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THURBER ENGINEERING LTD.

Geotechnical Design Report for Building Permit Application

CHEO 1Door4care Parking Garage

Client Name: EllisDon
Date: August 21, 2023
File: 36182

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THURBER ENGINEERING LTD.

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THURBER ENGINEERING LTD.

1. INTRODUCTION

Thurber Engineering Ltd. (Thurber) has been retained by EllisDon to provide geotechnical input to the design of foundations for the proposed parking structure at the Children's Hospital for Eastern Ontario (CHEO) Campus.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions included in Appendix A.

Geo-environmental (chemical) aspects of the project including disposal excess soil/groundwater off site, 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 our terms of reference for this project and are not addressed herein.

This report has been issued based on a review of the geotechnical investigations conducted by Infrastructure Ontario's engineer (GHD). The soil conditions may vary between and beyond the borehole locations, and accordingly geotechnical inspection during construction is important to assess any variation of subsurface conditions and to provide additional recommendations if necessitated by such variations.

The use of this report is contingent to ED obtaining a reliance letter from the owner (Infrastructure Ontario) for all the subsurface investigation report(s) provided by the owner and that the reliance letter will include Thurber in conjunction with ED.

It should be noted that Thurber accepts no responsibility for the accuracy and quality of the factual information presented by others.

2. BACKGROUND

Preliminary geotechnical investigations were conducted at the Site by GHD (Infrastructure Ontario's Consultant), the results of which were presented in a report titled "1Door4Care: CHEO Integrated Treatment Centre – Geotechnical Investigation Report (Parking Garage)" dated October 25, 2022.

The geotechnical investigations took place in two stages between January 12, 2021 and July 19, 2022. The scope of geotechnical investigation included advancing a total of 23 boreholes and 6 monitoring wells and geophysical survey using Ground Penetration Radar (GPR).

3. UNDERSTANDING OF SUBSURFACE CONDITIONS

A plan showing the location of the proposed structure at the site as well as the location of the boreholes and monitoring wells advanced at the site has been included in Appendix B. The record of borehole sheets along with the laboratory test results have been included in Appendix B.

The inferred subsurface conditions outlined in this report, have been inferred based on the record of boreholes presented in the above GHD's report.

In general, the subsurface conditions at the site consisted of asphalt over non-cohesive fill (predominantly gravelly sand/gravel/sandy gravel/silty sand to sand and gravel) which is in turn underlain by non-cohesive native soil (predominantly compact to dense gravelly sand/sand/silty sand/sand and gravel/sand and silt) over shale bedrock. The thickness of the fill at the site varied between 0.3 m and 0.8 m. The silty native soil extended to depths ranging from 0.6 m to 1.2 m below existing ground surface, and shale bedrock was encountered or inferred at depths ranging from 0.4 m to 1.2 m below existing ground surface.

Due to the method of investigation and the presence of highly weathered shale below native soil, the top of the bedrock profile cannot be accurately determined. However, the estimated depths to the highly weathered shale bedrock surface as well as estimated elevation of the competent shale bedrock from augering and coring or auger refusal at the location of each borehole at the site have been presented in the following table:

Table 3.1: Approximate Depth and Elevation of Bedrock

Borehole Identification Number	Estimated Depth/Elevation of Bedrock Surface (mbgs/m)	Estimated Elevation of Competent Bedrock Surface (m)
BH1-21	0.9 / 80.5	3.2 / 78.2*
BH2-21	1.1 / 80.2	2.8 / 78.6*
MW3-21	0.6 / 80.8	4.6 / 76.8
BH4-21	0.8 / 81.5	2.8 / 79.5*
MW5-21	0.4 / 81.4	-
MW6-21	1.2 / 80.9	3.5 / 78.7
BH7-21	0.8 / 81.5	2.5 / 79.7*
MW8-21	0.9 / 81.3	2.2 / 80.0*
B1-21	1.0 / 81.0	1.0 / 81.3*

Borehole Identification Number	Estimated Depth/Elevation of Bedrock Surface (mbgs/m)	Estimated Elevation of Competent Bedrock Surface (m)
B2-21	0.9 / 80.5	-
B3-21	1.2 / 80.9	-
MW9-22	0.8 / 81.2	2.6 / 79.4
BH10-22	0.7 / 81.5	1.2 / 80.9*
BH11-22	0.9 / 81.3	2.5 / 79.6
BH12-22	1.1 / 81.0	1.8 / 80.2*
BH13-22	1.0 / 81.2	1.9 / 80.2
BH14-22	0.7 / 81.5	1.2 / 81.0*
BH15-22	0.6 / 81.5	1.1 / 81.1*
BH16-22	0.9 / 81.2	1.2 / 80.9*
BH17-22	1.0 / 81.1	1.1 / 81.0*
BH18-22	0.8 / 81.3	1.4 / 80.7
BH19-22	0.9 / 80.2	-
MW20-22	1.0 / 80.2	1.6 / 79.6*

* Estimated Elevation due to Auger Refusal

The groundwater level measurements in the wells are summarized below:

Table 3.2: Groundwater Level Readings at the Site

Borehole	Ground Surface Elev. (m)	Depth to Water (m)	Groundwater Elev. (m)	Main Screened Deposit
MW3-21	81.37	2.7	78.7	Weathered Shale
		2.5	78.9	
		2.6	78.8	
MW5-21	81.83	Dry	Dry	Gravelly Sand FILL/Weathered Shale
MW6-21	82.17	3.0	79.2	Shale
		3.0	79.2	
		3.1	79.1	
		3.0	79.2	
		2.0	80.2	Shale

Borehole	Ground Surface Elev. (m)	Depth to Water (m)	Groundwater Elev. (m)	Main Screened Deposit
MW8-21	82.2	2.1	80.1	
		1.7	80.5	
		1.7	80.5	

The groundwater level will be subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet seasons. Perched water may be present at higher levels within the existing fills and/or directly above the bedrock surface.

4. FOUNDATION DESIGN RECOMMENDATIONS

The discussions and preliminary design recommendations presented in this report are based on the information provided to us and on the factual data obtained as part of the investigations completed by GHD. These preliminary recommendations are subject to changes and modifications subject to completion of a supplemental geotechnical investigation (to be carried out during execution).

It is understood that the proposed structure includes an 8-storey building with no below-grade levels. The average top of ground elevation within the proposed building footprint is about Elev. 82.1 m, based on boreholes MH6-21, B2-21, MW9-22, and BH11-22 to BH18-22. The final grades of the lowest level of the proposed structure will be at about Elev. 82.8 m, and the structure will be supported on spread/square footings founded at about Elev. 81.0 m (where bedrock was found at the site).

The reference geotechnical report indicated that bedrock at the site is Shale of Georgian Bay formation which is the dominant bedrock formation in the Greater Toronto Area (GTA). However, a review of bedrock geology maps for Ottawa (MAP 1508A published by Geological Survey of Canada) indicates that the site is located at the border of Carlsbad and Billings Shale formations.

Although the Georgian Bay Shale formation presents some long-term swelling potential associated with changes in salinity, changes in groundwater regime, changes in in-situ stresses, etc., the Carlsbad and Billings Shale formations of Ottawa have not shown such behavior. However, the shale from the Billings Formation (which is likely to be encountered at the site, and to be confirmed as part of the supplemental investigation during the execution) is susceptible to heaving if allowed to weather in the presence of oxygen and moisture. The general mechanism is that oxidation of pyrite within the shale produces sulfuric acid, which in turn reacts with calcite in the shale to form gypsum crystals, which occupy a larger volume than the original materials. A by-product of this chain of reactions also tends to increase sulphate levels which can attack buried concrete structures.

4.1 Foundation Excavation and Temporary Dewatering

It is anticipated that the finished floor of the building will be at about Elev. 82.7 m and that the excavations will be extended to about Elev. 81.0 m. In general, the open-cut excavations will extend through non-cohesive fill (predominantly gravelly sand/gravel/sandy gravel/silty sand to sand and gravel), non-cohesive native soil (predominantly compact to dense gravelly

sand/sand/silty sand/sand and gravel/sand and silt) and shale bedrock. Groundwater is expected to be at or below the base of excavation.

Use of a hydraulic excavator should be suitable for trench excavation within the overburden soils. Provision should be made for handling and removal of asphalt and possible obstructions (i.e., cobbles and boulders) within the fill/soils.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. Provided that the excavations are adequately dewatered, the overburden soils are classified as Type 3 above the groundwater level in accordance with the OHSA. Accordingly, excavations in the overburden above the groundwater level can be inclined at 1H:1V, or flatter.

Soil must not be stockpiled beside the excavation within a horizontal distance from the excavation wall equal to the depth of excavation.

Depending on the final elevation of the footings, bedrock removal may be necessary. It will be possible to remove the upper highly weathered portion of shale, to about 0.5 to 1.0 m depth using large hydraulic excavating equipment. Further shale bedrock removal could be accomplished using mechanical methods (such as hoe ramming); however, it is unlikely that removal of competent shale would be necessary for excavations with their base at or above Elev. 81 m.

Provided that the base of excavation is kept at or above Elev. 81 m, groundwater seepage into the excavation is expected to be handled by filtered sumps and drains.

4.2 Site Preparation

The existing fill and loose native soils founded at the site are not suitable for the support of foundations and floor slabs. These deposits, along with all existing foundations, floor slabs and utilities associated with the current site development, will need to be removed from beneath proposed foundations and slabs and from within the influence zone of the foundations and slabs. The influence zone includes the area beneath an imaginary line extending downward and outward from the edges of the proposed foundations/slabs at a 45 degrees angle down to undisturbed native soil or bedrock. Grades can be raised using Engineered Fill.

4.3 Protection of Expansive Shale

The shale bedrock at this site has the potential to swell following exposure to oxygen. The general mechanism is considered to be that pyrite (FeS2) which is present at low concentrations in the shale, is weathered in the combined presence of oxygen and water to form sulphuric acid.

That sulphuric acid then reacts with calcite, which is also present within the shale either as an integral part of the rock or as filling within fractures, to form gypsum. The gypsum crystals tend to form within existing fractures and to be volumetrically larger than the materials that formed them, thus resulting in heaving.

For the above reactions to occur there must be both water and oxygen available. An increase in the ground temperature, such as due to the heat from the parking vehicle, heated areas, etc., is also considered to promote the above reactions.

It is also possible for the products of the above reactions to attack the concrete (i.e., sulphate attack).

To help prevent expansion of the shale and/or reaction with the concrete, the shale must be protected from exposure to oxygen both in the long term as well as temporarily during construction adjacent to the existing building.

The shale bedrock subgrade, when exposed during construction, should be covered as soon as practical (within 12 hours) following the first exposure with a lean concrete layer at least 100 millimetres thick.

Construction planning should ensure the shale is not left exposed and uncovered overnight. Where shale is exposed on the sides of the excavation, the mud slab (with sulphate resistant cement) or shotcrete should be placed such that the concrete covers the shale to at least 100 millimetres above the top of rock level.

Previous excavations or trenches within the proposed construction area should be re-excavated down to shale bedrock and approximately 150 millimetres of the previously exposed shale removed prior to the placement of the concrete skim coat.

4.4 Engineered Fill Pad

The engineered fill, where and if required, should consist of Ontario Provincial Standard Specification (OPSS) Granular A or Granular B Type II placed in a maximum 300 mm thick loose

lifts and compacted to 100 percent of the material's standard Proctor maximum dry density (SPMDD). The top of the engineered fill should be at least 1.0 m wider than foundations at the underside of the footing. Where engineered fill is placed to support the structure footings, its thickness should not be less than 1.0 m unless the engineered fill is placed on bedrock, in which case a lower thickness would be acceptable for the engineered fill.

4.5 Foundation Design

The following options are considered feasible for support of the building structure:

Table 4.1: Foundation Design Options

Foundation Options	Advantages	Disadvantages
Spread/Square Footings on Competent Bedrock	Allows for relatively high geotechnical bearing capacities at ULS and SLS	May require deeper excavations and lower founding elevations
Spread/Square Footings on at least 0.2 m thick engineered fill on Weathered Bedrock	Allows shallower excavations	Will provide moderate geotechnical resistances at ULS and SLS

The following Table may be used for the design of shallow foundations bearing on a maximum 1 m thick engineered fill pad over weathered shale or directly supported on competent bedrock:

Table 4.2: Recommended Geotechnical Resistances at ULS and SLS

Founding Stratum	Footing Size (m)/Type	Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Resistance at SLS (kPa) for 20 mm of Settlement
Engineered Fill Pad over Weathered Shale	2 m wide strip	600	500
	3 m wide strip	650	480
	4 m wide strip	700	400
	2 m Square	850	800
	3 m Square	880	550
	4 m Square	900	400
Competent Shale	2 m wide strip	1,100	1,100
	3 m wide strip	1,200	1,100
	4 m wide strip	1,300	1,200
	2 m Square	1,600	1,500
	3 m Square		1,200

Founding Stratum	Footing Size (m)/Type	Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Resistance at SLS (kPa) for 20 mm of Settlement
	4 m Square		1,000

The resistance values provided above are for vertical, concentric loads. Where eccentric or inclined loads are applied, the resistance values used in the design must be reduced accordingly.

The sliding resistance of a cast-in-place footing on bedrock or engineered fill may be computed using the unfactored friction coefficient of 0.7 or 0.55, respectively.

Due to potential swelling of Billings Shale, the final prepared bedrock surface shall be covered by shotcrete or lean concrete within 12 hours of exposure.

Where previous excavations or trenches are present within about 1 m from the closest edge of each proposed foundation or within the footprint of the slab-on-grade, those utilities (including their bedding and backfill) should be fully removed (abandoned) and backfilled with lean concrete (to the top of the adjacent shale bedrock) after removal of about 150 millimetres of the previously exposed shale (the shale which was exposed during construction of the existing trenches).

4.6 Frost Depth

The design frost depth in Ottawa is 1.8 m below the ground surface. The base of all footings should be founded at a minimum depth of 1.8 m, both vertically and horizontally or be provided with an equivalent thickness of insulation such as expanded polystyrene (EPS) for frost protection. Typically, 25 mm of EPS can be considered equivalent to 300 mm of earth cover for frost protection.

