REPORT

Geotechnical Investigation Proposed Building Expansion

360 Friel Street, Ottawa, Ontario

Submitted to:

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Distribution List

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed expansion of the building located at 360 Friel Street in Ottawa, Ontario.

The purpose of this investigation was to assess the general subsurface conditions within the study area by means of advancing two boreholes and carrying out laboratory testing. Based on an interpretation of the factual information obtained during the investigation, a general description of the soil and groundwater conditions is presented. These interpreted subsurface conditions and available project details were used to prepare engineering guidelines related to the geotechnical design aspects of the project, including construction considerations which could influence design decisions.

The investigation and reporting for this project were carried out in general accordance with the scope of work provided in Golder's proposal CX21483012 approved by Smart Living Properties on August 3, 2021. This report addresses only the geotechnical aspects of the subsurface conditions at this site.

The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, are outside the terms of reference for this report.

The reader is referred to the "Important Information and Limitations of This Report" which follows the text but forms an integral part of this document.

2.0 SITE DESCRIPTION AND GEOLOGY

2.1 General

The site is currently occupied by an existing 2.5 storey brick-clad building with a paved driveway and partially paved parking at the rear. Based on the information provided the existing building includes a partial basement. The existing building is located within the Sandy Hill Cultural Heritage Character Area and is identified as a Grade 3 property in the Sandy Hill Cultural Heritage Guidelines. The location of the site is shown on the Key Plan on Figure 1.

Based on the conceptual design drawings provided, the proposed development will consist of a three-storey structure, with eight one-bedroom units and will include a full basement level. The proposed building will be constructed in close proximity to the rear of the existing building and is relatively close to the neighbouring structures.

2.2 Regional Geology

The surficial geological mapping[1] produced by the Geological Survey of Canada (GSC) indicates that the study area is underlain by alluvial deposits, which include sand with some silt. The published drift thickness mapping[2] (depth to bedrock) indicates that the bedrock surface is generally located at depths in the range of about 10 to 15 m. This region is underlain by a series of sedimentary rocks, consisting of sandstones, dolostones, limestones and shales that are, in turn, underlain at depth by igneous and metamorphic bedrock of the

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[1] Ontario Geological Survey 2010. Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV

[2] Bedrock Topography And Overburden Thickness Mapping, Southern Ontario, Ontario Geological Survey, Miscellaneous Release - Data 207

Precambrian Shield. Regional bedrock geology mapping[3] indicates that the bedrock at study area is limestone with interbedded shale of the Verulam formation.

3.0 PROCEDURE

The fieldwork for the investigation was carried out on September 23 and 24, 2021 and included advancing two boreholes, numbered 21-01 to 21-02. The boreholes were located within the approximate footprint of the proposed expansion.

The boreholes were advanced using truck mounted drilling equipment supplied and operated by CCC Geotechnical & Environmental Drilling Limited of Ottawa, Ontario.

Soil samples were obtained using a 50 mm outer diameter split-spoon sampler in general accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). Soil samples were obtained at vertical sampling intervals of about 0.76 m. In-situ vane testing was carried out within the cohesive deposits, to measure undrained and remoulded shear strength.

A monitoring well was installed in Borehole 21-02, to observe the stabilised groundwater level at the site. The monitoring well consists of a 32 mm outside diameter PVC pipe with a 1.5 m long slotted tip. The groundwater level was measured in the well on September 29, 2021. The monitoring well will require specialized abandonment/decommissioning procedures, and a provision should be made for decommissioning by the Contractor during construction.

The boreholes were backfilled with bentonite mixed with soil cuttings within the overburden. The boreholes were then capped with granular material, to match the surrounding surface cover. The boreholes were backfilled in general accordance with the intent of O.Reg 903, as amended. The site conditions were restored following completion of the fieldwork.

One soil sample was submitted to Eurofins Environment Testing for chemical analysis related to potential corrosion of exposed buried steel and potential sulphate attack on buried concrete elements (corrosion and sulphate attack).

The fieldwork was supervised on a full-time basis by members of Golder's staff who located the boreholes in the field, directed the drilling, sampling, and in-situ testing operations, logged the boreholes and examined and cared for the samples. The soil samples were identified in the field, placed in labelled containers, and transported to Golder's laboratory in Ottawa for further examination and testing. Index and classification tests consisting of water content determinations, grain size distribution analyses, and Atterberg Limits testing were carried out on selected soil samples. The laboratory tests were carried out to ASTM Standards, at Golder's Ottawa laboratory.

The borehole locations and elevations were surveyed by Golder using a Trimble S6 Robotic Total Station and a Trimble R10 referenced to the NAD83 CSRS CBNv6-2010.0 MTM Zone 9 geodetic datum. The borehole locations, including northing and easting coordinates, ground surface elevations, and drilled depths are summarized in Table 1.

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[3] Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release---Data 126-Revision 1.

Table 1: Borehole Location Summary

Borehole	NAD83 CSRS CBNv62010.0 MTM Zone 9		Ground Surface Elevation (m)	Drilled Length (m)
	Northing (m)	Easting (m)		
21-01	5032244.5	368928.9	70.1	14.7^R
21-02	5032249.6	368923.8	70.2	7.4

Note: ^{R} Denotes auger refusal; bedrock was not proven through coring.

4.0 DESCRIPTION OF SUBSURFACE CONDITIONS

4.1 General

The subsurface soil, and groundwater conditions encountered in the boreholes and the results of the in-situ testing from the investigation are given on the Record of Boreholes, presented in Appendix A. The results of the geotechnical laboratory testing are presented on the Record of Borehole sheets as well as on Figures B1 to B5 in Appendix B. The general location of the boreholes is illustrated on Figure 1.

The results of basic chemical analysis are provided in Appendix C. Site photographs showing the general conditions at the site are presented in Appendix D.

4.2 Site Stratigraphy Overview

At the boreholes, the subsurface conditions generally consist of granular surface cover, overlying fill materials, overlying a very stiff to stiff weathered clay crust overlying a stiff clay, which in turn overlies a loose to very dense silt and sand glacial till.

The groundwater level was measured at the site at a depth of 6.5 m, corresponding to Elevation 63.7 m.

The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from observations of drilling progress and noncontinuous sampling and therefore, represent transitions between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole locations.

It should be noted that an inspection of the samples collected from the site by Golder confirmed the presence of possible fuel contamination at Borehole 21-02 and slight hydrocarbon odour from the samples at Borehole 21-01. Since the scope of the geotechnical investigation did not include environmental sampling and testing these observations were not confirmed with analytical testing nor was any delineation of potential impacts undertaken. It is recommended that this observation be reviewed (by Smart Living) with the environmental consultant for the project and addressed as appropriate.

The results of the utility locates carried out prior to carrying the field investigation indicated the presence of a buried utility line located within the proposed building footprint. It is likely that utility relocation will be required as part of construction.

A more detailed description of the overburden soil deposits, conditions encountered during the field investigation is provided in the following sections.

4.3 Fill

Fill consisting predominantly of gravel and sand was encountered immediately below the existing ground surface at Borehole 21-01. The top of this layer was encountered at Elevation 70.1 m and the layer is about 0.15 m thick. The measured moisture content of a single sample of this material was 6%. The results of a grain size analysis carried out on a single sample of the sand and gravel fill material are provided on Figure B1 in Appendix B.

Fill consisting predominantly of sand and clay was encountered immediately below the existing ground surface at Borehole 21-02. The top of this layer was encountered at Elevation 70.2 m and the layer is about 0.76 m thick. An SPT N value of 9 blows per 0.3 m of penetration was measured in this layer indicating a loose state of compactness.

