF BOREHOLE: 99-202

SHEET 1 OF 1

LOCATION: See Site plan

BORING DATE: January 5, 2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

BORING METHOD: Power Auger, 200mm Diam (Hollow Stem)

DESCRIPTION	ELEV. DEPTH (m)
Ground Surface	86.60
TOPSOIL	0.14
Very stiff to stiff brown to grey brown SILTY CLAY, occasional Fe staining (Weathered Crust)	
Stiff to firm grey SILTY CLAY	82.64 / 3.96
End of Borehole	79.29 / 7.31

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	50 DO	8
2	50 DO	5
3	50 DO	2
4	50 DO	PM

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ — 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp —W— Wl — 20 40 60 80

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION:

- Bentonite Seal
- Native Backfill
- Bentonite Seal
- Standpipe
- Granular Filter

W.L in Standpipe at Elev.85.61m Jan. 6, 2000

DEPTH SCALE (METRES): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

DEPTH SCALE 1 : 75

Golder Associates

LOGGED: D.W.M.

CHECKED: -----------

PROJECT: 991-2238

RECORD OF BOREHOLE: 99-203

SHEET 1 OF 1

LOCATION: See Site plan

BORING DATE: January 5, 2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

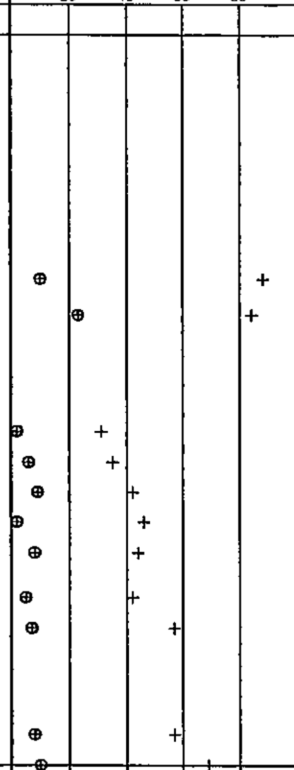
DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger; 200mm Diam (Hollow Stem)	Ground Surface	86.76					
		TOPSOIL	86.59 / 0.17					
		Very stiff to stiff brown to grey brown SILTY CLAY, occasional Fe staining (Weathered Crust)		1	50 DO	6		
				2	50 DO	3		
		Firm to stiff grey SILTY CLAY, occasional thin silty sand seams	83.06 / 3.70	3	50 DO	2		
		End of Borehole	79.44 / 7.32					W.L in Open Hole at Elev.84.84m Jan. 5, 2000

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - O

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp —O W— Wl; 20 40 60 80



DEPTH SCALE 1 : 75

Golder Associates

LOGGED: D.W.M.

CHECKED: ----------

PROJECT: 991-2238

RECORD OF BOREHOLE: 99-204

SHEET 1 OF 1

LOCATION: See Site plan

BORING DATE: January 4, 2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + rem V. ⊕ Q - ● U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—O W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		87.25							
	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.10							
		Very stiff to stiff brown to grey brown SILTY CLAY, trace fine sand, occasional Fe streaks (Weathered Crust)									
1					1	50 DO	6				
2					2	50 DO	6				
3					3	50 DO	1				∇
4.57		Firm grey SILTY CLAY, occasional thin silty sand seams		82.68 4.57							
5					4	50 DO	PM				
6					5	50 DO	PM				
7.31		End of Borehole		79.94 7.31							W.L. in Open Hole at Elev.84.50m on completion of drilling Jan. 4, 2000

BOREHOLE 991-2238.GPJ HYDROGEO.GDT 1/13/00

DEPTH SCALE

1 : 75

Golder Associates

LOGGED: D.W.M.