Perimeter footings and interior footings within 1.5 m of perimeter walls of heated structures should be protected by a minimum soil cover of 1.5 m or equivalent insulations. For interior foundations with a horizontal distance greater than 1.5 m from the perimeter of a heated building, frost protection is not required.

4.7 Slab-On-Grade and Raft Foundations

A conventional slab-on-grade is suitable for this project after completion of the site preparation and protection of the swelling shale as described in previous sections. The design of slabs-on-grade may be based on a modulus of subgrade reaction of 25 MPa/m, based on a loaded area of

0.3 m by 0.3 m. A layer of free draining granular material such as OPSS Granular A at least 200 mm thick compacted to 100% of SPMDD should be placed below the floor slab to create a level construction pad and to provide drainage and support. Any bulk fill required to raise the grade to the underside of the Granular A should consist of OPSS Granular B Type II.

Perimeter drains and under slab drains are not required in areas where the Finished Floor Elevation is at least 200 mm above the exterior grades and surface water is directed away from the building.

In building areas that include below grade structures (e.g., elevator pits), the walls and floors should be designed as water-tight and to resist hydrostatic pressures unless perimeter and under slab drainage is provided. The decision on whether to provide drainage for the below grade structures should consider factors such as the quality and quantity of water that will be removed from the site and the need to prevent the underlying shale bedrock from drying out which could lead to heave.

4.8 Backfill to Structures and Lateral Earth Pressure

Backfilling the structures should be conducted with free draining non frost susceptible granular material such as OPSS Granular A or Granular B Type I, II or III conforming to the requirements of OPSS.MUNI 1010. Small vibratory compaction equipment should be used within about 0.5 m of the wall to minimize compaction induced stresses. Compaction of the backfill materials should be conducted as per OPSS.MUNI 501.

Lateral earth pressures acting on the structure may be assumed to be triangular and to be governed by the characteristics of the backfill. For a fully drained condition, the pressures should be computed in accordance with the CHBDC but generally are given by the expression:

$$P_h(d) = K^*(\gamma d + q)$$

where: $P_h(d)$ = lateral earth pressure at depth d (kPa);

K = static earth pressure coefficient (see table);

γ = unit weight of retained soil (kN/m^3), adjusted for groundwater level;

d = depth below top of fill where pressure is computed (m); and

q = value of any surcharge (kPa).

A compaction surcharge should be applied in the design. The magnitude of the lateral pressure representing the compaction surcharge should be 12 kPa at the top of fill which linearly decreases to zero at a depth of 1.7 m (for OPSS Granular B Type I) or at a depth of 2.0 m (for OPSS Granular A or Granular B Type II).

Earth pressure coefficients for backfill to the structure walls are dependent on properties of the granular fill used as the backfill. Typical earth pressure coefficients are shown in the table below, assuming the ground surface behind the wall is flat.

Table 4.3: Lateral Earth Pressure Coefficients

Loading Condition	OPSS Granular A or Granular B Type II $\Phi = 35°$, $\gamma = 22.0$ kN/m^3	OPSS Granular B Type I or Type III $\Phi = 32°$, $\gamma = 21.0$ kN/m^3
Active, K_a	0.27	0.31
At-Rest, K_o	0.43	0.47
Passive, K_p	3.7	3.3

4.9 Site Seismic Classification

Based on the results of the MASW survey conducted in the vicinity of the proposed structure, described in a report by GHD titled “1Door4Care: CHEO Integrated Treatment Centre – Geotechnical Investigation Report (1Door4Care)” dated October 25, 2022, the average shear wave velocity at the site is greater than 760 m/s, and less than 1500 m/s, therefore, a Site Class B designation should be used in the design of the proposed structure provided that the thickness of soil between underside of the foundations and the top of bedrock does not exceed 3 m.

Based on correspondence with structural engineers it is understood that a Request For Information (RFI) will be sent to IO to identify the governing code (NBC 2015, NBC 2020, OBC 2012, etc.) in design of the structure. Further recommendations along with the anticipated seismic hazard values will be provided once clarifications have been received.

4.10 Cement Type

A moderate potential for sulphate attack was identified for the weathered shale. Therefore, design of the foundations and below grade walls of the proposed structure should consider CSA Type MS or MH cements.

4.11 Site Servicing

Bedding requirements for the sewers and watermains are summarized as follows:

- Where the subgrade consists of native soil, a bedding thickness of 150 mm can be used in accordance with City of Ottawa Standard Detail Drawing, S6, S7 and W17; or
- Where the subgrade consists of bedrock, the bedding thickness should be increased to 300 mm in accordance with City of Ottawa Standard Detail Drawing S6, S7, and W17 to reduce the potential for point loads from a potentially irregular bedrock surface.

In all cases the bedding material and pipe cover (to at least 300 mm above the top of pipe) should consist of Granular A (S.P. F-3147) that is compacted using suitable vibratory compaction equipment in accordance with S.P. D-029.

The lateral clearance from the outside edge of the pipe to the trench wall should be a minimum of 450 mm for a pipe diameter less than or equal to 900 mm. For pipes with a diameter larger than 900 mm, the minimum lateral clearance should be increased to 500 mm.

The use of clear crushed stone as a bedding layer should not be permitted since fine particles of the overlying backfill soils could potentially migrate into the voids in the clear crushed stone and cause settlement of the pipe and/or the road surface.

Trench backfill above the pipe cover/embedment material should conform to City of Ottawa specification S.P. F-2120 and/or OPSD 802.030 to 803.034 whichever is governing. Backfill should consist of approved excavated material, such as heterogeneous fill (provided that it is fee of organic matter and other deleterious materials), or native inorganic overburden that has a suitable moisture content for compaction.

As noted previously, the shale bedrock at this site is potentially expansive following exposure to oxygen. Due to the risk for expansion, the excavated shale bedrock is not recommended for reuse as trench backfill. The excavated shale, as well as any fill that contains organic and/or deleterious materials, should be transferred off-site in accordance with the Soil Characterization Report prepared for this project, which is provided under separate cover.

If imported fill is required to make up the balance of trench backfill, it should consist of compactable and inorganic earth borrow (OPSS.MUNI 206/212) or Select Subgrade Material (OSSS.MUNI 1010).

All trench backfill, including re-used soils and imported fill, should be compacted in accordance with City S.P. D-029. If the trench backfill material is too wet to achieve the required compaction requirements, it should be stockpiled and allowed to dry, or wasted and replaced with more suitable fill.

The trench backfill above the bedrock surface and within the frost zone (i.e., between the pavement subgrade level and 1.8 m depth, or the bedrock surface, whichever is shallower) should match the soil exposed on the trench walls for frost heave compatibility. This will require some separation of materials upon excavation. Qualified geotechnical personnel should approve the backfill materials for frost compatibility and review the requirements for frost tapers at the time of construction based on the soils exposed in the trench walls. Watermains with less than 2.4 m of cover should be insulated in accordance with City of Ottawa Standard Detail Drawing W22.

Backfilling operations during cold weather must avoid frozen lumps of material, snow, and ice; otherwise, settlement should be expected.

Seepage barriers should be constructed at periodic intervals along the trench to reduce the potential for groundwater level lowering in the surrounding area due to the “French drain” effect on the granular bedding and surround. Otherwise, long-term groundwater level lowering could result in heaving of the shale beneath the new service pipes or adjacent structures. Seepage barriers also act as cut-offs to prevent migration of contaminants along the relatively permeable backfill in the trenches, as well as a mitigation method during construction to limit groundwater inflow along the trench.

It is important that the seepage barriers extend from trench wall to trench wall and that they fully penetrate the granular surround materials to the trench bottom. The seepage barriers should be at least 1.5 m long. Construction of the seepage barriers should be in accordance with the City of Ottawa’s Standard Detail Drawing No. S8. Seepage barriers should be placed at a maximum spacing of 75 m along the trench and on either side of crossing roadways to limit hydraulic connections with intersecting services.

5. CLOSURE

This report was issued for the purpose of building permit application only, before any final design or construction details had been prepared or issued. Therefore, differences may exist between the report recommendations and the final design, the project specifications, or conditions during construction. In such instances, Thurber Engineering Ltd. should be contacted immediately to address these differences. Designers and contractors undertaking or bidding the work should examine the factual results of the investigation, satisfy

themselves as to the adequacy of the information for design and construction, and make their own interpretation of the data as it may affect their proposed scope of work, cost, schedules, safety, and equipment capabilities.

We trust this information meets your present needs. If you have any questions, please contact the undersigned at your convenience.

Nina Warrier, P. Eng.
Geotechnical Engineer

Date: ***August 21, 2023***
File: ***36182***

Mehdi Mostakhdemi, M.Sc., P. Eng.
Review Engineer

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

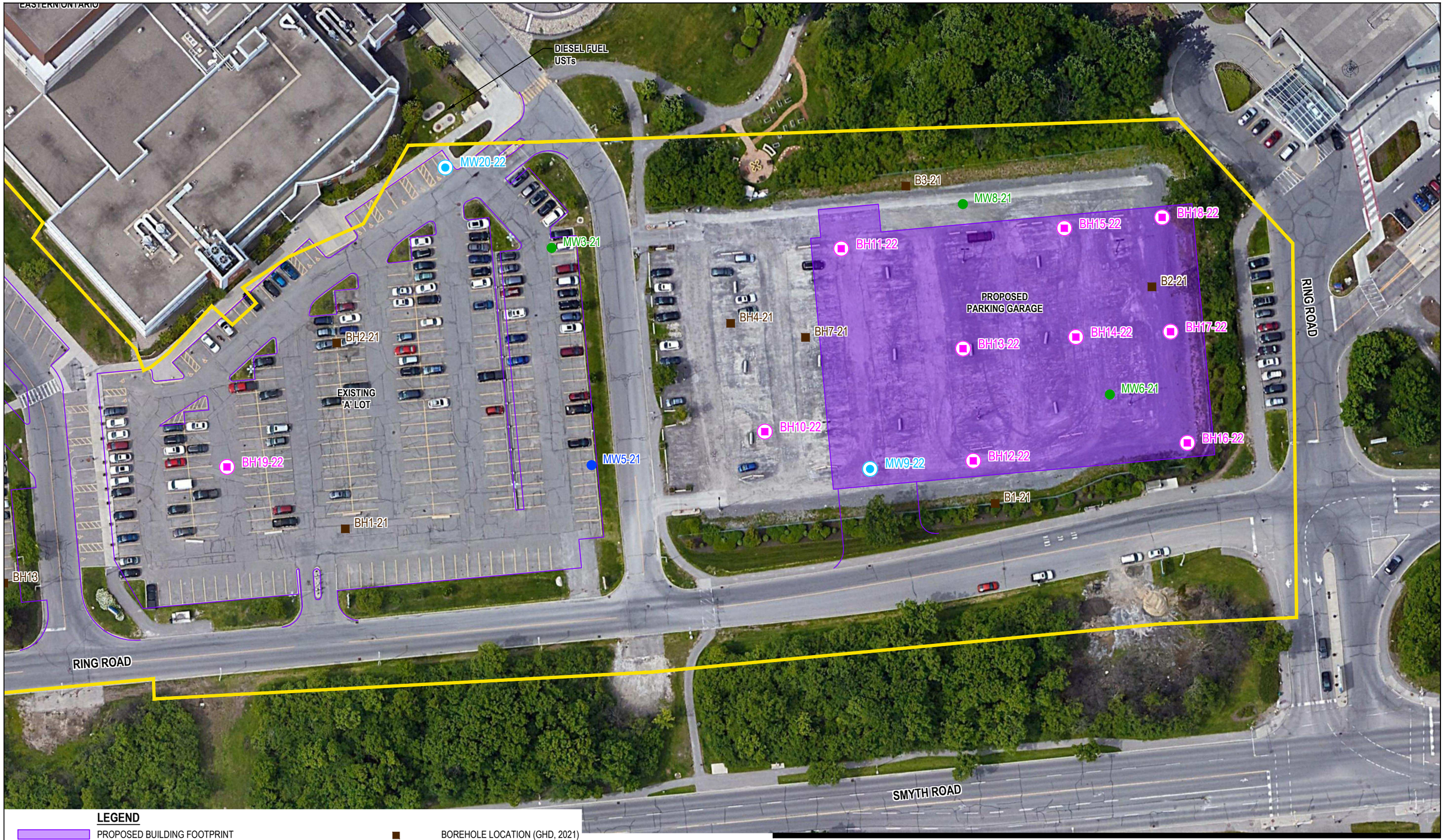
The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

THURBER ENGINEERING LTD.

APPENDIX A

Borehole Location Plan (from GHD's) Report

Record of Boreholes and Laboratory Test Results



LEGEND

- PROPOSED BUILDING FOOTPRINT
- PROPOSED PARKING AREA OR SITE FEATURE
- PROPOSED PROJECT AREA FOR SITE DUE DILIGENCE BOUNDARY
- BOREHOLE LOCATION (GHD, 2022)
- SHALLOW OVERBURDEN/BEDROCK MONITORING WELL LOCATION (GHD, 2022)
- BOREHOLE LOCATION (GHD, 2021)
- DEEP BEDROCK MONITORING WELL LOCATION (GHD, 2020-21)
- SHALLOW OVERBURDEN/BEDROCK MONITORING WELL LOCATION (GHD, 2020-21)

0 8 16 24m

1:800

Coordinate System:
NAD 83 UTM ZONE 18
METRES

N

GHD

PROPOSED PARKING GARAGE
CHILDREN'S HOSPITAL OF EASTERN ONTARIO CAMPUS
401 & 407 SMYTH ROAD, OTTAWA, ONTARIO

INVESTIGATIVE LOCATION PLAN

Project No. **11205379**
Date **September 2022**

FIGURE 2

Filename: \\ghdnet\ghd\CA\Toronto\Projects\662\11205379\Digital_Design\ACAD 2018\Figures\RPT015\11205379-GHD-00-00-RPT-EN-D101_WA-015.dwg
Plot Date: 02 September 2022 8:28 AM

Data Sources: SURVEY BY J.D. BARNES LIMITED, DECEMBER 19, 2019. (UTM18-NAD83).
CHEO, 1DOORFOR4CARE (1D4C), SITE PLAN - PHASE 1A, Solic. No: 2111095, Date: 02/20/22.

Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey sols is measured by the value of undrained shear strength (Cu).

Classification (Unified system)

Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 4.25 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology

"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

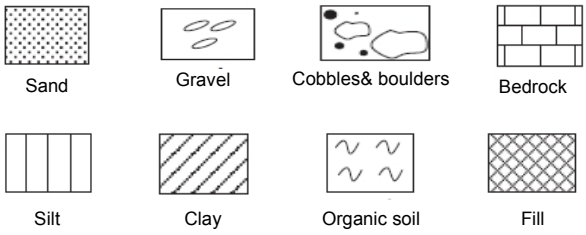
Relative density of granular soils	Standard penetration index "N" value (BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu) (P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation

"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND



Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
ST: Shelby tube
AG: Auger
SSE, GSE, AGE: Environmental sampling
PS: Piston sample (Osterberg)
RC: Rock core
GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_c: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressure meter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

I_p: Plasticity index
W_l: Liquid limit
Wp: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
γ: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor

Explanation of Terms Used in the Bedrock Core Log

Strength (ISRM)

Terms	Grade	Description	Unconfined Compressive Strength (MPa)	(psf)
Extremely Weak Rock	RQ	Indented by thumbnail	0.25-1.0	36-145
Very Weak	R1	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1.0-5.0	145-725
Weak Rock	R2	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5.0-25	725-3625
Medium Strong	R3	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer.	25-50	3625-7250
Strong Rock	R4	Specimen requires more than one blow of geological hammer to fracture it.	50-100	7250-14500
Very strong Rock	R5	Specimen requires many blows of geological hammer to fracture it.	100-250	14500-36250
Extremely Strong Rock	R6	Specimen can only be chipped with geological hammer.	>250	>36250

Bedding (Geological Society Eng. Group Working Party, 1970, Q.J. of Eng. Geol. Vol 3)

Term	Bed Thickness	
Very thickly bedded	>2 m	>6.5 ft.
Thickly bedded	600 mm-2 m	2.00-6.50 ft.
Medium bedded	200 mm-600 mm	0.65-2.00 ft.
Thinly bedded	60 mm-200 mm	0.20-0.65 ft.
Very thinly bedded	20 mm-60 mm	0.06-0.20 ft.
Laminated	6 mm-20 mm	0.02-0.06 ft.
Thinly laminated	<6 mm	<0.02 ft.

TCR (Total Core Recovery)

Sum of lengths of rock core recovered from a core run, divided by the length of the core rum and expressed as a percentage

SCR (Solid Core Recover)

Sum length of solid full diameter drill core recovered expressed as a percentage of the total length of the core run.

Explanation of Terms Used in the Bedrock Core Log

Weathering (ISRM)

Terms	Grade	Description
Fresh	W1	No visible sign of rock material weathering.
Slightly	W2	Discolouration indicates weathering of rock weathered material and discontinuity surfaces. All the rock material may be discoloured by weathering and may be somewhat weaker than in its fresh condition.
Moderately	W3	Less than half of the rock material is weathered decomposed and/or disintegrated a soil. Fresh or discoloured rock is present either as a corestone.
Highly Weathered	W4	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a continuous framework or as corestones.
Completely Weathered	W5	All rock material is decomposed and/or disintegrated to a soil. The original mass structure is still largely intact.
Residual Soil	W6	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has been significantly transported.

ROD (Rock Quality Designation, after Deere, 1968)

Sum of lengths of pieces of rock core measured along centerline of core equal to or greater than 100 mm from a core run, divided by the length of the core run, divided by the length of the core run and expressed as a percentage.
Core fractured by drilling is considered intact. RQD normally quoted for N-Size core.

RQD (%)	Rock Quality
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very Poor

(FI) Fracture Index

Expressed as the number of discontinuities per 300 mm (1 ft.) Excluded drill-induced fractures and fragmented zones. Reported as “>25” if frequency exceeds 25 fractures/0.3 m.

Broken Zone
Zone where core diameter core of very low RQD which may include some drill-induced fractures.

Fragmented Zone
Zone where core is less than full diameter and RQD = 0.

Discontinuity Spacing (ISRM)

Term	Average Spacing	
Extremely widely spaced	>6 m	>20.00 ft.
Very widely spaced	2 m-6 m	6.50-20.00 ft.
Widely spaced	600 mm-2 m	2.00-6.50 ft.
Moderately spaced	200 mm-600 mm	0.65-2.00 ft.
Closely spaced	60 mm-200 mm	0.20-0.65 ft.
Very closely spaced	20 mm-60 mm	0.06-0.20 ft.
Extremely closely spaced	<20 mm	>0.06 ft.

Note: Excludes drill-induced fractures and fragmented rock.

Discontinuity Orientation

Discontinuity, fracture, and bedding plane orientations are cited as the acute angle measured with respect to the core axis. Fractures perpendicular to the core axis are at 90 degrees and those parallel to the core axis are at 0 degrees.

REFERENCE No.: 11205379-90 ENCLOSURE No.: 1

BOREHOLE No.: BH1-21
ELEVATION: 81.39 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 15, 2021 DATE (FINISH): January 15, 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027575.049 EASTING: 449073.301

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		81.39		GROUND SURFACE			%			N
	0.13	81.26		ASPHALT : 125 mm		GS1		4	--	--
				FILL : SAND and GRAVEL, trace clay, brown, moist, loose to very dense Gravel : 48%, Sand : 41%, Clay : 3%, Silt : 8%		SS1	25	5	10-5-4-6	9
	0.91	80.48								
	1.0			Gravel : 39%, Sand : 39%, Clay : 7%, Silt : 15%		SS2	88	10	12-30-50/ 100mm	50+
				BEDROCK (inferred), shale fragments, greyish brown, very dense		SS3	100	4	50/ 100mm	50+
	2.0					SS4	100	4	50/ 75mm	50+
	3.0					SS5	100	4	50/ 75mm	50+
	3.20	78.19		auger refusal						

END OF BOREHOLE :

NOTE :
- End of Borehole at 3.20 m bgs
- Borehole was backfilled with bentonite holeplug and sealed with cold patch
- bgs donates 'below ground surface'

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

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REFERENCE No.: 11205379-90 ENCLOSURE No.: 2

BOREHOLE No.: BH2-21
ELEVATION: 81.36 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 18, 2021 DATE (FINISH): January 18, 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027616.781 EASTING: 449071.365

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		81.36		GROUND SURFACE			%			N
0	0.10	81.26		ASPHALT : 100 mm		GS1		4	--	--
1				FILL : SAND and GRAVEL, trace silt, brown, moist, compact Gravel : 42%, Sand : 50%, Clay : 2%, Silt : 6%						
2	0.61	80.75				SS1	71	19	9-7-3-4	10
3	1.0									
4	1.14	80.22		SAND, some silt, trace clay and gravel, dark brown, moist, very dense Gravel : 15%, Sand : 61%, Clay : 6%, Silt : 18%		SS2	87	7	10-22-42/ 100mm	50+
5						SS3	83	4	50/ 125mm	50+
6	2.0			BEDROCK (inferred), shale fragments, grey, moist, very dense						
7						SS4	100	4	50/ 75mm	50+
8										
9	2.77	78.59		auger refusal		SS5	100	9	50/ 25mm	50+
10	3.0									
11										
12										
13	4.0									
14										
15										
16	5.0									
17										
18										
19										
20	6.0									
21										
22										
23	7.0									
24										
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) ☐ Lab
○ Water content (%)
Atterberg limits (%) W_p W_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

END OF BOREHOLE :

NOTE :
- End of Borehole at 2.77 m bgs
- Borehole was backfilled with bentonite holeplug and sealed with cold patch
- bgs donates 'below ground surface'

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REFERENCE No.: 11205379-90 ENCLOSURE No.: 3

BOREHOLE No.: MW3-21
ELEVATION: 81.37 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 14, 2021 DATE (FINISH): January 15, 2021

LEGEND

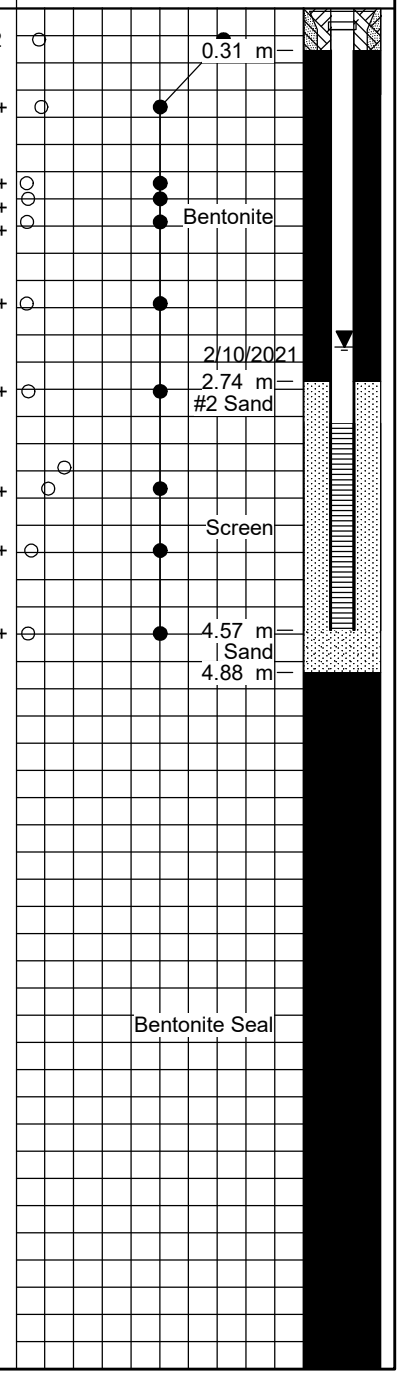
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027638.113 EASTING: 449119.449

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		81.37		GROUND SURFACE			%			N
0				ASPHALT : 175 mm						
1	0.18	81.19		GRAVEL : 125 mm		SS1	100	8	17-22-50/ 150mm	72
	0.30	81.07		FILL :						
2	0.61	80.76		SAND/SILTY SAND, some gravel, trace organics, shale fragments, brown, damp/moist, very dense		SS2	100	9	42-50/ 75mm	50+
3	1.0			BEDROCK (inferred), shale fragments, grey, wet, very dense		SS3	100	4	50/ 125mm	50+
4						SS4	100	4		50+
5				Gravel : 19%, Sand : 50%, Clay : 14%, Silt : 17%		SS5	100	4	50/ 100mm	50+
6									50/	
7	2.0					SS6	100	4	100mm	50+
8									50/ 75mm	
9						SS7	83	4	50/ 150mm	50+
10	3.0									
11						SS8		17	--	--
12						SS8A	100	11	50/ 50mm	50+
13	4.0					SS9	100	5	50/ 50mm	50+
14										
15	4.57	76.80		auger refusal		SS10	100	4	50/ 50mm	50+
16				SHALE-BEDROCK, laminated, interbeds of limestone/siltstone (hard layers), highly weathered to fresh, weak to moderately strong, grey		RC1	100	--	100	--
17	5.0									
18										
19						RC2	100	--	78	--
20	6.0									
21										
22										
23	7.0									
24						RC3	98	--	85	--
25										
26	8.0									
27										
28										
29						RC4	100	--	93	--
30	9.0									
31										
32						RC5	83	--	61	--

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



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REFERENCE No.: 11205379-90 ENCLOSURE No.: 3

BOREHOLE No.: MW3-21
ELEVATION: 81.37 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (I.O.)
PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure
LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario
DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian
DATE (START): January 14, 2021 DATE (FINISH): January 15, 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027638.113 EASTING: 449119.449

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		81.37		GROUND SURFACE			%			N
33	10.06	71.31		**END OF BOREHOLE :**						
34				**NOTE :** - End of Borehole at 10.06 m bgs - Borehole was dry upon completion - Rock coring from 4.57 m bgs - 50 mm diameter monitoring well installed at 7.47 m bgs - Groundwater found at 2.69 m bgs on January 28, 2021 - Groundwater found at 2.49 m bgs on February 10, 2021 - bgs donates 'below ground surface'						
35										
36	11.0									
37										
38										
39	12.0									
40										
41										
42										
43	13.0									
44										
45										
46	14.0									
47										
48										
49	15.0									
50										
51										
52	16.0									
53										
54										
55										
56	17.0									
57										
58										
59	18.0									
60										
61										
62	19.0									
63										
64										
65										

Shear test (Cu) △ Field
Sensitivity (S) ☐ Lab
○ Water content (%)
Atterberg limits (%) w_p w_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

10.06 m

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REFERENCE No.: 11205379-90 ENCLOSURE No.: 4

BOREHOLE No.: BH4-21
ELEVATION: 82.23 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 18, 2021 DATE (FINISH): January 18, 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027621.207 EASTING: 449159.803

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.23		GROUND SURFACE			%			N
0				FILL : SAND and GRAVEL, trace clay and silt, brown, moist to wet, dense Gravel : 46%, Sand : 41%, Clay : 3%, Silt : 10%		SS1	75	--	15-27-21-10	48
1										
2	0.76	81.47				SS2	91	7	6-19-34-50/ 50mm	53
3	1.0			BEDROCK (inferred), shale fragments, grey, moist, very dense						
4						SS3	90	8	21-50/ 100mm	50+
5										
6						SS4	100	4	50/ 75mm	50+
7	2.0									
8						SS5	100	5	50/ 75mm	50+
9	2.77	79.46		auger refusal						
10	3.0			**END OF BOREHOLE :**						
11										
12				**NOTE :** - End of Borehole at 2.77 m bgs - Borehole was backfilled with bentonite holeplug and sealed with cold patch - bgs donates 'below ground surface'						
13	4.0									
14										
15										
16	5.0									
17										
18										
19										
20	6.0									
21										
22										
23	7.0									
24										
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379-90 ENCLOSURE No.: 5

BOREHOLE No.: MW5-21

ELEVATION: 81.83 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 15, 2021 DATE (FINISH): January 15, 2021