Fill consisting predominantly of clayey silt or silty clay, with varying amounts of sand and gravel, was encountered below the gravel and sand fill at Borehole 20-01 and below the sand and clay fill at Borehole 21-02. The top of this layer was encountered at Elevations 69.9 and 69.4 m, and the thickness of this layer ranges from about 1.2 to 1.5 m. The SPT N values ranged from 5 to 11 blows per 0.3 m of penetration indicating a stiff to very stiff consistency.

4.4 Clay

A clay deposit was encountered beneath the fill materials in both boreholes advanced at the site.

The upper portion of the deposit has been weathered to a stiff crust. The top of this layer was encountered at Elevations 68.8 and 67.9 m and the thickness of this layer ranges from about 1.4 to 1.5 m. The SPT N values measured within the weathered crust ranged from 2 to 11 blows per 0.3 m of penetration, indicating a stiff to very stiff consistency.

The measured moisture content of a single sample of the weathered crust was 41%. The results of grain size analysis testing carried out on single sample of this material are illustrated on Figure B2 in Appendix B. The results of Atterberg Limits testing completed on one sample of the weathered crust indicate a liquid limit of 90, a plastic limit of 28 and plasticity index 62. The Atterberg Limits analysis results are illustrated on Figure B3 in Appendix B and indicate a clay of high plasticity (CH).

The clay below the depth of weathering is grey. The top of the grey clay layer was encountered at Elevations 67.2 and 66.5 m. The thickness of this layer where fully penetrated at Borehole 21-01 was 10.8 m. Borehole 21-02 was terminated in this stratum. The SPT N values measured in the unweathered clay ranged from 0 (weight of hammer; WH) to 3 blows per 0.3 m of penetration. In-situ shear vane test results indicate the undrained shear strength of the grey unweathered clay ranges from 50 to greater than 100 kPa but is typically 50 to 80 kPa, indicating stiff consistency.

The measured moisture content of a single sample of the grey clay was 75%. The results of grain size analysis testing carried out on single sample this material of the are illustrated on Figure B2 in Appendix B. The results of Atterberg Limits testing completed on one sample of the grey clay indicate a liquid limit of 81, a plastic limit of 27 and plasticity index 54. The Atterberg Limits analysis results are illustrated on Figure B3 in Appendix B and indicate a clay of high plasticity (CH).

4.5 Glacial Till

A deposit of glacial till was encountered beneath the grey clay at Borehole 21-01 at Elevation 56.4 m. The glacial till generally consists of a heterogeneous mixture of sandy silt with varying amounts of gravel. Cobbles and boulders were also encountered in this layer. Auger refusal was encountered at Borehole 21-01 at Elevation 55.5 m, which could indicate the presence of the bedrock surface or could reflect the presence of cobbles and boulders within the till matrix.

SPT N values of 6 and 55 blows per 0.3 m of penetration were measured in this layer indicating a loose to very dense state of compactness. The higher blow count (i.e., 55) noted on the Record of Borehole for the till may have been influenced by the underlying bedrock surface or the presence of cobbles or boulders within the till, rather than the state of compactness of the soil matrix.

The measured moisture content of a single sample of the glacial till was 22%. The results of grain size analysis testing carried out on single sample of this material are illustrated on Figure B4 in Appendix B. The results of Atterberg Limits testing completed on one sample of the grey clay indicate a liquid limit of 19, a plastic limit of 15 and plasticity index 4. The Atterberg Limits analysis results are illustrated on Figure B5 in Appendix B and indicate the fine portion of the till is a low plastic silt (ML).

4.6 Groundwater Conditions

A monitoring well was installed in Borehole 21-02, to observe the stabilized groundwater level at the site. The groundwater level was measured on September 29, 2021, a depth of 6.5 m, corresponding to Elevation 63.7 m.

It is expected that the groundwater levels will be subject to fluctuations both seasonally and as a result of precipitation events.

4.7 Corrosion and Sulphate Attack Potential

One soil sample was submitted to Eurofins Environment Testing for chemical analysis related to potential corrosion of exposed buried steel (corrosion and sulphate attack). The test results are provided in Appendix C and are summarized in Table 2.

Table 2: Results of Chemical Analysis

Borehole	Sample Depth (m)	Chloride (%)	pH	Electrical Conductivity (mS/cm)	Resistivity (ohm-cm)	Sulphate (%)
21-01	3.0 to 3.7	0.028	8.34	0.06	16,700	<0.01

5.0 DISCUSSION AND GEOTECHNICAL RECOMMENDATIONS

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the available information described herein and project requirements. 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, schedule, safety, and equipment capabilities.

The results and guidelines presented herein are subject to the limitations in the "Important Information and Limitations of this Report" attachment which follows the text of this report but forms an integral part of this document.

5.2 Proposed Works

Based on the conceptual design drawings provided, the proposed development will consist of a three-storey structure, with a full basement level. As such, the excavation for the building/basement is expected to extend to depths of about 3 to 4 m below existing site grades corresponding to a founding elevation of approximately 66.6 m. The anticipated founding subgrade material would be within the native stiff clay. It is understood that no significant grade change is proposed for the site.

5.3 Foundation Design

5.3.1 General

The subsurface conditions present below the surficial fill at this site generally consist of sensitive clay, underlain by glacial till over limestone bedrock. Based on our understanding of the proposed building (i.e., a low-rise, relatively light residential structure, it is expected that conventional spread footing foundations can be used. In the event more heavily loaded foundations are required a raft or piled foundation could also be considered, however they would not typically be required for this type of development. Should much more heavily loaded foundations be required additional guidance can be provided during the detailed design.

The proposed building will be constructed in close proximity to the rear of the existing building and is relatively close to the neighbouring structures. It is understood there is a partial basement at the existing buildings (and likely other nearby structures). It will be important to understand the depth and size of the existing foundations during the detailed design and planning phase of the project as the location, depth and size of the existing footings may affect the placement and capacity of the proposed footings, as well as excavation limits, excavation support, underpinning, etc.

5.3.2 Seismic Site Classification

In accordance with the OBC, the selection of the seismic site classification is based on the soil conditions encountered in the upper 30 m of the stratigraphy below the founding elevation. Based on the soil conditions encountered below the founding elevation, the site is classified as a Seismic Site Class D.

5.3.3 Liquefaction Assessment

The soils beneath the anticipated founding elevation of 66.6 m consist of stiff clay and a dense glacial till, which are not considered to be susceptible to liquefaction under the design earthquake loading.

5.3.4 Bearing Resistances

Strip or pad footing foundations founded on undisturbed native clay may be designed based on the factored geotechnical resistance values provided in Table 3.

Table 3: Factored Geotechnical Resistances

Footing Width (m)	Factored ULS (kPa)	SLS (kPa)
Strip Footings		
0.60	300	150
0.90	290	125
1.20	285	100
1.50	280	80
Pad Footings		
0.90	340	250
1.20	330	200
1.50	325	150

The factored ULS geotechnical resistances includes a resistance factor of 0.5. The factored geotechnical resistance at Serviceability Limit State (SLS) corresponds to a maximum total and differential settlements of approximately 25 mm and 20 mm, respectively.

The geotechnical resistances provided above are for vertical concentric loading and will need to be adjusted for the effects of inclined or eccentric loading, if applicable.

5.3.5 Sliding Resistance

Resistance to lateral forces through sliding resistance between concrete and underlying materials should be evaluated using an unfactored coefficients of friction provided in Table 4.

Table 4: Unfactored Coefficients of Friction between Footing Material and Founding Material

Culvert Material	Founding Material	
	Native Clay	Granular A Bedding
Cast-in-place concrete	0.35	0.55
Precast concrete	0.30	0.45

5.4 Lateral Earth Pressures for Design

The following guidelines and recommendations are provided regarding the lateral earth pressures for static (i.e., not earthquake) loading conditions. These lateral earth pressures assume that the ground above the wall will be flat, not sloping. If the inclination of the slope above the wall changes, then new lateral earth pressures will need to be calculated.