CHECKED: ------------

RECORD OF BOREHOLE: 99-204A

PROJECT: 991-2238
SHEET 1 OF 1
LOCATION: See Site plan
BORING DATE: January 6, 2000
DATUM: Local
SAMPLER HAMMER, 64kg; DROP, 760mm
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		87.25							
0	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.10							
		Very stiff to stiff brown to grey brown SILTY CLAY, trace fine sand, occasional Fe streaks (Weathered Crust)									
4		Firm grey SILTY CLAY		82.98 / 4.27							
6		End of Borehole		81.32 / 5.93							

DEPTH SCALE
1 : 75

Golder Associates

LOGGED: D.W.M.
CHECKED: ------------

RECORD OF BOREHOLE: 99-205

PROJECT: 991-2238
SHEET 1 OF 1

LOCATION: See Site plan
BORING DATE: January 4, 2000
DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm
PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		87.22				
		TOPSOIL		0.11				Bentonite Seal
		Very stiff to stiff brown to grey brown SILTY CLAY (Weathered Crust)						
1					1	50 DO	5	
2					2	50 DO	4	
3					3	50 DO	2	Native Backfill
4		Firm to stiff grey SILTY CLAY		83.22 4.00				
5								Bentonite Seal
6					4	50 DO	PM	Standpipe
7								Granular Filter
		End of Borehole		79.88 7.34				W.L in Standpipe at Elev.85.79m Jan. 4, 2000

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80
SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - O; 20 40 60 80
HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}
WATER CONTENT PERCENT: Wp —O W— Wl; 20 40 60 80
ADDITIONAL LAB. TESTING

DEPTH SCALE 1 : 75

Golder Associates

LOGGED: D.W.M.
CHECKED: ----------

PROJECT: 991-2238

RECORD OF BOREHOLE: 99-206

SHEET 1 OF 1

LOCATION: See Site plan

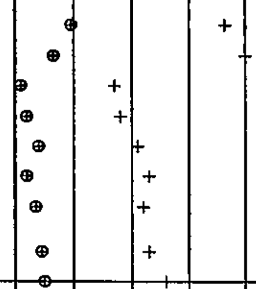
BORING DATE: January 5, 2000

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - O (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³); WATER CONTENT PERCENT Wp —O W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		86.72							
	Power Auger 200mm Diam (Hollow Stem)	TOPSOIL		0.12							
		Very stiff to stiff brown to grey brown SILTY CLAY (Weathered Crust)									
		Firm to stiff grey SILTY CLAY		83.02 / 3.70							
6		End of Borehole		80.79 / 5.93							



DEPTH SCALE

1 : 75

Golder Associates

LOGGED: D.W.M.

CHECKED: ----------

BOREHOLE 991-2238.GPJ HYDROGEO.GDT 1/13/00

RECORD OF BOREHOLE 98-3

PROJECT: 981-2030
LOCATION: See Plan
SAMPLER HAMMER, 63.6kg; DROP, 760mm

BORING DATE: Apr. 27, 1998

SHEET 1 OF 1
DATUM: Geodetic
PENETRATION TEST HAMMER, 63.6kg; DROP, 760mm

BORING METHOD: Power Auger, 200mm Diam (Hollow Stem)

Depth (m)	Description	Elev. / Depth (m)	Sample Number	Type	Blows/0.3m	Piezometer or Standpipe Installation
0	Ground Surface	86.63				
	Dark brown silty TOPSOIL	0.00				Bentonite Seal
	Mixed TOPSOIL and SILTY CLAY	86.23 / 0.40				
	Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)	0.55	1	50 DO	7	Native Backfill
			2	50 DO	4	Standpipe
						Caved Material
		81.69 / 4.94	3	50 DO	1	
	Firm to stiff grey SILTY CLAY					
7	End of Hole	79.62 / 7.01				W.L in Standpipe at Elev.85.99m May 1, 1998

Chart columns: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V - +, rem.V - ⊕, Q - ●, U - O; 20, 40, 60, 80); HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT (Wp, W, Wl; 20, 40, 60, 80); ADDITIONAL LAB. TESTING

Shear strength annotations: >96, >96

DATA INPUT: C:98-3-030.drf/S.L

DEPTH SCALE
1 to 75

Golder Associates

LOGGED: D.J.S
CHECKED:

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