NORTHING: 5027589.381 EASTING: 449128.777

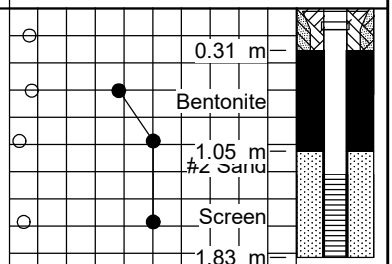
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		81.83		GROUND SURFACE			%			N
0	0.10	81.73		ASPHALT : 100 mm		GS1		7	--	--
1	0.30	81.53		SAND and GRAVEL, some silt, trace clay, brown, moist, dense						
	0.40	81.43		Gravel : 43%, Sand : 41%, Clay : 3%, Silt : 13%		SS1	100	8	8-18-20-35	38
2										
3	1.0			FILL : GRAVELLY SAND, some silt, trace clay, brown, moist, dense		SS2	100	3	50/ 125mm	50+
4										
5				Gravel : 23%, Sand : 49%, Clay : 8%, Silt : 20%		SS3	100	5	50/ 100mm	50+
6	1.83	80.00		BEDROCK (inferred), shale fragments, grey, damp, very dense						
7	2.0									
8				**END OF BOREHOLE :**						
9										
10	3.0			**NOTE :**						
11				- End of Borehole at 1.83 m bgs						
12				- Borehole was dry upon completion						
13	4.0			- Monitoring well installed at 1.837 m bgs						
14				- Borehole was dry on January 28, 2021						
15				- Borehole was dry on February 10, 2021						
16	5.0			- bgs donates 'below ground surface'						
17										
18										
19										
20	6.0									
21										
22										
23	7.0									
24										
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) w_p w_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



File: N:\CA\MISSISSAUGA - 111 BRUNEL\LEGACY\LOG DATABASE\8-CHAR\11-----\1120-----\112053-\11205379\11205379 - 90.GPJ Library File: GHD_GEOTECH_V02.GLB Report: SOIL LOG WITH GRAPH+WELL Date: 2/26/21

REFERENCE No.: 11205379-90 ENCLOSURE No.: 6

BOREHOLE No.: MW6-21
ELEVATION: 82.17 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 12, 2021 DATE (FINISH): January 13, 2021

LEGEND

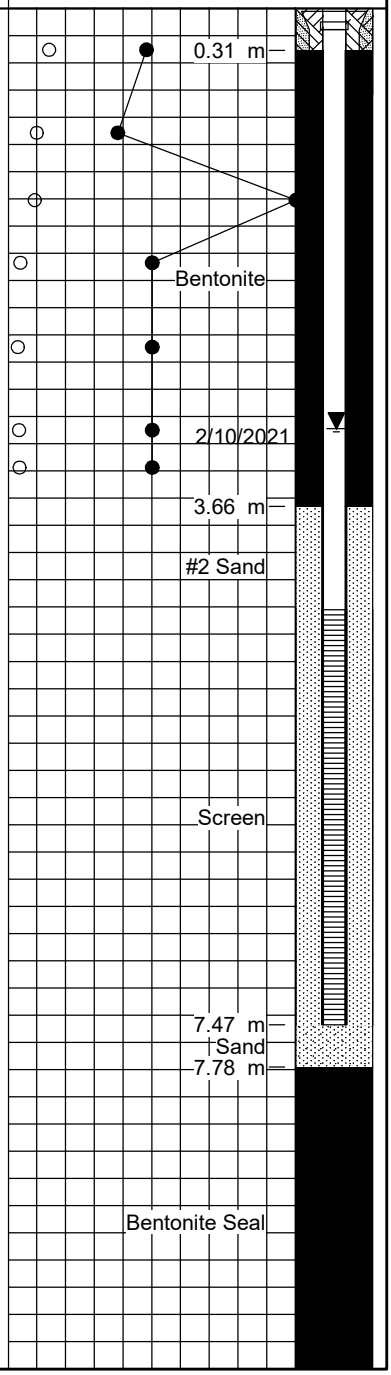
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027605.404 EASTING: 449244.983

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.17		GROUND SURFACE			%			N
0				GRAVEL : 350 mm						
1	0.35	81.82		FILL :		SS1	87	14	10-30-18-8	48
2	0.61	81.56		SILTY SAND, trace gravel, trace organics, grey/brown, moist, dense						
3	1.0			NATIVE :		SS2	100	10	4-11-27-45	38
4	1.22	80.95		ML-GRAVELLY SAND, trace clay, brown, moist, dense		SS3	100	9	35-20-50/ 75mm	100
5				Gravel : 32%, Sand : 45%, Clay : 7%, Silt : 16%						
6	2.0			BEDROCK (inferred), shale fragments, grey, moist, very dense		SS4	100	4	50/ 75mm	50+
7										
8						SS5	100	3	50/ 100mm	50+
9										
10	3.0					SS6	100	4	50/ 100mm	50+
11						SS7	100	4	50/ 50mm	50+
12	3.51	78.66		SHALE-BEDROCK, laminated, interbeds of limestone/siltstone (hard layers), highly weathered to fresh, weak to moderately strong, grey		RC1	58	--	50	--
13	4.0									
14						RC2	93	--	24	--
15										
16	5.0									
17										
18						RC3	95	--	54	--
19										
20	6.0									
21										
22										
23	7.0					RC4	97	--	55	--
24										
25										
26	8.0									
27										
28						RC5	100	--	52	--
29										
30	9.0									
31										
32						RC6	100	--	71	--

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



File: N:\CA\MISSISSAUGA - 111 BRUNEL\LEGACY\LOG DATABASE\8-CHAR\11-----\1120-----\112053-\112053791\11205379 - 90.GPJ Library File: GHD_GEOTECH_V02.GLB Report: SOIL LOG WITH GRAPH+WELL Date: 2/26/21

REFERENCE No.: 11205379-90 ENCLOSURE No.: 6

BOREHOLE No.: MW6-21
ELEVATION: 82.17 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 12, 2021 DATE (FINISH): January 13, 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027605.404 EASTING: 449244.983

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.17		GROUND SURFACE			%			N
33	10.06	72.11		**END OF BOREHOLE :**						
34				**NOTE :** - End of Borehole at 10.06 m bgs - Borehole was dry upon completion - Rock coring from 3.51 m bgs - Monitoring well installed at 7.47 m bgs - Groundwater found at 2.97 m bgs on January 28, 2021 - Groundwater found at 3.09 m bgs on February 10, 2021 - bgs donates 'below ground surface'						
35										
36	11.0									
37										
38										
39	12.0									
40										
41										
42										
43	13.0									
44										
45										
46	14.0									
47										
48										
49	15.0									
50										
51										
52	16.0									
53										
54										
55										
56	17.0									
57										
58										
59	18.0									
60										
61										
62	19.0									
63										
64										
65										

Shear test (Cu) △ Field
Sensitivity (S) ☐ Lab
○ Water content (%)
Atterberg limits (%) w_p w_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

10.06 m

File: N:\CA\MISSISSAUGA - 111 BRUNEL\LEGACY\LOG DATABASE\8-CHAR\11-----\1120----\112053--\11205379\11205379 - 90.GPJ Library File: GHD_GEOTECH_V02.GLB Report: SOIL LOG WITH GRAPH+WELL Date: 2/26/21

REFERENCE No.: 11205379-90 ENCLOSURE No.: 7

BOREHOLE No.: BH7-21
ELEVATION: 82.22 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 19, 2021 DATE (FINISH): January 19, 2021

NORTHING: 5027618.043 EASTING: 449176.612

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.22		GROUND SURFACE			%			N
0				FILL :						
1				SILTY SAND and GRAVEL, brown, moist, very dense		SS1	54	6	28-35-17-10	52
2	0.76	81.46		BEDROCK (inferred), shale fragments, grey, moist, very dense		SS2	100	7	15-40-50/ 125mm	50+
3	1.0									
4						SS3	100	4	45-50/ 75mm	50+
5										
6						SS4	100	4	50/ 125mm	50+
7	2.0									
8	2.52	79.70		auger refusal		SS5	100	3	50/ 75mm	50+
9										
10	3.0			**END OF BOREHOLE :**						
11										
12				**NOTE :**						
13	4.0			- End of Borehole at 2.52 m bgs						
14				- Borehole was backfilled with bentonite holeplug and sealed with cold patch						
15				- bgs donates 'below ground surface'						
16	5.0									
17										
18										
19										
20	6.0									
21										
22										
23	7.0									
24										
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379-90 ENCLOSURE No.: 8

BOREHOLE No.: MW8-21
ELEVATION: 82.20 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 18, 2021 DATE (FINISH): January 18, 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

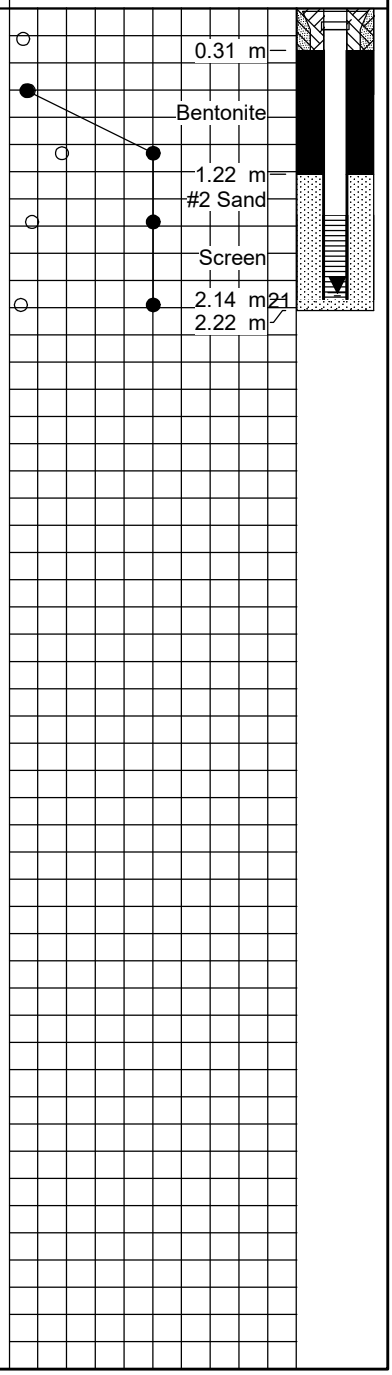
NORTHING: 5027647.908 EASTING: 449211.832

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.20		GROUND SURFACE			%			N
0	0.05	82.15		ASPHALT : 50 mm						
1				FILL : SANDY GRAVEL, brown, moist, loose Gravel : 61%, Sand : 33%, Clay : 2%, Silt : 6%		GS1		5	--	--
2						SS1	100	7	3-4-2-3	6
3	0.86	81.34		BEDROCK (inferred), shale fragments, reddish brown/grey, wet, very dense		SS2	100	18	23-50/ 150mm	50+
4	1.0									
5						SS3	100	8	50/ 100mm	50+
6	2.0									
7	2.22	79.98		auger refusal		SS4	100	4	50/ 75mm	50+
8	3.0									
9										
10										
11										
12	4.0									
13										
14										
15										
16	5.0									
17										
18										
19										
20	6.0									
21										
22										
23	7.0									
24										
25										
26	8.0									
27										
28										
29										
30	9.0									
31										
32										

END OF BOREHOLE :

NOTE :
- End of Borehole at 2.22 m bgs
- Borehole was dry upon completion
- Monitoring well installed at 2.14 m bgs
- Groundwater found at 2.03 m bgs on January 28, 2021
- Groundwater found at 2.09 m bgs on February 10, 2021
- bgs donates 'below ground surface'

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)



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REFERENCE No.: 11205379-90 ENCLOSURE No.: 9

BOREHOLE No.: B1-21
ELEVATION: 82.29 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 18, 2021 DATE (FINISH): January 18, 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027580.742 EASTING: 449219.213

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.29		GROUND SURFACE			%			N
0										
1	0.46	81.83		FILL : SILTY SAND and GRAVEL, greyish brown, moist, loose		SS1	62	2	7-3-2-3	5
2				NATIVE : SAND and GRAVEL, some silt, trace clay, brown, moist, very dense Gravel : 39%, Sand : 39%, Clay : 7%, Silt : 15%		SS2	89	10	9-24-50/ 125mm	50+
3	0.91	81.38								
4	1.04	81.25		BEDROCK, shale fragments, brownish red/grey, moist, very dense auger refusal						
5										
6	2.0									
7										
8										
9										
10	3.0									
11										
12										
13	4.0									
14										
15										
16	5.0									
17										
18										
19										
20	6.0									
21										
22										
23	7.0									
24										
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) w_p w_l
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

END OF BOREHOLE :

NOTE :
- End of Borehole at 1.04 m bgs
- Borehole was dry upon completion
- bgs donates 'below ground surface'

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REFERENCE No.: 11205379-90 ENCLOSURE No.: 10

BOREHOLE No.: B2-21
ELEVATION: 82.18 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY: S. Shahangian

DATE (START): January 18, 2021 DATE (FINISH): January 18, 2021

NORTHING: 5027629.392 EASTING: 449254.399

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.18		GROUND SURFACE			%			N
0				FILL : SILTY SAND and GRAVEL, brown, moist, dense		SS1	71	4	13-17-24-9	41
3	1.0	81.27		BEDROCK, shale fragments, grey, very dense		SS2	100	10	4-10-28-34	38
5	1.52	80.66				SS3		9	22-50/ 150mm	50+

END OF BOREHOLE :

NOTE :
- End of Borehole at 1.52 m bgs
- Borehole was dry upon completion
- bgs donates 'below ground surface'

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379-90 ENCLOSURE No.:

BOREHOLE No.: B3-21
ELEVATION: 82.27 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.)