The following recommendations are made concerning the design of the basement wall:

- The granular fill should be placed within the wedge shaped zone defined by a 45° line extending up and back from the rear face of the wall foundation.
- To account for compaction induced loads during construction, the minimum lateral earth pressure acting on any part of the wall should be taken as 12 kPa, for design purposes. Care must be taken during the compaction operation not to overstress the wall. Heavy construction equipment should be maintained a distance of at least 1 metre away from the walls while the backfill soils are being placed. Hand-operated compaction equipment should be used to compact the backfill soils within a 1.0 m wide zone adjacent to the walls.

5.4.1 Static Lateral Earth Pressures

The retaining wall should be designed to resist lateral earth pressures calculated as follows:

$$\sigma_h\,(z) \quad = K\,(\gamma z + q)$$

Where: $\sigma_h(z)$ = Lateral earth pressure on the wall at depth z, in kPa;

K = Earth pressure coefficient;

γ = Unit weight of retained soil

z = Depth below top of wall, m; and,

q = uniform surcharge at ground surface behind the wall to account for traffic, equipment, or stockpiled soil, the cumulative value of all surcharge must be less than 15 kPa.

The pressures are based on using engineered granular fill or clear stone and the following parameters (unfactored) provided in Table 5 may be used:

Table 5: Static Lateral Earth Pressure Coefficients, Earth Granular A, B Type II and Clear Stone

Soil Type	Internal Angle of Friction (ϕ°)	Soil Unit Weight (γ, kN/m^3)	Coefficients of Earth Pressure		
			Active, Ka	At-Rest, Ko	Passive, Kp
Granular A	35	22	0.27	0.43	3.7
Granular B Type II	35	21	0.27	0.43	3.7
Clear Stone	28	17	0.36	0.53	2.8

Where the wall support does not allow lateral yielding (i.e., restrained structure where the rotational or horizontal movement is not sufficient to mobilize an active earth pressure condition), at rest earth pressures (plus any compaction surcharge) should be assumed for geotechnical design. Where the wall allows lateral yielding, active earth pressures may be used in the geotechnical design of the structure.

5.4.2 Seismic Lateral Earth Pressures for Design

The lateral earth pressures acting on the below-grade walls as a result of seismic events will be highly dependent on the backfill types and methods. The lateral earth pressures noted above would increase under seismic loading conditions. The earthquake-induced dynamic pressure distribution, which is to be added to the static earth pressure distribution, is a linear distribution with maximum pressure at the top of the wall and minimum pressure at its toe (i.e., an inverted triangular pressure distribution).

The combined pressure distribution (static plus seismic) may be determined as follows:

$$\sigma_h(z) = K_o \gamma z + (K_{AE} - K_A) \gamma (H\text{-}z)\text{; non-yielding walls}$$

$$\sigma_h(z) = K_a \gamma d + (K_{AE} - K_a) \gamma (H\text{-}d)\text{, yielding walls}$$

Where:	$\sigma_h(d)$	is the (static plus seismic) lateral earth pressure at depth, z, (kPa);
	K_a	is the static active earth pressure coefficient;
	K_o	is the static at-rest earth pressure coefficient;
	K_{AE}	is the seismic active earth pressure coefficient;
	γ	is the unit weight of the backfill soil (kN/m^3);
	d	is the depth below the top of the wall (m); and,
	H	is the total height of the wall (m).

The pressures are based on using engineered granular fill or clear stone and the following K_{AE} parameters (unfactored) provided in Table 6 may be used in design.

Table 6: Seismic Active Pressure Coefficients, K_{AE} for Various Materials

Structure Type	Design Earthquake	Site Specific PGA (g)	Granular A	Granular B Type II	Clear Stone
Non-Yielding Wall	2,475-year	0.301	0.48	0.48	0.61
Yielding Wall			0.36	0.36	0.47

5.5 Site Grading and Excavations

5.5.1 Overburden Excavation

Excavations should be carried out in accordance with the guidelines outlined in the latest edition of the Occupational Health and Safety Act (OHSA) for Construction Activities.

Excavations within the overburden of up to 4 m below the existing grade through the existing fill and native clay deposits are anticipated to reach the founding surface. The groundwater level was measured at 6.5 m below the existing ground surface and approximately 2 m below the anticipated founding level.

The soils at this site would be generally classified as Type 3 soils (compact to loose fill material and stiff native clay above the groundwater level) in accordance with the OHSA. Accordingly, excavations should be made with side slopes no steeper than 1H:1V.

If the required safe side slopes for the open cut excavations cannot be accommodated, then temporary protection (i.e., excavation shoring) will be required to facilitate excavation to the foundation level for the construction of the footings.

All excavations must be made in such a was so as to safeguard the existing structures (both the existing building on the site as well as neighbouring structures). In particular, where temporary excavations have the potential to impact adjacent foundations additional geotechnical review may be required. Any shoring or excavation support will need to account for the loading of adjacent foundations, and be suitably stiff so as to prevent deflection. Design of temporary excavations and excavation support is generally the responsibility of the excavation contractor.

5.5.2 Foundation and Basement Wall Backfill

The fill materials and natural soils at this site are considered frost susceptible and should not be used as backfill against basement walls. To avoid problems with frost adhesion and heaving, the foundation and basement walls should be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements for OPSS Granular B Type I or II.

To avoid ground settlements around the foundations, which could affect site grading and drainage, all the backfill materials should be placed in 300 mm lifts and be compacted to at least 95% of the materials Standard Proctor Maximum Dry Density (SPMDD).

The foundations and basement wall backfill should be drained by means of a perforated pipe subdrain in a surround of 19 mm clear stone, fully wrapped in a geotextile, which leads by positive drainage to a storm sewer or to a sump pit from which the water is pumped.

5.5.3 Floor Slab

For predictable performance of the floor slab, a provision should be made for at least 200 mm of 19 mm crushed clear stone to form the base of the floor slab. If the floor slabs are to be surface covered with non-breathable floor coverings, a vapour barrier should be provided above the clear stone base. A geotextile should be provided between the clear stone and founding clay soils, to avoid loss of fine soil particles from the subgrade soil into the voids in the clear stone. The geotextile should consist of a Class II non-woven geotextile with a Filtration Opening Size (FOS) not exceeding about 100 microns, in accordance with Ontario Provincial Standard Specification (OPSS) 1860.

5.5.4 Frost Protection

The native subgrade soils on this site are frost susceptible. Therefore, all exterior perimeter foundation elements or foundation elements in heated areas should be provided with a minimum of 1.5 m of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 m of earth cover.

5.6 Corrosion and Cement Type

One soil sample was submitted to Eurofins Environment Testing for chemical analysis related to potential corrosion of exposed buried steel and potential sulphate attack on buried concrete elements (corrosion and sulphate attack). The test results are provided in Appendix C.

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 in Table 2 of this report, were compared with Table 3 of Canadian Standards Association Standards A23.1-14 (CSA A23.1) and generally indicate a low degree of sulphate attack potential on concrete structures at this site. Accordingly, GU cement could be specified for concrete in below grade applications.

The pH, resistivity and chloride concentration provide an indication of the degree of corrosiveness of the sub-surface environment. Generally, the test results provided in Table 2 indicate a moderate potential for corrosion of exposed ferrous metal at the site which should be considered in the design.

Signature Page

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Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client **Smart Living Properties.** 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. Golder cannot be responsible for use of this report, or portions thereof, unless Golder 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 Golder's express written consent. If the report was prepared to be included for a specific permit application process, then the client may authorize the use of this report for such purpose by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process, provided this report is not noted to be a draft or preliminary report, and is specifically relevant to the project for which the application is being made. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, 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 Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder'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 Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder 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. Golder cannot 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 Groundwater 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, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS
OF THIS REPORT (cont'd)

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 Golder 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.