PROJECT: Preliminary Geotechnical Investigation - Proposed Parking Structure

LOCATION: Children's Hospital of Eastern Ontario Campus - 401 Smyth Road, Ottawa, Ontario

DESCRIBED BY: K. Schaller CHECKED BY:

DATE (START): DATE (FINISH):

LEGEND

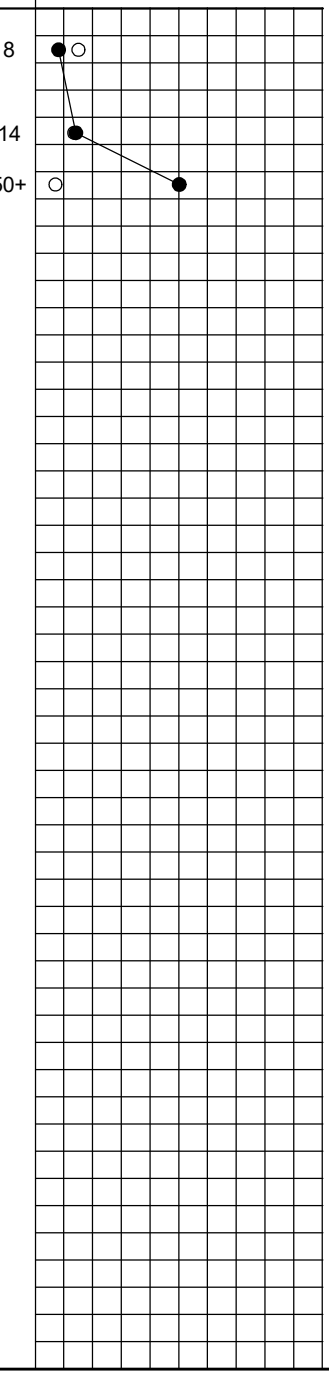
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027652.016 EASTING: 449199.133

Depth (Feet)	Depth (Metres)	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15 cm/ RQD(%)	'N' Value/ SCR(%)
		82.27		GROUND SURFACE			%			N
0				FILL :						
1				SILTY SAND with gravel, greyish brown, moist, loose		SS1	62	15	6-6-2-2	8
2	0.61	81.66		trace to some clay						
3	1.0			Sand, some gravel, silt and clay, reddish grey, moist, stiff		SS2	100	13	4-5-9-25	14
4	1.22	81.05								
	1.37	80.90		BEDROCK (inferred), shale fragments, greyish brown, very dense		SS3	100	7	50/ 150mm	50+
5										
6				**END OF BOREHOLE :**						
7	2.0			**NOTE :**						
8				- End of Borehole at 1.37 m bgs						
9				- Borehole was dry upon completion						
10	3.0			- bgs donates 'below ground surface'						
11										
12										
13	4.0									
14										
15										
16	5.0									
17										
18										
19	6.0									
20										
21										
22										
23	7.0									
24										
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) ☐ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



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REFERENCE No.: 11205379 ENCLOSURE No.: 9

BOREHOLE No.: MW9-22
ELEVATION: 82.0 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation
LOCATION: 401 Smyth Road, Ottawa, Ontario
DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers
DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar
DATE (START): 19 July 2022 DATE (FINISH): 19 July 2022

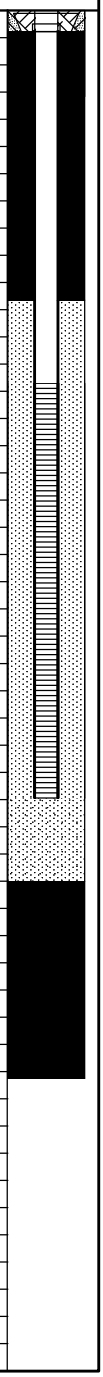
LEGEND
SS - SPLIT SPOON
ST - SHELBY TUBE
RC - ROCK CORE
▼ - WATER LEVEL

NORTHING: 5027588.5 m EASTING: 449191.1 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.0		GROUND SURFACE				%		
0										
1	0.3	81.8		FILL : GM-SAND and GRAVEL, grey/brown, moist, compact		SS1	62	6	9-8-10-4	18
2										
3	0.8 / 1.0	81.2		NATIVE : SM-SILTY SAND and GRAVEL, grey/brown, moist, compact to dense		SS2	83	3	2-11-27-50	38
4				SHALE-BEDROCK, weathered, light brown						
5										
6										
7	2.0									
8										
9	2.6	79.4		SHALE-BEDROCK, highly to moderately weathered, moderately bedded, weak to moderately strong, grey/black		RC1	90	--	13	--
10	3.0									
11										
12										
13	4.0					RC2	100	--	40	--
14										
15										
16										
17	5.0									
18										
19						RC3	97	--	65	--
20	6.0									
21										
22										
23	7.0					RC4	93	--	67	--
24										
25										
26	7.9 / 8.0	74.2		**END OF BOREHOLE :**						
27										
28				**NOTE :**						
29				- End of Borehole at 7.85 m bgs						
30	9.0			- Rock coring from 2.59 m bgs						
31				- Monitoring well installed at 5.79 m bgs						
32				- bgs donates 'below ground surface'						

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



File: N:\CA\TORONTO\PROJECTS\66211\205379\TECH\LOG DATABASE\11205379 - PARKING GARAGE ADDITION.GPJ Library File: 11205379 GHD_GEOTECH_V05.GLB Report: 11205379 SOIL LOG WITH GRAPH+WELL Date: 1/9/22

REFERENCE No.: 11205379 ENCLOSURE No.: 10

BOREHOLE No.: BH10-22
ELEVATION: 82.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation

LOCATION: 401 Smyth Road, Ottawa, Ontario

DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers

DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar

DATE (START): 12 July 2022 DATE (FINISH): 12 July 2022

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027596.9 m EASTING: 449167.5 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.1		GROUND SURFACE				%		
0				FILL : GM-SAND and GRAVEL, some silt, trace clay, brown, moist, compact Gravel : 43%, Sand : 43%, Silt : 11%, Clay : 3%		SS1	83	3	16-13-12-4	25
1	0.5									
2	0.6	81.5		NATIVE : SM-SILTY SAND and GRAVEL, trace clay, very dense		SS2	87	6	7-38-50/ 75mm	88/ 75mm
	0.7	81.4		SHALE-BEDROCK, weathered, light brown						
3	1.0									
4	1.2	80.9		Borehole terminated due to spoon and auger refusal						
5	1.5			**END OF BOREHOLE :**						
6				**NOTE :** - End of Borehole at 1.22 m bgs - Borehole was dry upon completion - bgs donates 'below ground surface'						
7	2.0									
8	2.5									
9										
10	3.0									
11										
12	3.5									
13	4.0									
14										
15	4.5									
16										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379 ENCLOSURE No.: 11

BOREHOLE REPORT

BOREHOLE No.: BH11-22
ELEVATION: 82.1 m
Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation
LOCATION: 401 Smyth Road, Ottawa, Ontario
DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers
DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar
DATE (START): 18 July 2022 DATE (FINISH): 18 July 2022

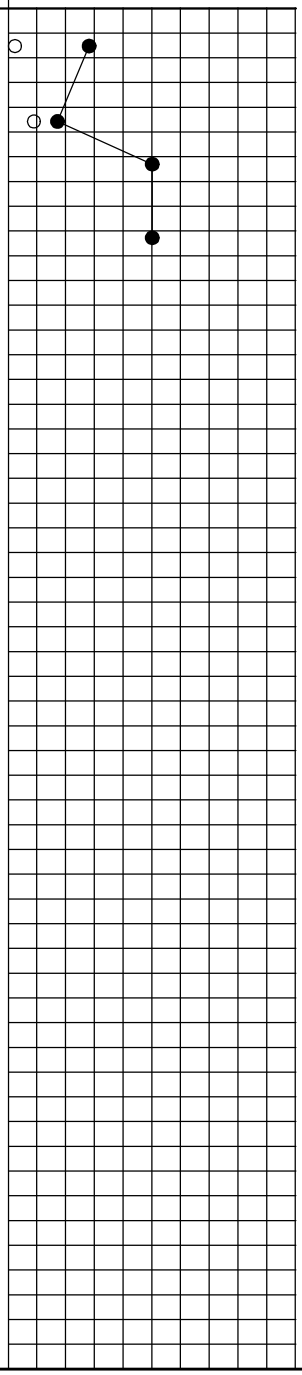
LEGEND
SS - SPLIT SPOON
ST - SHELBY TUBE
RC - ROCK CORE
▼ - WATER LEVEL

NORTHING: 5027638.0 m EASTING: 449184.6 m

Depth (Feet)	Depth (Metres)	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.1		GROUND SURFACE				%		
0				FILL :						
1				GW-GM-SANDY GRAVEL, trace silt, trace clay, brown, moist, compact		SS1	67	2	19-17-11-3	28
2	0.6	81.5		Gravel : 52%, Sand : 37%, Silt : 8%, Clay : 3%						
3	0.9	81.3				SS2	62	9	3-6-11-14	17
	1.0			NATIVE :						
4				SM-ML-SAND and SILT, trace clay, grey/brown, moist, compact		SS3	100	--	50/ 75mm	50+
5										
6				SHALE-BEDROCK, weathered, light brown		SS4	100	--	50/ 50mm	50+
7	2.0									
8	2.5	79.6		auger refusal						
9				SHALE-BEDROCK, moderately bedded, moderately weathered, medium strong, grey/black						
10	3.0					RC1	78	--	36	--
11										
12										
13	4.0					RC2	100	--	60	--
14										
15										
16										
17	5.0									
18										
19						RC3	100	--	50	--
20	6.0									
21										
22										
23	7.0					RC4	100	--	55	--
24										
25										
26	8.0	74.2								
27	8.0			**END OF BOREHOLE :**						
28										
29				**NOTE :**						
30	9.0			- End of Borehole at 7.98 m bgs						
31				- Borehole was dry upon completion						
32				- bgs donates 'below ground surface'						
33	10.0									
34										
35										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



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REFERENCE No.: 11205379 ENCLOSURE No.: 12

BOREHOLE No.: BH12-22
ELEVATION: 82.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation

LOCATION: 401 Smyth Road, Ottawa, Ontario

DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers

DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar

DATE (START): 12 July 2022 DATE (FINISH): 12 July 2022

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027590.3 m EASTING: 449214.3 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.1		GROUND SURFACE				%		
0				FILL : GM-GRAVEL, some sand and silt, trace clay, brown, moist, compact Gravel : 66%, Sand : 14%, Clay & Silt : 20%		SS1	46	3	13-25-5-5	30
1	0.5									
2	0.7	81.4		NATIVE : SM-ML-SAND and SILT, trace clay, brown, moist, very dense		SS2	100	5	15-39-40-50/ 75mm	79
3	1.0									
	1.1	81.0		SHALE-BEDROCK, weathered, light brown		SS3	100	--	50/ 0mm	50/ 0mm
4										
5	1.5									
6	1.8	80.2		Borehole terminated due to spoon and auger refusal						
	2.0			**END OF BOREHOLE :**						
7				**NOTE :** - End of Borehole at 1.83 m bgs - Borehole was dry upon completion - bgs donates 'below ground surface'						
8	2.5									
9										
10	3.0									
11										
	3.5									
12										
13	4.0									
14										
15	4.5									
16										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379 ENCLOSURE No.: 13

GHD

BOREHOLE No.: BH13-22
ELEVATION: 82.2 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation

LOCATION: 401 Smyth Road, Ottawa, Ontario

DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers

DESCRIBED BY: L. McCann/S. Wallis CHECKED BY: A. Khandekar

DATE (START): 4 July 2022 DATE (FINISH): 4 July 2022

LEGEND

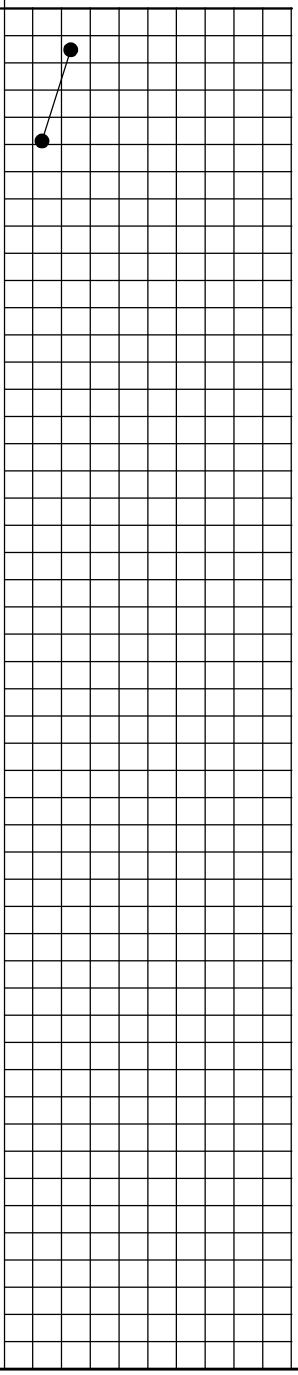
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027615.5 m EASTING: 449212.0 m

Depth (Feet)	Depth (Metres)	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.2		GROUND SURFACE				%		
0	0.1	82.1		ASPHALT : 75 mm						
1				FILL : GW-GM-SANDY GRAVEL, light brown/grey, dry, compact		SS1	100	--	10-13-10-5	23
2										
3	0.9	81.3		NATIVE : SP-GP-SAND and GRAVEL, trace clay, brown, moist, compact		SS2	71	--	2-2-11-15	13
4	1.0	81.2		SHALE-BEDROCK, weathered, grey		RC1	82	--	0	--
5										
6	1.9	80.2		SHALE-BEDROCK, moderately to highly weathered, thinly bedded, highly to moderately fractured, grey, weak						
7	2.0									
8						RC2	95	--	10	--
9										
10	3.0			occasional clay and shale layers						
11										
12										
13	4.0					RC3	100	--	37	--
14										
15										
16	5.0			occasional clay and shale layers						
17										
18										
19						RC4	100	--	43	--
20	6.0									
21										
22	6.6	75.5								
23	7.0			**END OF BOREHOLE :**						
24										
25				**NOTE :**						
26	8.0			- End of Borehole at 2.37 m bgs						
27				- Borehole was dry upon completion						
28				- Rock coring from 1.32 m bgs						
29				- bgs donates 'below ground surface'						
30	9.0									
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



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REFERENCE No.: 11205379 ENCLOSURE No.: 14

BOREHOLE No.: BH14-22
ELEVATION: 82.2 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation

LOCATION: 401 Smyth Road, Ottawa, Ontario

DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers

DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar

DATE (START): 12 July 2022 DATE (FINISH): 12 July 2022

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027618.1 m EASTING: 449237.3 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.2		GROUND SURFACE				%		
0				FILL : GW-GM-SANDY GRAVEL, trace silt, trace clay, brown, moist, dense Gravel : 66%, Sand : 22%, Clay & Silt : 12%		SS1	58	2	11-25-16-6	41
1	0.5									
2	0.6	81.6		NATIVE : SP-GP-SAND and GRAVEL, trace silt, trace clay, brown, moist, very dense						
	0.7	81.5		SHALE-BEDROCK, weathered, light brown		SS2	100	5	7-35-48-42	83
3	1.0									
4	1.2	81.0		Borehole terminated due to spoon and auger refusal						
5	1.5			**END OF BOREHOLE :**						
6				**NOTE :** - End of Borehole at 1.22 m bgs - Borehole was dry upon completion - bgs donates 'below ground surface'						
7	2.0									
8	2.5									
9										
10	3.0									
11	3.5									
12										
13	4.0									
14										
15	4.5									
16										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379 ENCLOSURE No.: 15

BOREHOLE No.: BH15-22
ELEVATION: 82.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation

LOCATION: 401 Smyth Road, Ottawa, Ontario

DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers

DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar

DATE (START): 12 July 2022 DATE (FINISH): 12 July 2022

NORTHING: 5027642.6 m EASTING: 449234.7 m

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.1		GROUND SURFACE				%		
0				FILL : SM-SAND and GRAVEL, trace silt, trace clay, brown, moist, dense Gravel : 40%, Sand : 47%, Silt : 10%, Clay : 3%		SS1	62	3	16-18-13-5	31
1	0.5									
2	0.6	81.5		SHALE-BEDROCK, weathered, light brown		SS2	100	6	20-25-50/ 125mm	75/ 125mm
3	1.0									
	1.1	81.1		Borehole terminated due to spoon and auger refusal						
4				**END OF BOREHOLE :**						
5	1.5			**NOTE :** - End of Borehole at 1.07 m bgs - Borehole was dry upon completion - bgs donates 'below ground surface'						
6										
7	2.0									
8	2.5									
9										
10	3.0									
11										
12	3.5									
13	4.0									
14										
15	4.5									
16										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

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REFERENCE No.: 11205379 ENCLOSURE No.: 16

BOREHOLE No.: BH16-22
ELEVATION: 82.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation
LOCATION: 401 Smyth Road, Ottawa, Ontario
DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers
DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar
DATE (START): 12 July 2022 DATE (FINISH): 17 December 2022

LEGEND
SS - SPLIT SPOON
ST - SHELBY TUBE
RC - ROCK CORE
▼ - WATER LEVEL

NORTHING: 5027594.4 m EASTING: 449262.3 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content %	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
0		82.1		GROUND SURFACE						
1	0.5			FILL : SW-SM-SAND and GRAVEL, trace silt, trace clay, brown, moist, compact Gravel : 44%, Sand : 45%, Silt : 9%, Clay : 2%		SS1	54	3	2-6-8-6	14
2	0.7	81.4		NATIVE : SP-GP-SAND and GRAVEL, trace silt, trace clay, brown, moist, compact						
3	0.9	81.2				SS2	87	7	2-4-11-14	15
	1.0			SHALE-BEDROCK, weathered, light brown						
4	1.2	80.9		Borehole terminated due to spoon and auger refusal		SS3	100	--	50/ 0mm	50/ 0mm
5	1.5			**END OF BOREHOLE :**						
6				**NOTE :** - End of Borehole at 1.22 m bgs - Borehole was dry upon completion - bgs donates 'below ground surface'						
7	2.0									
8	2.5									
9										
10	3.0									
11	3.5									
12										
13	4.0									
14										
15	4.5									
16										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379 ENCLOSURE No.: 17

GHD

BOREHOLE No.: BH17-22
ELEVATION: 82.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation
LOCATION: 401 Smyth Road, Ottawa, Ontario
DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers
DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar
DATE (START): 12 July 2022 DATE (FINISH): 12 July 2022

LEGEND
SS - SPLIT SPOON
ST - SHELBY TUBE
RC - ROCK CORE
▼ - WATER LEVEL

NORTHING: 5027619.3 m EASTING: 449258.6 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.1		GROUND SURFACE				%		
0				FILL : GW-GM-GRAVEL with SAND, trace silt, trace clay, brown, moist, compact Gravel : 52%, Sand : 39%, Silt : 7%, Clay : 2%,		SS1	54	--	4-10-17-11	27
1	0.5									
2	0.7	81.4		NATIVE : SP-GP-SAND and GRAVEL, trace silt, trace clay, brown, moist, compact		SS2	100	--	3-8-22-50/ 75mm	30
3	1.0									
	1.1	81.0		SHALE-BEDROCK, weathered, light brown,						
4	1.1	81.0		Borehole terminated due to spoon and auger refusal						
5	1.5			**END OF BOREHOLE :**						
6				**NOTE :** - End of Borehole at 1.14 m bgs - Borehole was dry upon completion - bgs donates 'below ground surface'						
7	2.0									
8	2.5									
9										
10	3.0									
11										
12	3.5									
13	4.0									
14										
15	4.5									
16										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379 ENCLOSURE No.: 18

BOREHOLE No.: BH18-22
ELEVATION: 82.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation

LOCATION: 401 Smyth Road, Ottawa, Ontario

DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers

DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar

DATE (START): 15 July 2022 DATE (FINISH): 15 July 2022

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027645.0 m EASTING: 449256.7 m

Depth (Feet)	Depth (Metres)	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		82.1		GROUND SURFACE				%		
0				FILL :						
1				GW-GM-SANDY GRAVEL with sand, trace silt, trace clay, grey/brown, moist, compact		SS1	62	--	9-8-10-4	18
2	0.6	81.5		Gravel : 73%, Sand : 21%, Silt : 5%, Clay : 1%						
3	0.8 1.0	81.3		NATIVE :		SS2	83	--	2-11-27-50	38
4				SP-GP-SAND and GRAVEL, trace silt, trace clay, moist, dense						
5	1.4	80.7		SHALE-BEDROCK		RC1	100	--	0	--
6	2.0			auger refusal						
7				SHALE-BEDROCK, moderately to highly weathered, thinly bedded, very weak to moderately strong, grey/black						
8										
9										
10	3.0					RC2	100	--	0	--
11										
12										
13	4.0									
14										
15						RC3	100	--	36	--
16	5.0									
17										
18										
19										
20	6.0					RC4	100	--	51	--
21										
22										
23	7.0									
24	7.1	75.0		**END OF BOREHOLE :**						
25										
26	8.0			**NOTE :**						
27				- End of Borehole at 7.13 m bgs						
28				- Rock coring from 1.40 m bgs						
29	9.0			- Borehole was dry upon completion						
30				- bgs donates 'below ground surface'						
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) ☐ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 11205379 ENCLOSURE No.: 19

BOREHOLE No.: BH19-22
ELEVATION: 81.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation

LOCATION: 401 Smyth Road, Ottawa, Ontario

DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers

DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar

DATE (START): 14 July 2022 DATE (FINISH): 14 July 2022

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

NORTHING: 5027588.9 m EASTING: 449046.7 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		81.1		GROUND SURFACE				%		
0	0.1	81.0		ASPHALT : 75 mm						
1				FILL : SM-GRAVELLY SAND, trace silt, trace clay, brown, loose		SS1	79	--	4-5-3-6	8
	0.5									
2	0.7	80.4		NATIVE : SP-GP-SAND and GRAVEL, some silt, trace clay, brown, moist, very dense Gravel : 31%, Sand : 46%, Silt : 16%, Clay : 7%						
3	0.9	80.2				SS2	71	--	17-33-50/ 125mm	83/ 125mm
	1.0			SHALE-BEDROCK, weathered, light brown to grey/black						
4	1.4	79.7								
5	1.5			**END OF BOREHOLE :**						
6				**NOTE :** - End of Borehole at 1.37 m bgs - Borehole was dry upon completion - bgs donates 'below ground surface'						
	2.0									
7										
8	2.5									
9										
10	3.0									
11										
	3.5									
12										
13	4.0									
14										
	4.5									
15										
16										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

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REFERENCE No.: 11205379 ENCLOSURE No.: 20

GHD

BOREHOLE No.: MW20-22
ELEVATION: 81.2 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (I.O.) PROJECT: Preliminary Geotechnical Investigation
LOCATION: 401 Smyth Road, Ottawa, Ontario
DRILLING RIG: Track Drill Rig DRILLING METHOD: 203mm OD Hollow Stem Augers
DESCRIBED BY: D. Ash CHECKED BY: A. Khandekar
DATE (START): 14 July 2022 DATE (FINISH): 14 July 2022

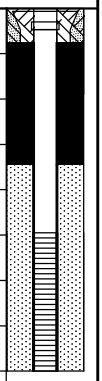
LEGEND
SS - SPLIT SPOON
ST - SHELBY TUBE
RC - ROCK CORE
▼ - WATER LEVEL

NORTHING: 5027656.2 m EASTING: 449095.7 m

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)
		81.2		GROUND SURFACE				%		
0	0.1	81.1		ASPHALT : 75 mm						
1	0.5			FILL : SM-GRAVELLY SAND, some silt, trace clay, brown, moist, compact Gravel : 36%, Sand : 44%, Silt : 16%, Clay : 4%		SS1	58	5	6-10-8-5	18
2	0.8	80.5		NATIVE : SP-GP-SAND and GRAVEL, trace silt, trace clay, brown, moist, dense Gravel : 46%, Sand : 41%, Silt : 9%, Clay : 4%						
3	1.0	80.2				SS2	87	5	8-21-29-27	50
4	1.0			SHALE-BEDROCK, weathered, grey						
5	1.5					SS3	100	--	50/ 75mm	50/ 75mm
	1.6	79.6		Borehole terminated due to spoon and auger refusal						
6	2.0			**END OF BOREHOLE :**						
7				**NOTE :** - End of Borehole at 1.60 m bgs - Monitoring well installed at 1.60 m bgs - bgs donates 'below ground surface'						
8	2.5									
9										
10	3.0									
11										
12	3.5									
13	4.0									
14										
15	4.5									
16										
17	5.0									
18	5.5									
19										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

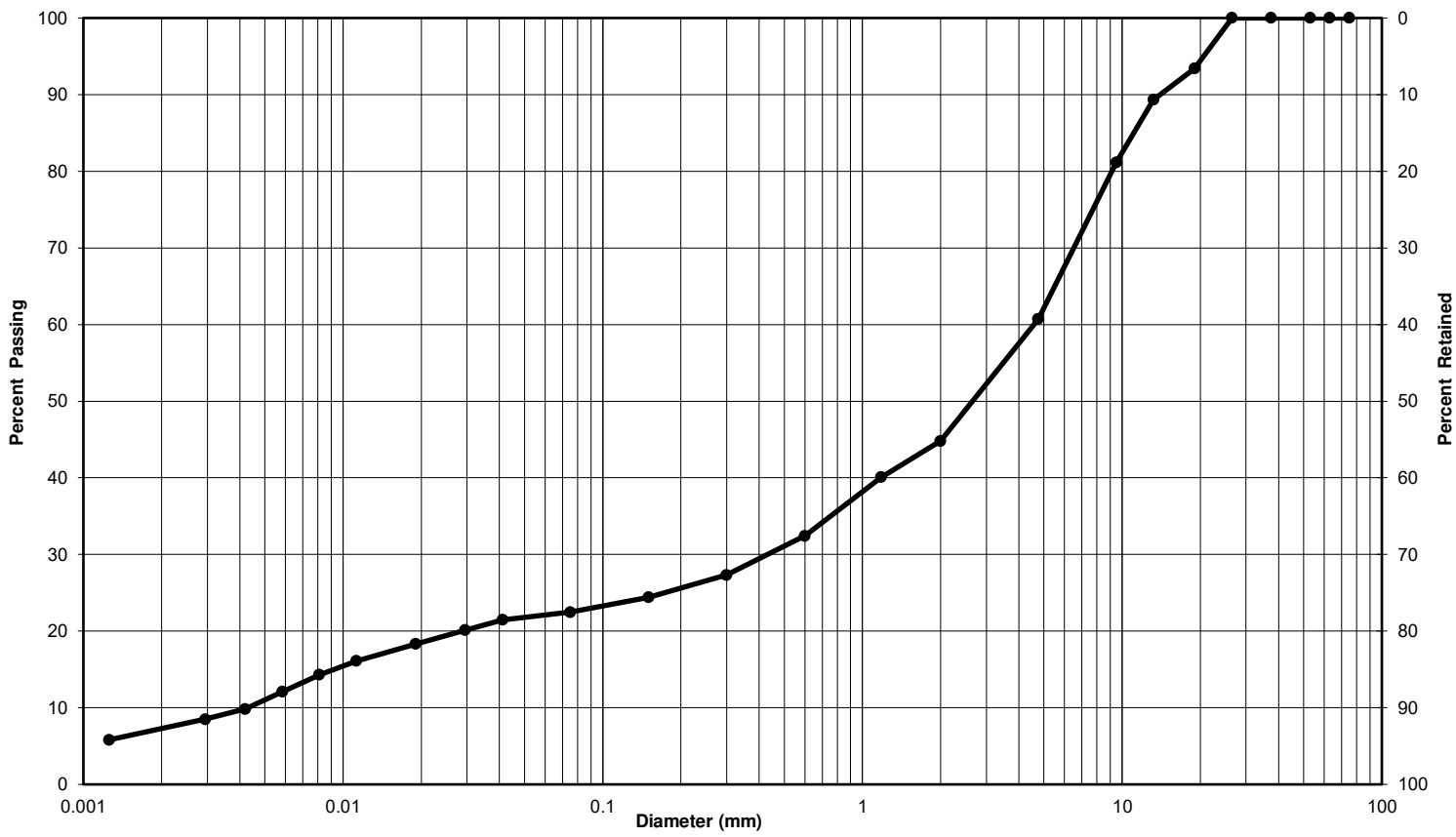
10 20 30 40 50 60 70 80 90



File: N:\CA\TORONTO\PROJECTS\66211\205379\TECH\LOG DATABASE\11205379 - PARKING GARAGE ADDITION.GPJ Library File: 11205379 GHD_GEOTECH_V05.GLB Report: 11205379 SOIL LOG WITH GRAPH+WELL Date: 1/9/22