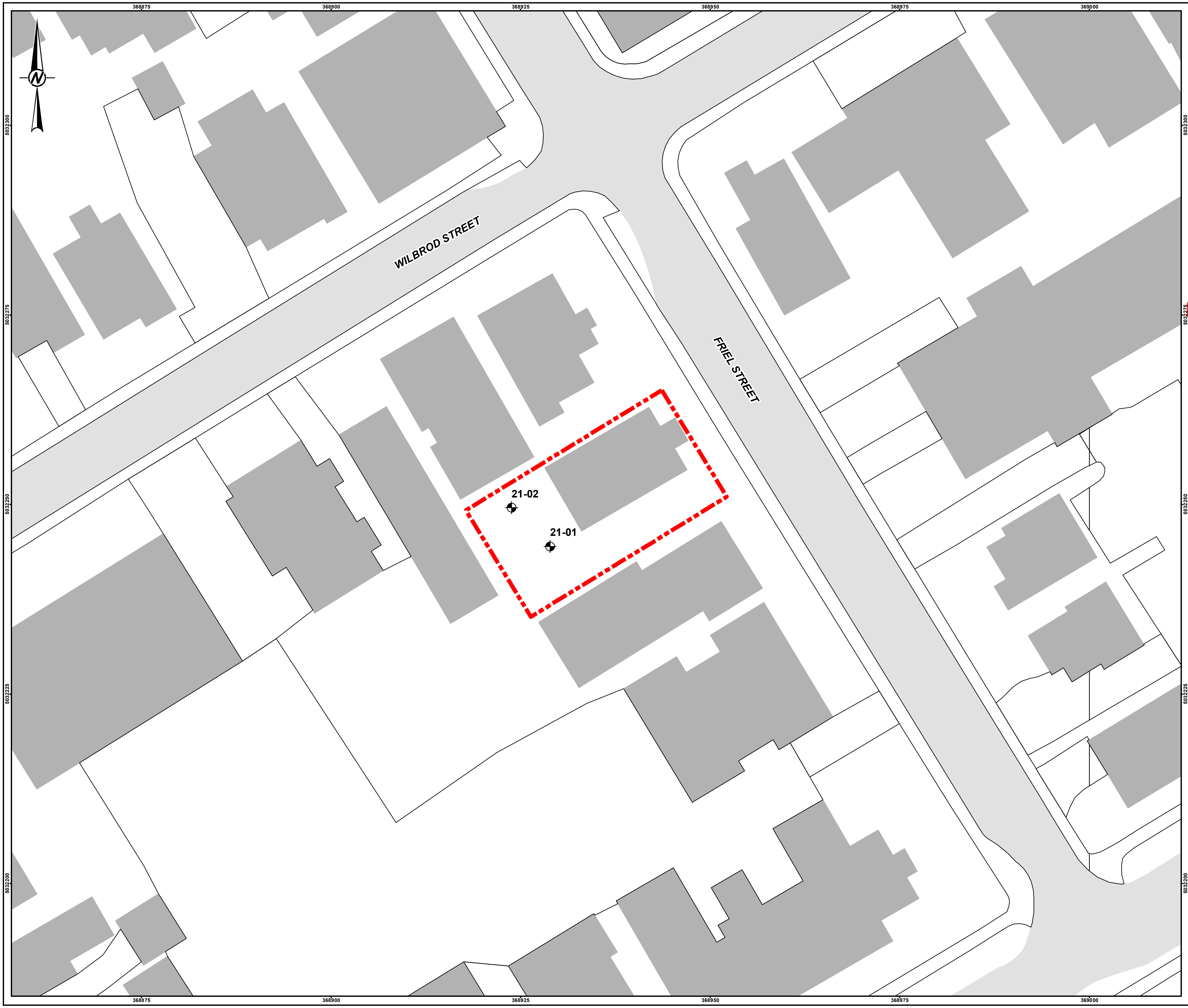
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater 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 Golder's report. Golder 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 Golder's report.

During construction, Golder 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 Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder 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, Golder'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 Golder 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 Golder 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. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



KEY MAP

SCALE 1:25,000

LEGEND

⊕ APPROXIMATE BOREHOLE LOCATION

▭ APPROXIMATE SITE BOUNDARY

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. BASE DATA BY CITY OF OTTAWA TOPOGRAPHIC MAPPING.
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 5 10 20
1:500 METRES

CLIENT
SMART LIVING PROPERTIES

PROJECT
GEOTECHNICAL INVESTIGATION
360 FRIEL STREET, OTTAWA, ONTARIO

TITLE
SITE PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-10-04
DESIGNED	----
PREPARED	JEM
REVIEWED	KCP
APPROVED	CH

PROJECT NO.	CONTROL	REV.	FIGURE
21483012	0001	0	1

Path: N:\Active\Spatial_IM\Smart_Living_Properties\360_Friel_St_Ottawa\99_PROJ\21483012_SLP_Geotech\0001_Geotech_Investigation\21483012-0001-BG-0001.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
25mm
0

APPENDIX A

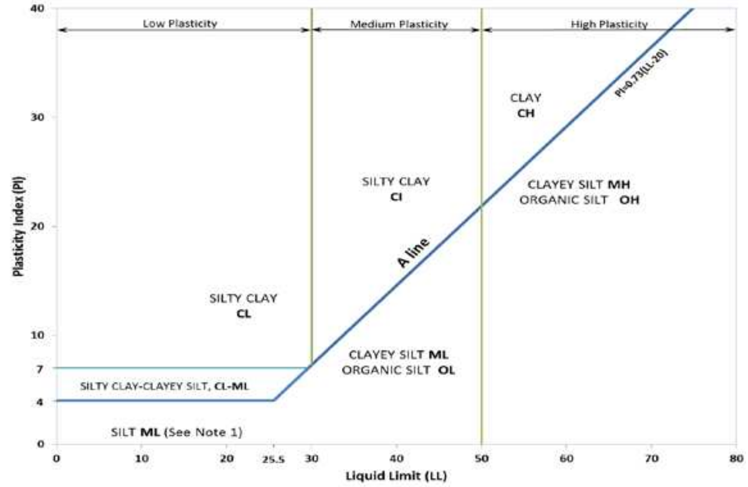
Record of Boreholes

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10}xD_{60}}$	Organic Content	USCS Group Symbol	Group Name
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)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2)**	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

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)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

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

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
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
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
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
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

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

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 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.

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

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
σ_1, σ_2, σ_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

(a) Index Properties (continued)

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	non-plastic
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 δ
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: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