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	B1-21	Sample No.:	SS2
Depth:	0.7-1.0m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

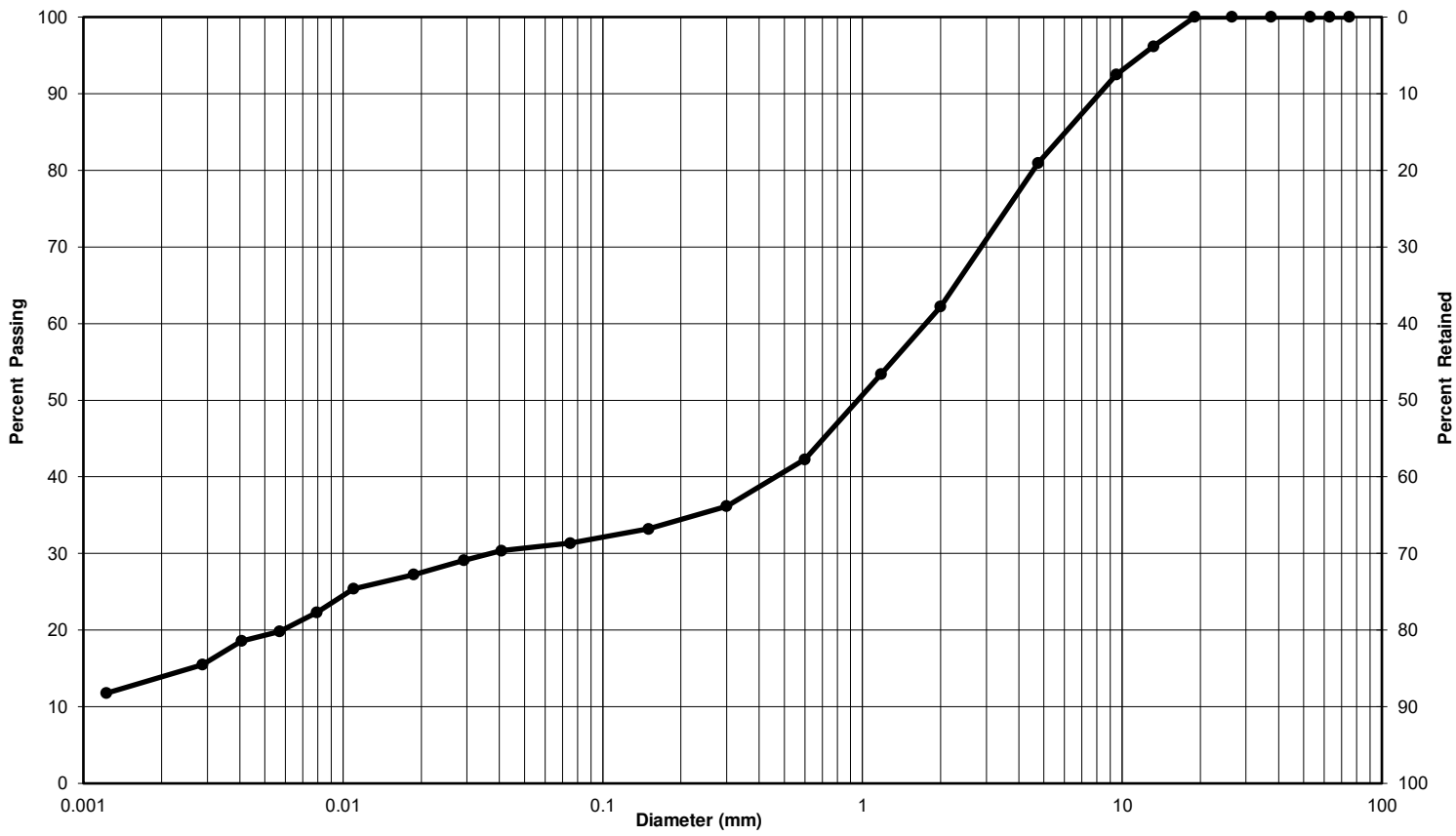
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Gravel, some Silt, trace Clay	39	39	22
Clay-size particles (<0.002 mm):			7 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	B3-21	Sample No.:	SS2
Depth:	0.7-1.0	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

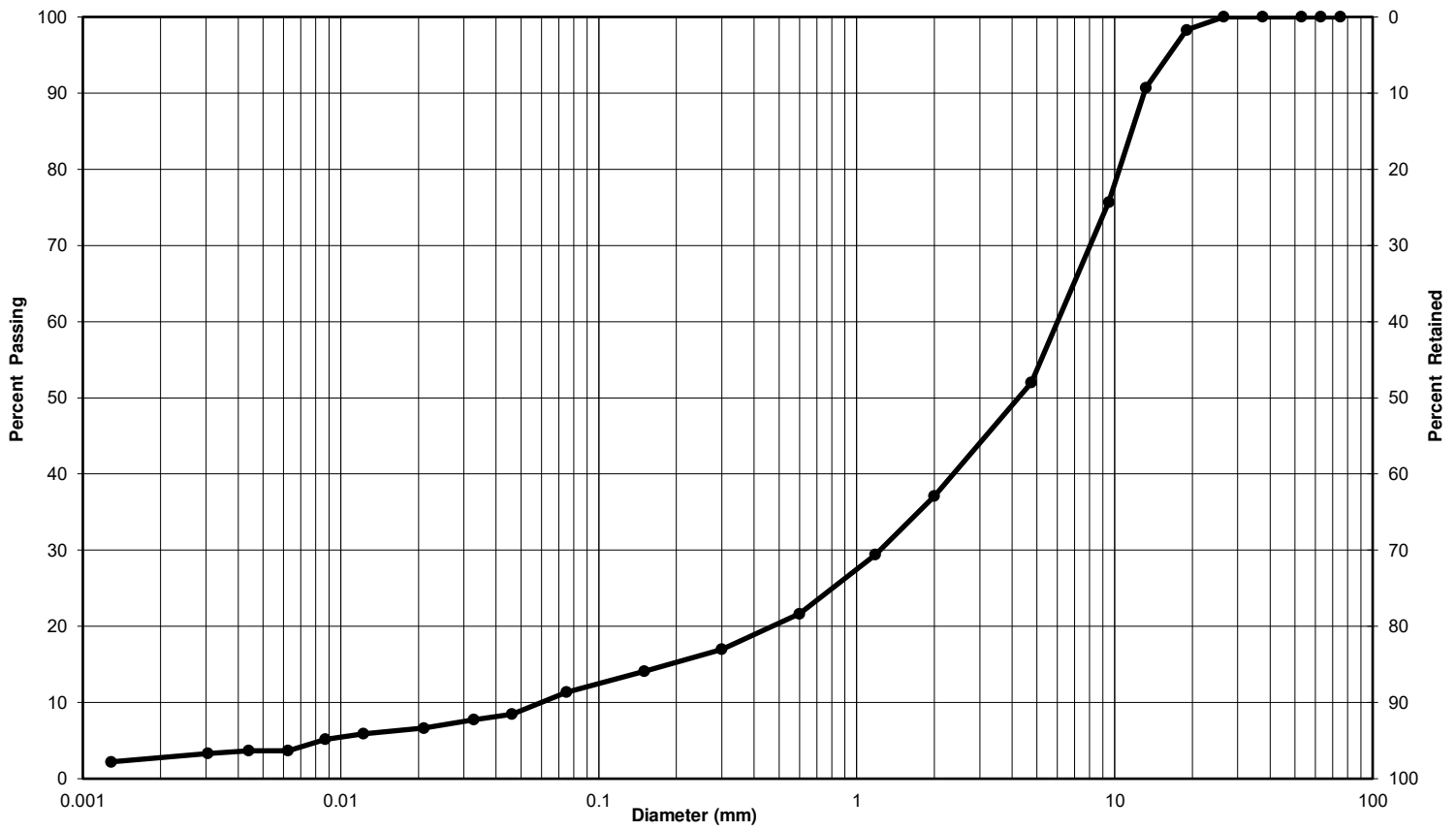
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand, some Gravel, some Silt, some Clay	19	50	31
Clay-size particles (<0.002 mm):			14 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	BH1-21	Sample No.:	Grab
Depth:	0.1-0.3m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

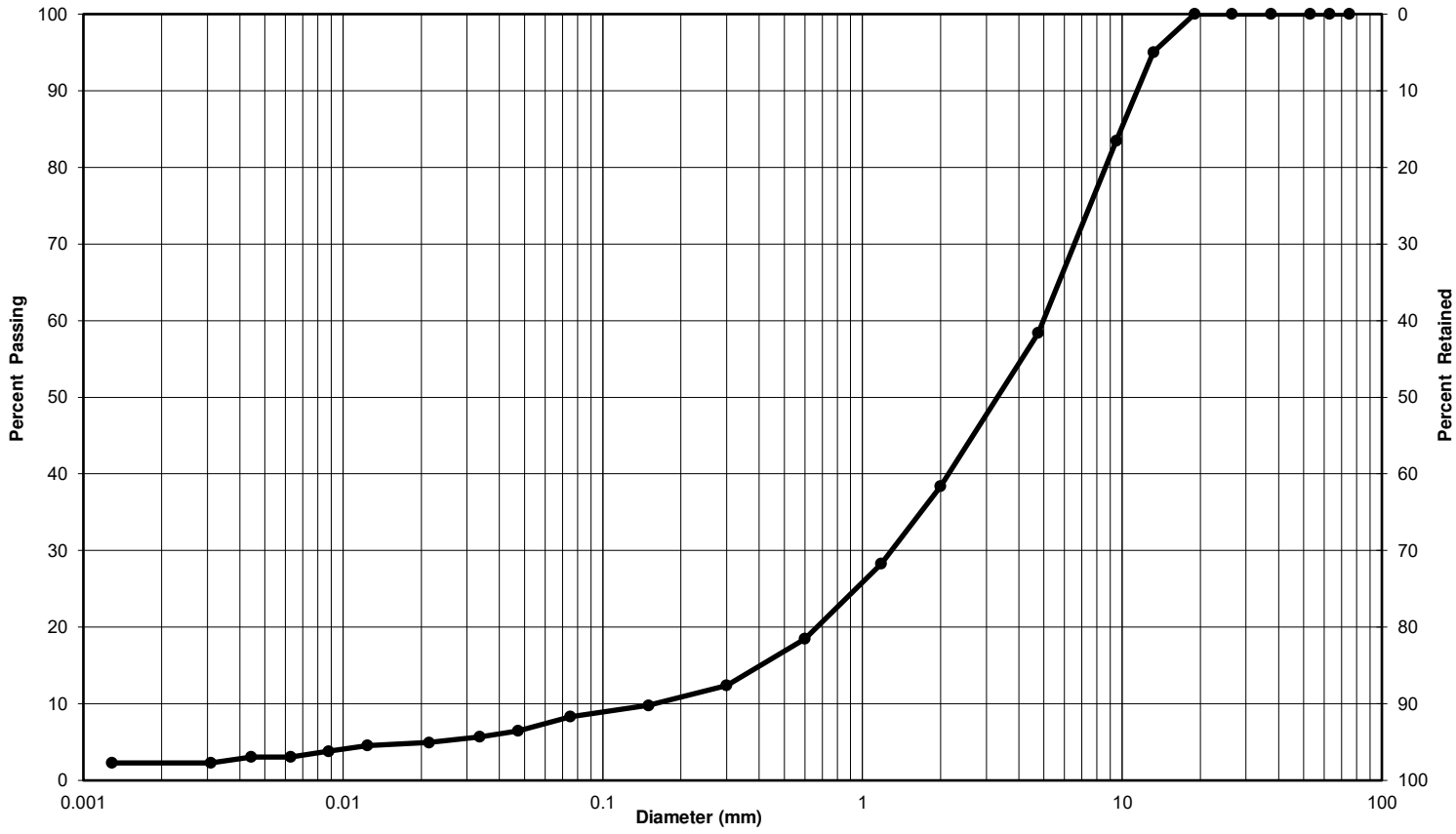
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel and Sand, trace Silt, trace Clay	48	41	11
			3 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	BH2-21	Sample No.:	Grab
Depth:	0.1-0.3m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