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

PROJECT: 21483012

RECORD OF BOREHOLE: 21-01

SHEET 1 OF 2

LOCATION: N 5032244.5 ;E 368928.9

BORING DATE: September 23, 2021

DATUM: Geodetic

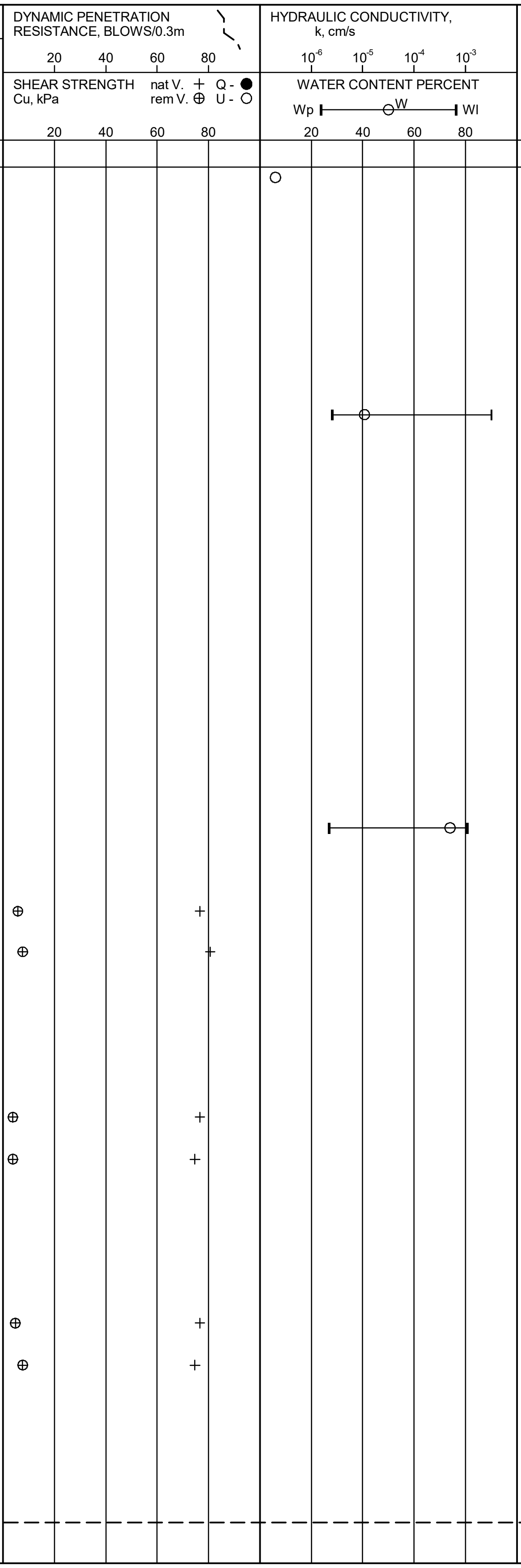
SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

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

SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)
GROUND SURFACE		70.12
FILL - (GM/SM) GRAVEL and SAND, SOME SILT	▨	0.00
FILL - (CI/CH) SILTY CLAY, some sand; brown to grey, contains metal and brick debris pieces; cohesive, w~PL, stiff	▨	0.15
(CH) CLAY; grey, hydrocarbon odour noted during drilling (WEATHERED CRUST); w>PL, very stiff	▨	68.75 1.37
(CH) CLAY; grey, hydrocarbon odour noted from 3.0 to 4.0 m depth during drilling; w>PL, stiff	▨	67.22 2.90

SAMPLES NUMBER	TYPE	BLOWS/0.30m	ADDITIONAL LAB. TESTING
1	SS	11	M
2	SS	6	
3	SS	11	MH
4	SS	6	
5	SS	3	
6	SS	2	
7	SS	1	MH
8	SS	WH	
9	SS	WH	
10	SS	WH	



PIEZOMETER OR STANDPIPE INSTALLATION

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

LOGGED: KG

CHECKED: KCP

PROJECT: 21483012

RECORD OF BOREHOLE: 21-01

SHEET 2 OF 2

LOCATION: N 5032244.5 ;E 368928.9

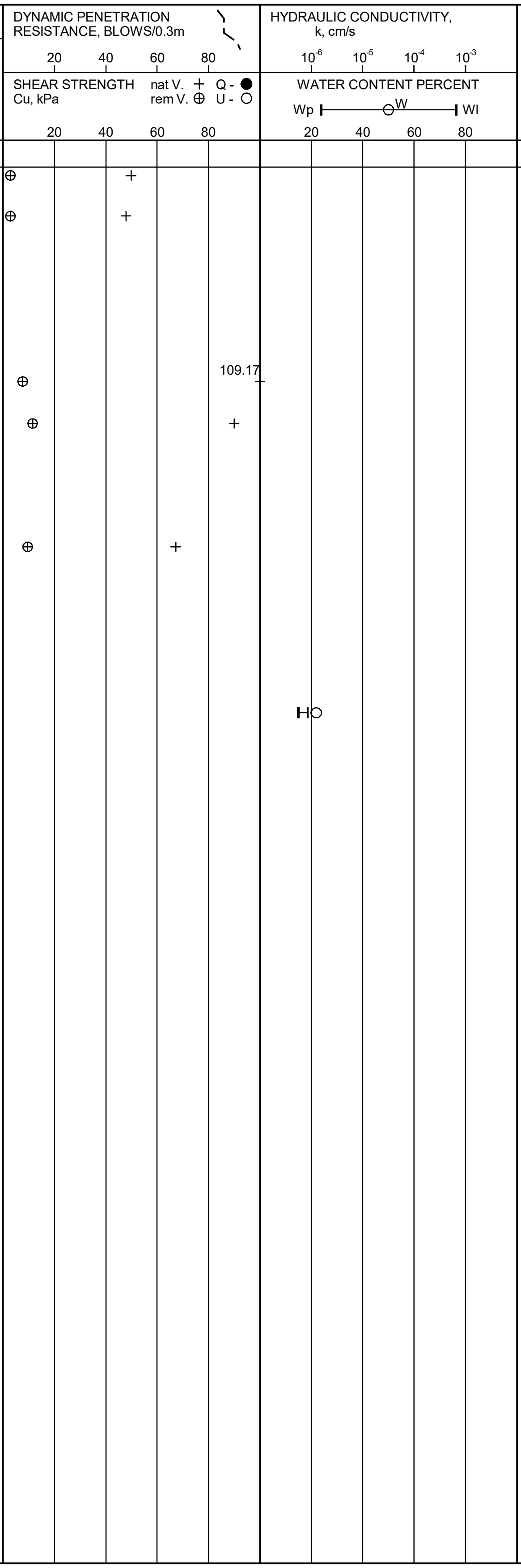
BORING DATE: September 23, 2021

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/0.30m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---							
10	Power Auger 200 mm Diam. (Hollow Stem)	(CH) CLAY; grey, hydrocarbon odour noted from 3.0 to 4.0 m depth during drilling; w>PL, stiff	▨						
11					11	SS	WH		
12					12	SS	WH		
13									
		(ML) sandy SILT, some clay, trace to some gravel; contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet, loose to very dense		56.40 13.72					
14					13	SS	6	MH	
					14	SS	55		
		End of Borehole Auger Refusal		55.46 14.66					
15									
16									
17									
18									
19									
20									



DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: KG

CHECKED: KCP

PROJECT: 21483012

RECORD OF BOREHOLE: 21-02

SHEET 1 OF 1

LOCATION: N 5032249.6 ;E 368923.8

BORING DATE: September 24 & 26, 2021

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

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

SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)
GROUND SURFACE		70.19
FILL - mixture of SILTY SAND and SILTY CLAY; dark brown, contains cobbles and rootlets; moist	▩	0.00
FILL - (CL/CI) SILTY CLAY, trace gravel and sand; grey brown with black mottling; cohesive, w<PL, soft	▩	69.43 0.76
(CH) CLAY; grey (WEATHERED CRUST); w>PL, very stiff	▨	67.90 2.29
(CH) CLAY; grey; w>PL, stiff	▨	66.53 3.66
End of Borehole		62.82 7.37

NUMBER	TYPE	BLOWS/0.30m
1	SS	9
2	SS	5
3	SS	11
4	SS	7
5	SS	2
6	SS	WH
7	SS	WH
8	SS	WH

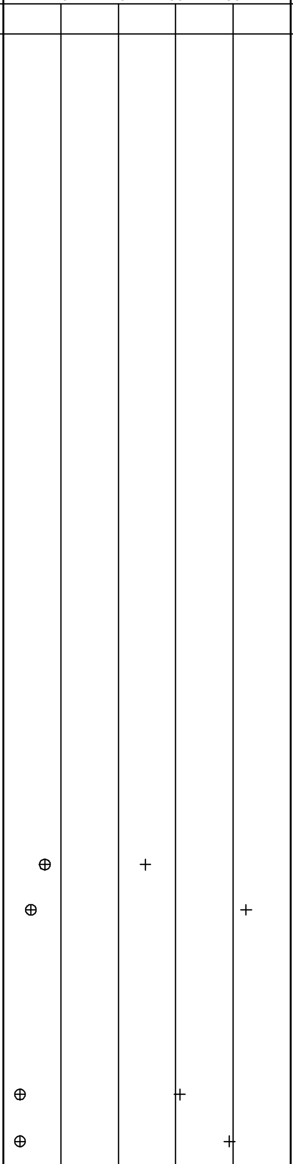
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

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

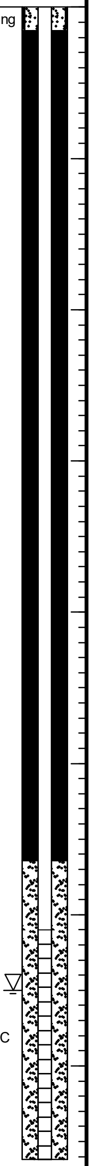
HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

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

ADDITIONAL LAB. TESTING



PIEZOMETER OR STANDPIPE INSTALLATION



Flush Mount Casing

Bentonite Seal

Silica Sand

51 mm Diam. PVC #10 Slot Screen

WL in Screen at Elev. 63.69 m on September 29, 2021

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

DEPTH SCALE 1 : 50

GOLDER MEMBER OF WSP

LOGGED: KG

CHECKED: KCP

MIS-BHS 001 21483012.GPJ GAL-MIS.GDT 21-10-19 JEM

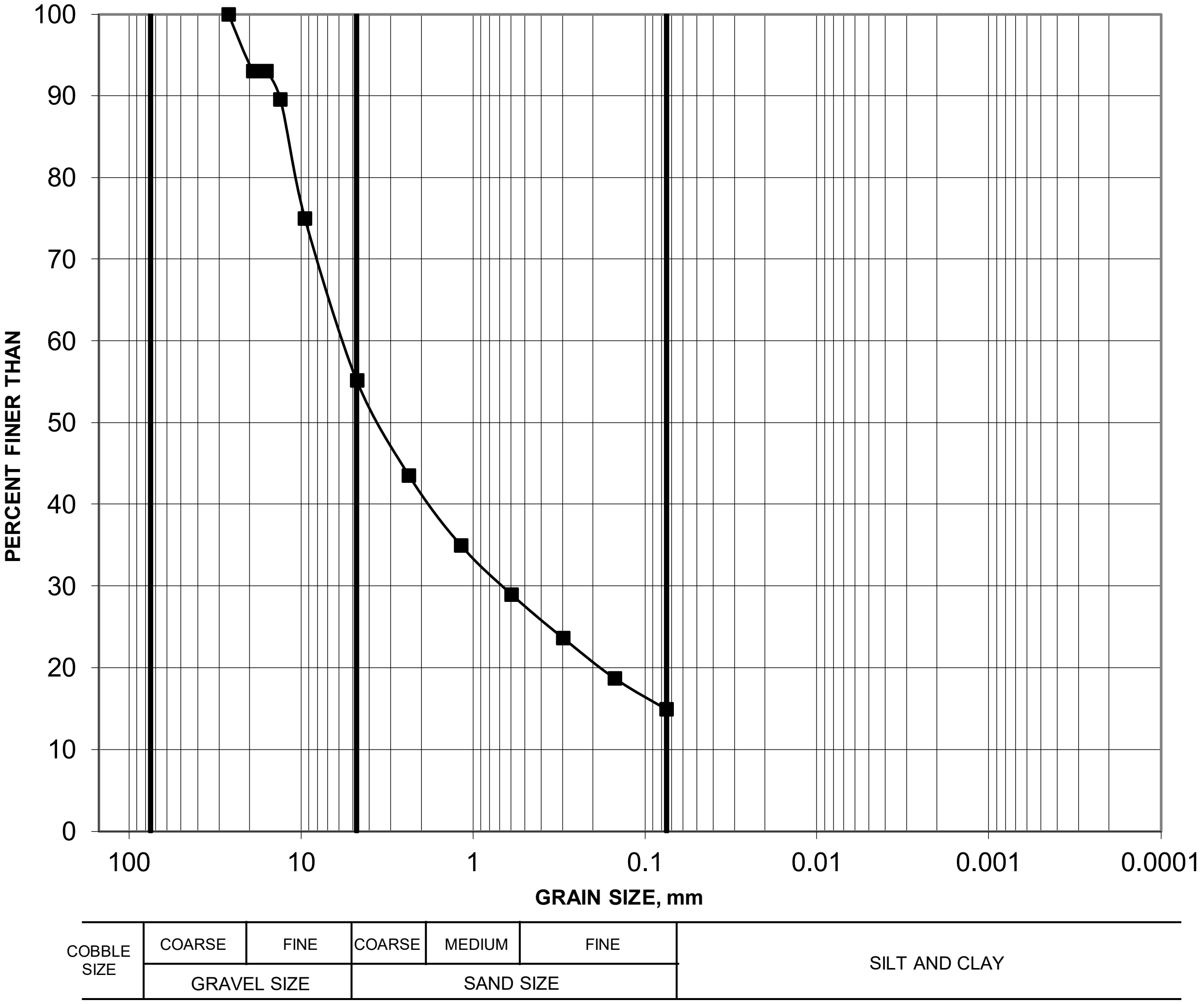
APPENDIX B

Geotechnical Laboratory Results

GRAIN SIZE DISTRIBUTION

FIGURE B1

SAND AND GRAVEL (FILL)



			Constituents (%)			
Borehole	Sample	Depth (m)	Gravel	Sand	Silt	Clay
■ 21-01	1A	0.00-0.15	45	40	15	

Project: 21483012 - 1000

GOLDER
MEMBER OF WSP

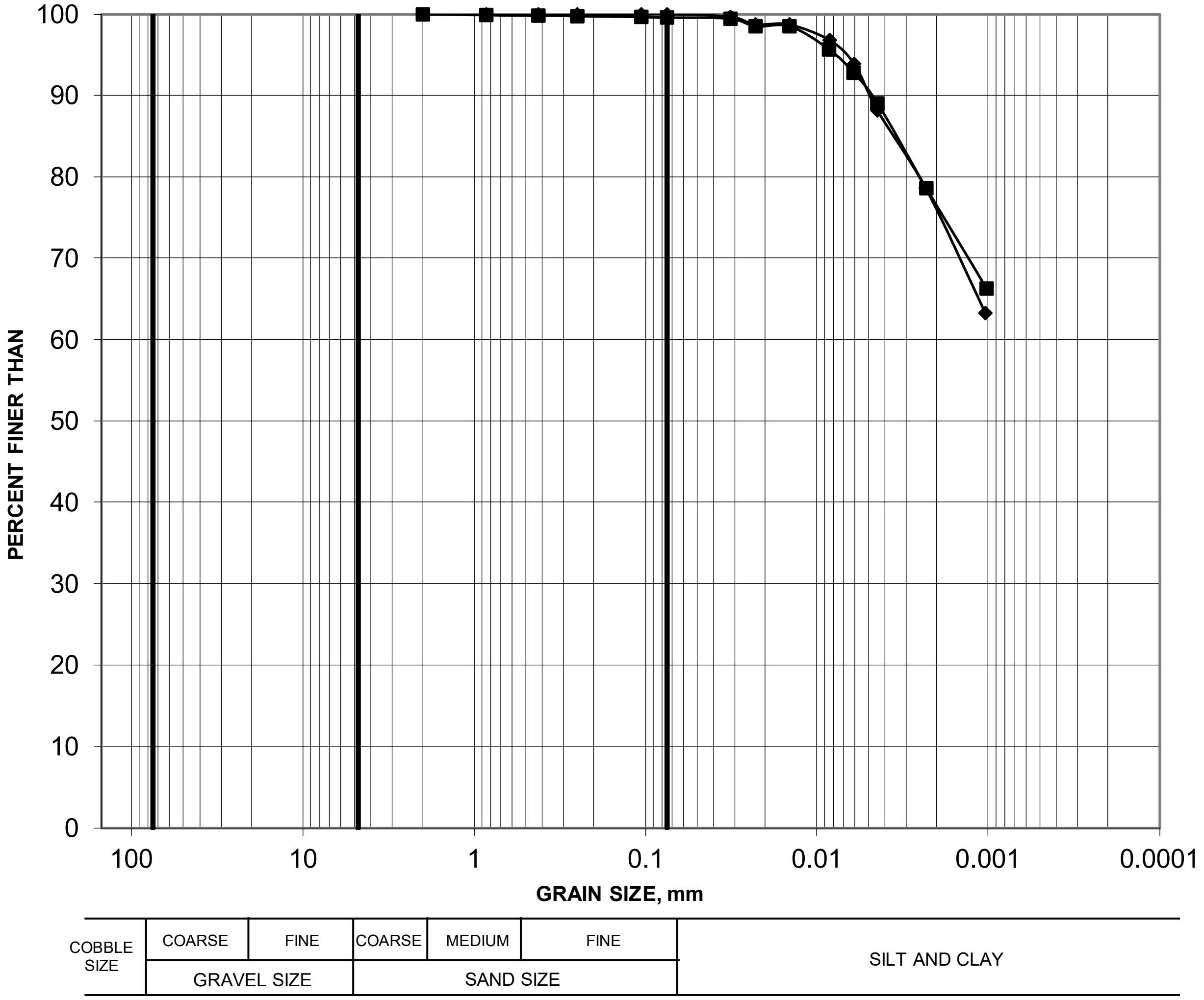
Created by: KCP
Checked by: MI

https://golderassociates.sharepoint.com/sites/35409g/Shared Documents/Active/2021/21483012/figures/

GRAIN SIZE DISTRIBUTION

FIGURE B2

CLAY



				Constituents (%)			
	Borehole	Sample	Depth (m)	Gravel	Sand	Silt	Clay
■	21-01	3	1.52-2.13	0	0	24	76
◆	21-01	7	4.57-5.18	0	0	24	76

Project: 21483012 - 1000

GOLDER
MEMBER OF WSP

Created by: KCP
Checked by: MI

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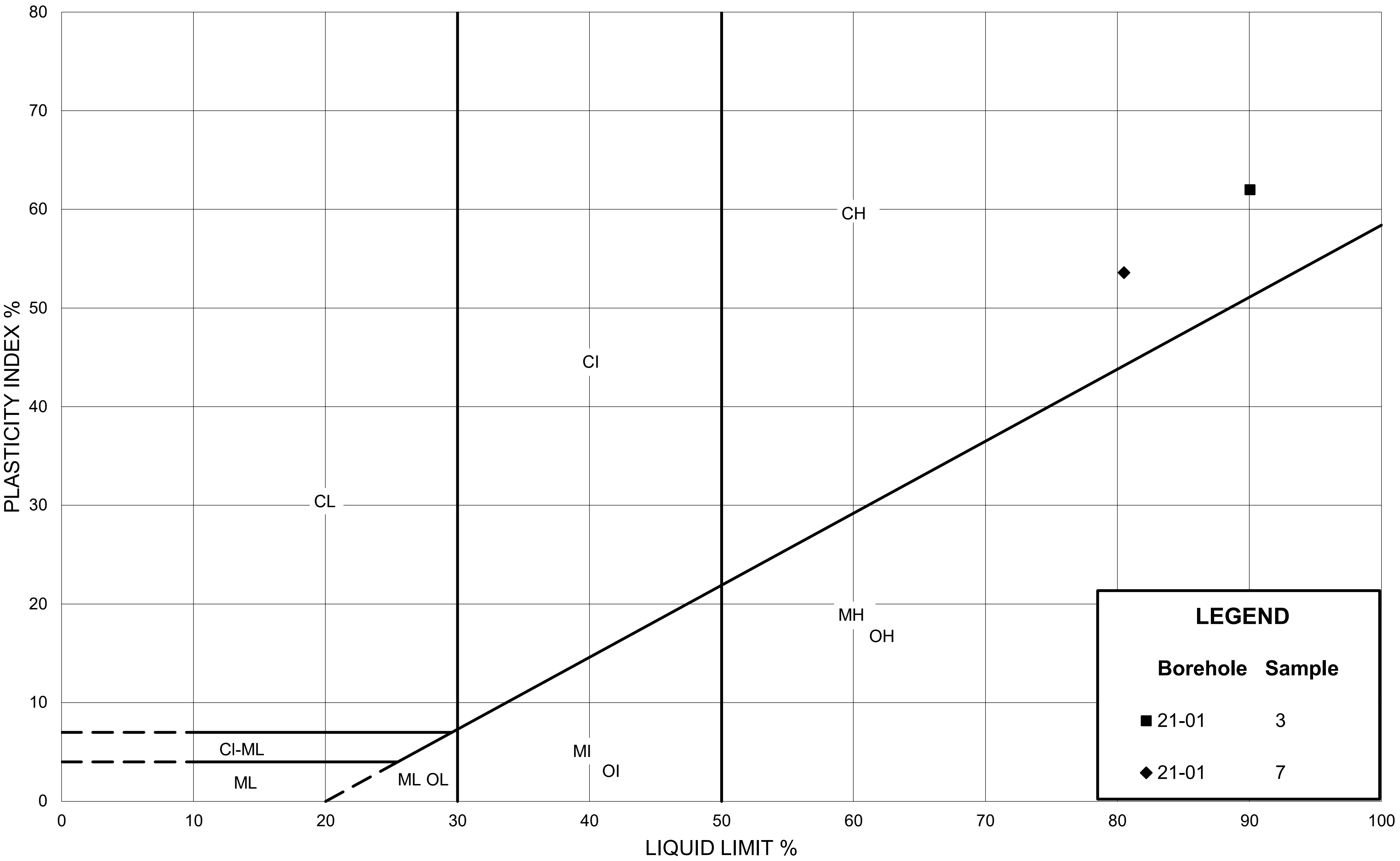


GOLDER
MEMBER OF WSP

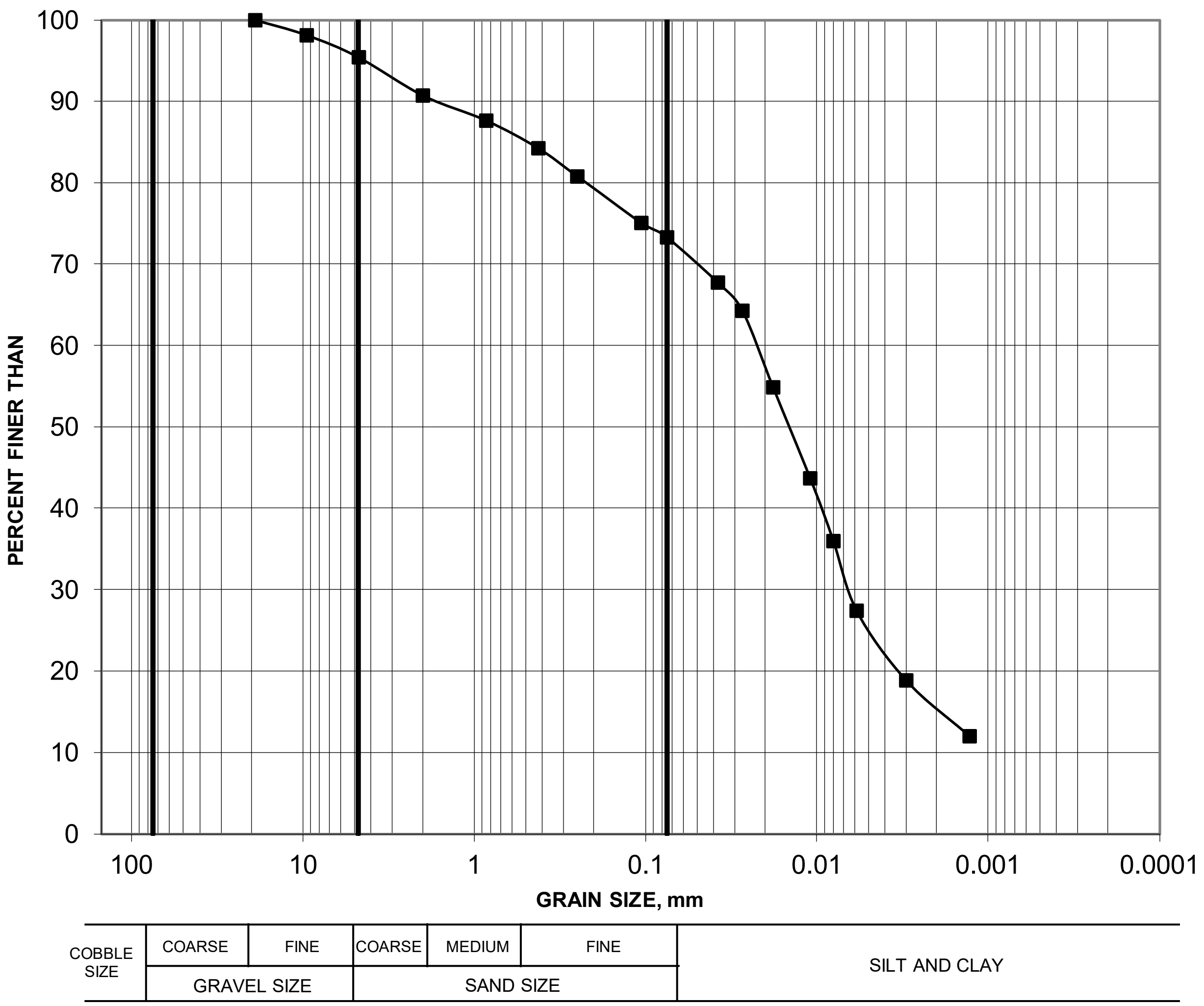
PLASTICITY CHART
CLAY

Figure: B3
Project: 21483012/1000
Created By: KCP Checked By: MI

GRAIN SIZE DISTRIBUTION

FIGURE B4

GLACIAL TILL



				Constituents (%)			
	Borehole	Sample	Depth (m)	Gravel	Sand	Silt	Clay
—■—	21-01	13	13.72-14.33	5	22	57	16

Project: 21483012 - 1000

Created by: KCP
Checked by: MI

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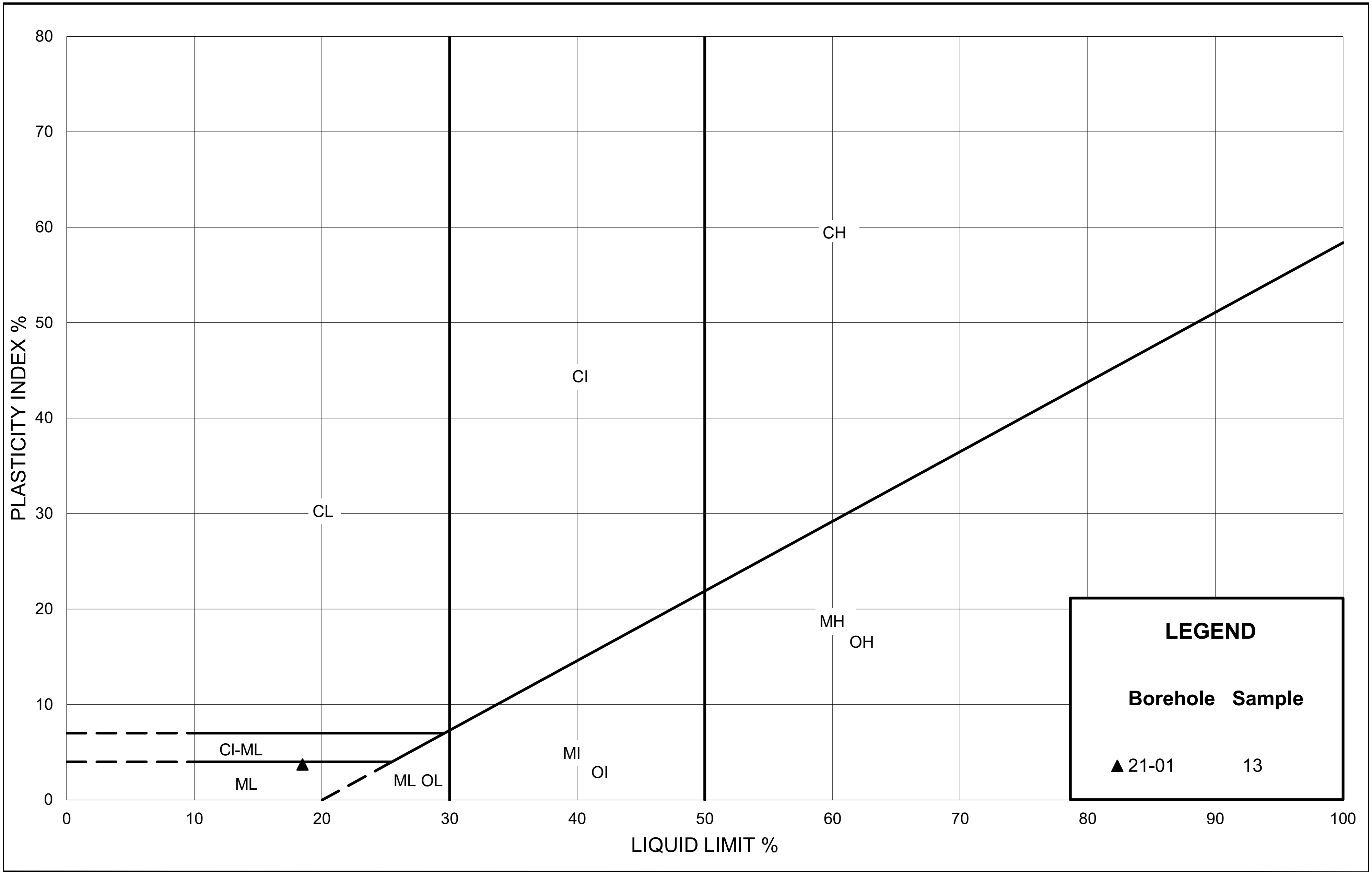

GOLDER
MEMBER OF WSP

PLASTICITY CHART
GLACIAL TILL

Figure:	B5
Project:	21483012/1000
Created By: KCP	Checked By: MI

APPENDIX C

Results of Chemical Analysis

eurofins Environment Testing

Certificate of Analysis

Client:	Golder Associates Ltd (Ottawa) 1931 Robertson Road, Ottawa, Ontario K
Attention:	Mr. Kenton Power
PO#:	
Invoice to:	Golder Associates Ltd

Report Number:	1963473
Date Submitted:	2021-09-28
Date Reported:	2021-10-05
Project:	21483012/1000
COC #:	880684

Group	Analyte	MRL	Units	Guideline	Lab I.D.: 1585597 Sample Matrix: Soil Sample Type: Sampling Date: 2021-09-23 Sample I.D.: 21-01 sa5 / 10-12'
Anions	Cl	0.002	%		0.028
	SO4	0.01	%		<0.01
General Chemistry	Electrical Conductivity	0.05	mS/cm		0.06
	pH	2.00			8.34
	Resistivity	1	ohm-cm		16700

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 D

Site Photographs

Photograph 1: Proposed building location looking south towards Borehole 21-01

Photograph 2 Proposed building location looking north towards Borehole 21-02

Photograph 3: Looking west from Friel Street towards site location

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