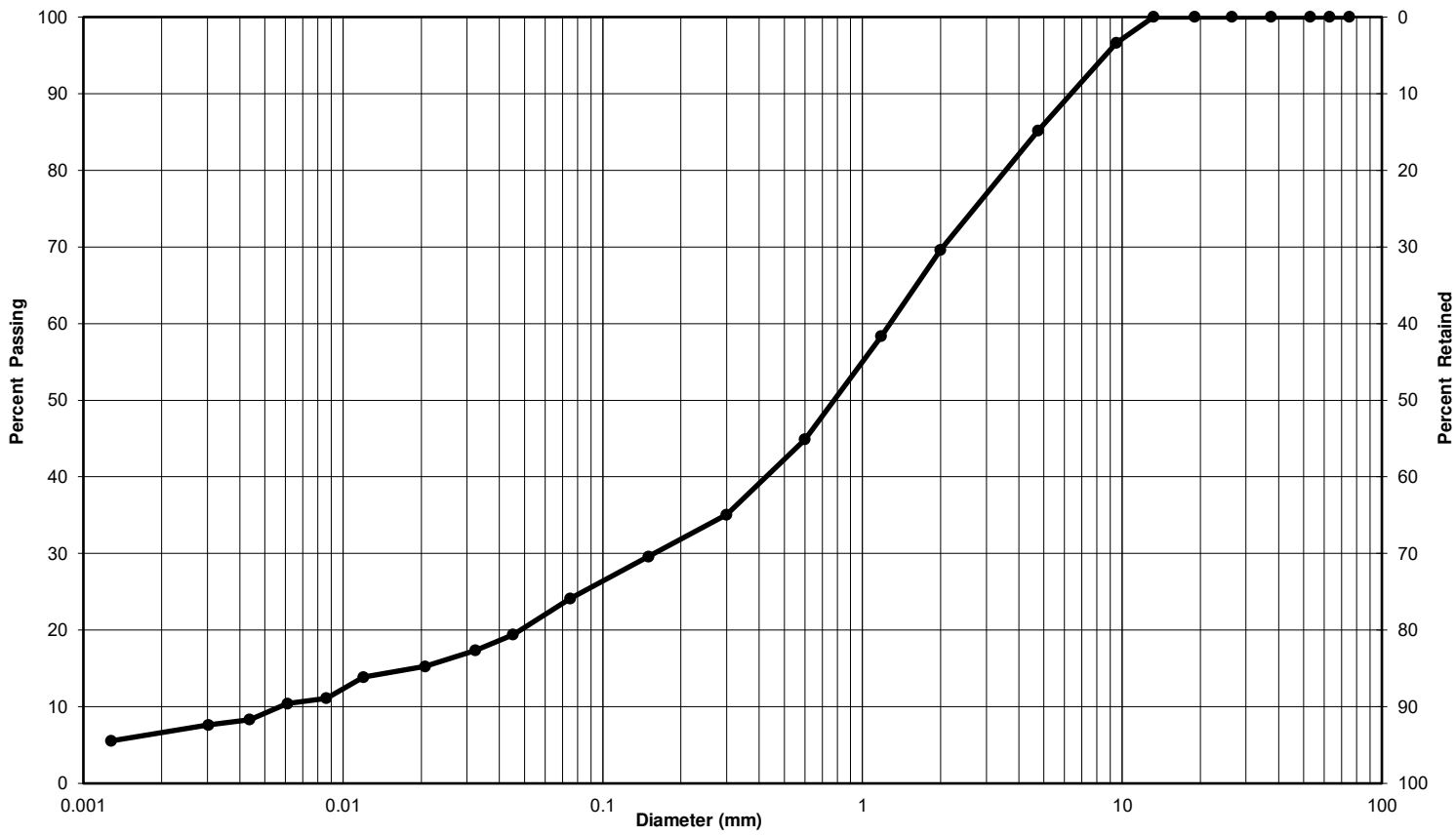
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Gravel, trace Silt, trace Clay	42	50	8
			2 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	BH2-21	Sample No.:	SS1
Depth:	0.5-0.8m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

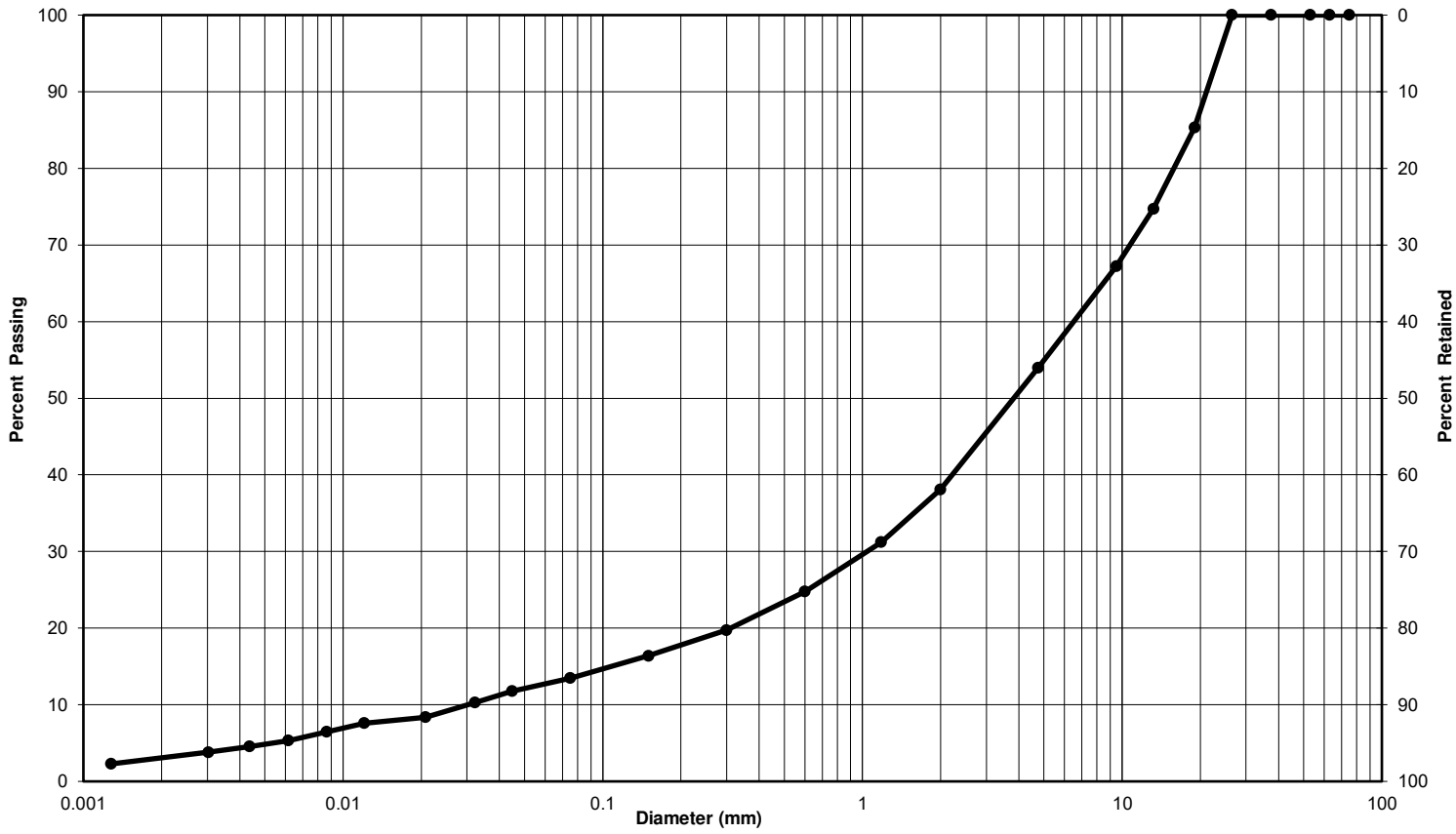
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand, some Silt, some Gravel, trace Clay	15	61	24
Clay-size particles (<0.002 mm):			6 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	BH4-21	Sample No.:	SS1
Depth:	0.2-0.5m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

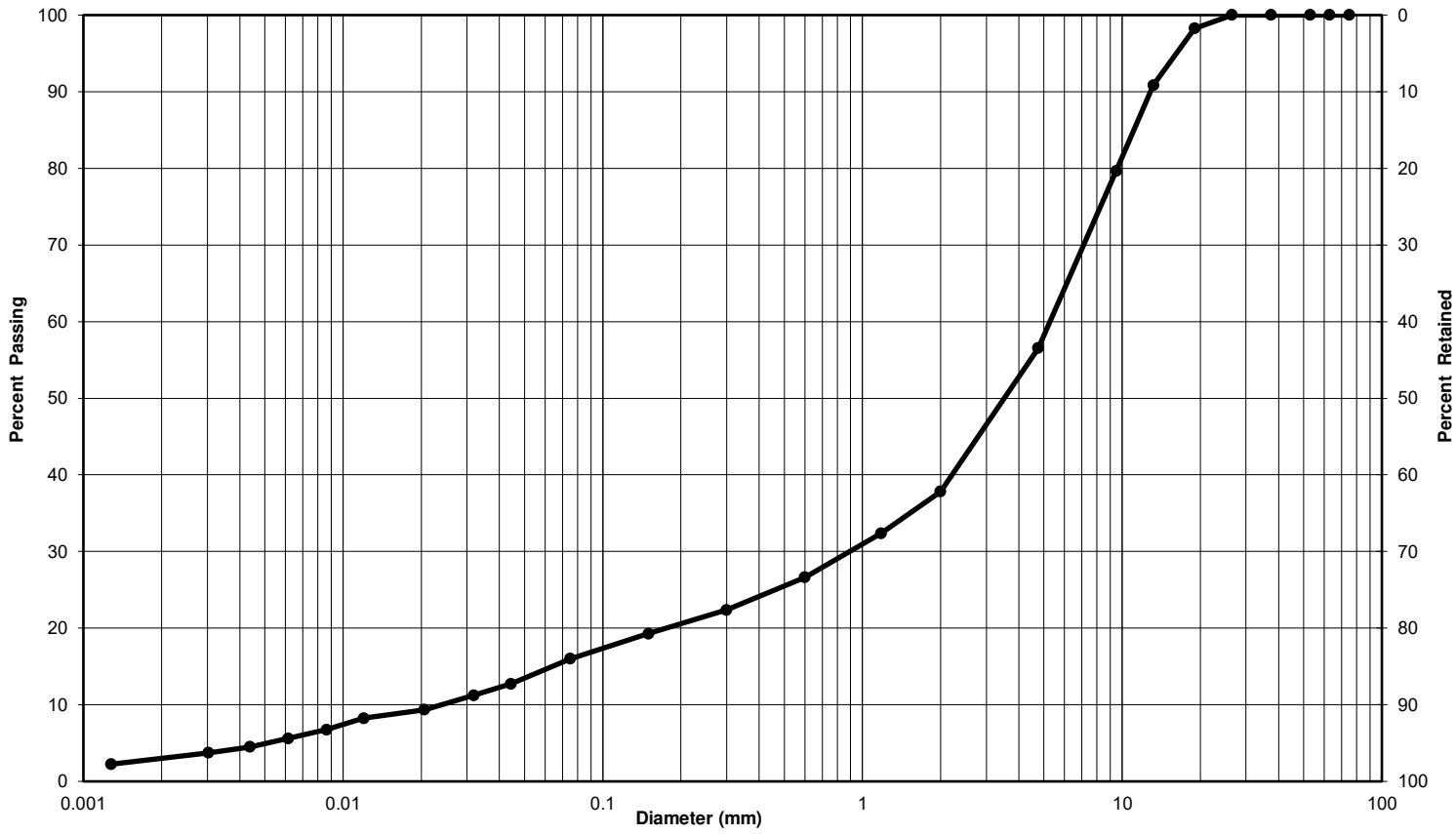
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel and Sand, trace Silt, trace Clay	46	41	13
			3 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	MW5-21	Sample No.:	Grab
Depth:	0.1-0.3m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

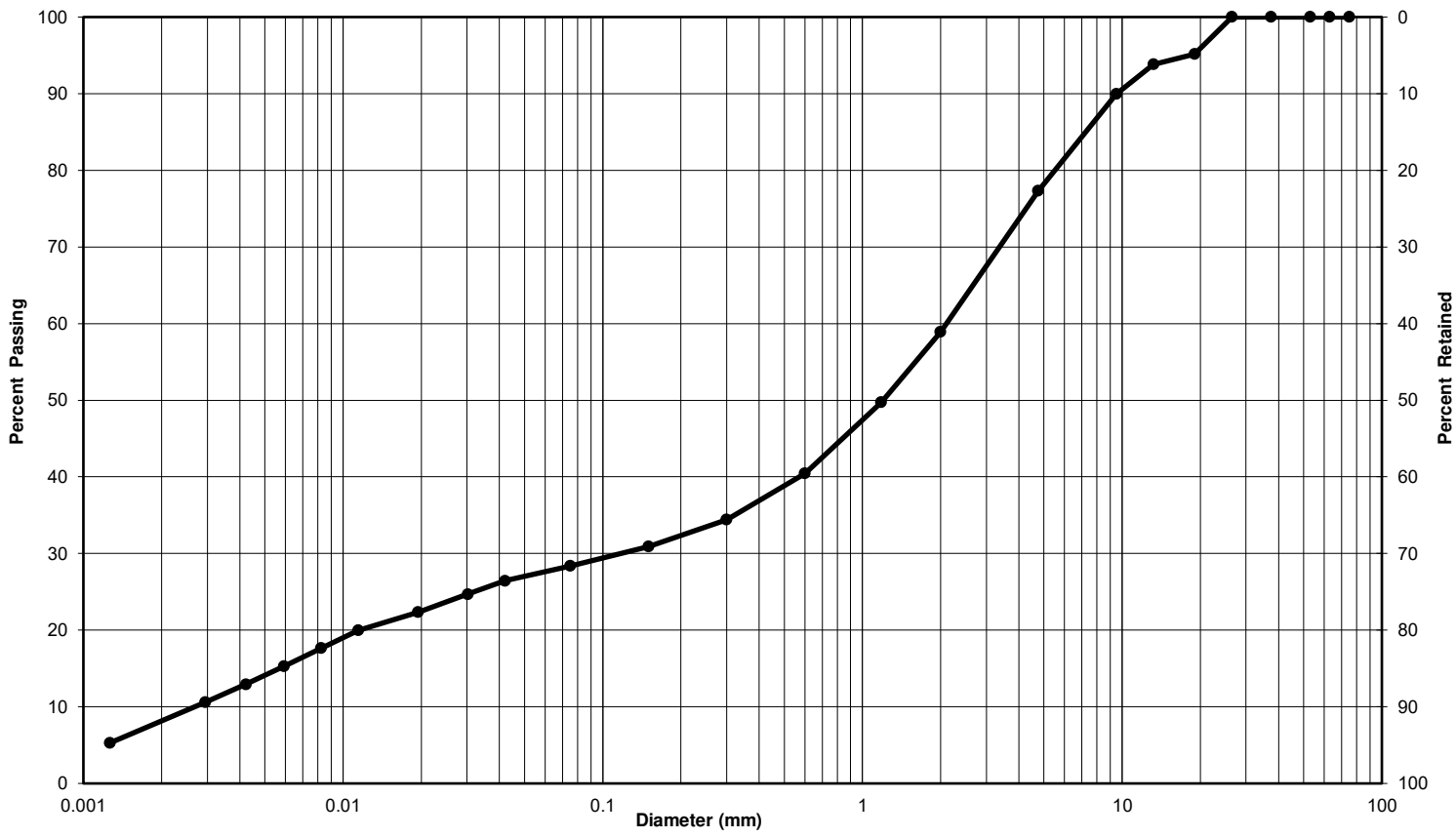
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel and Sand, some Silt, trace Clay	43	41	16
Clay-size particles (<0.002 mm):			3 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	MW5-21	Sample No.:	SS1
Depth:	0.5-0.8m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

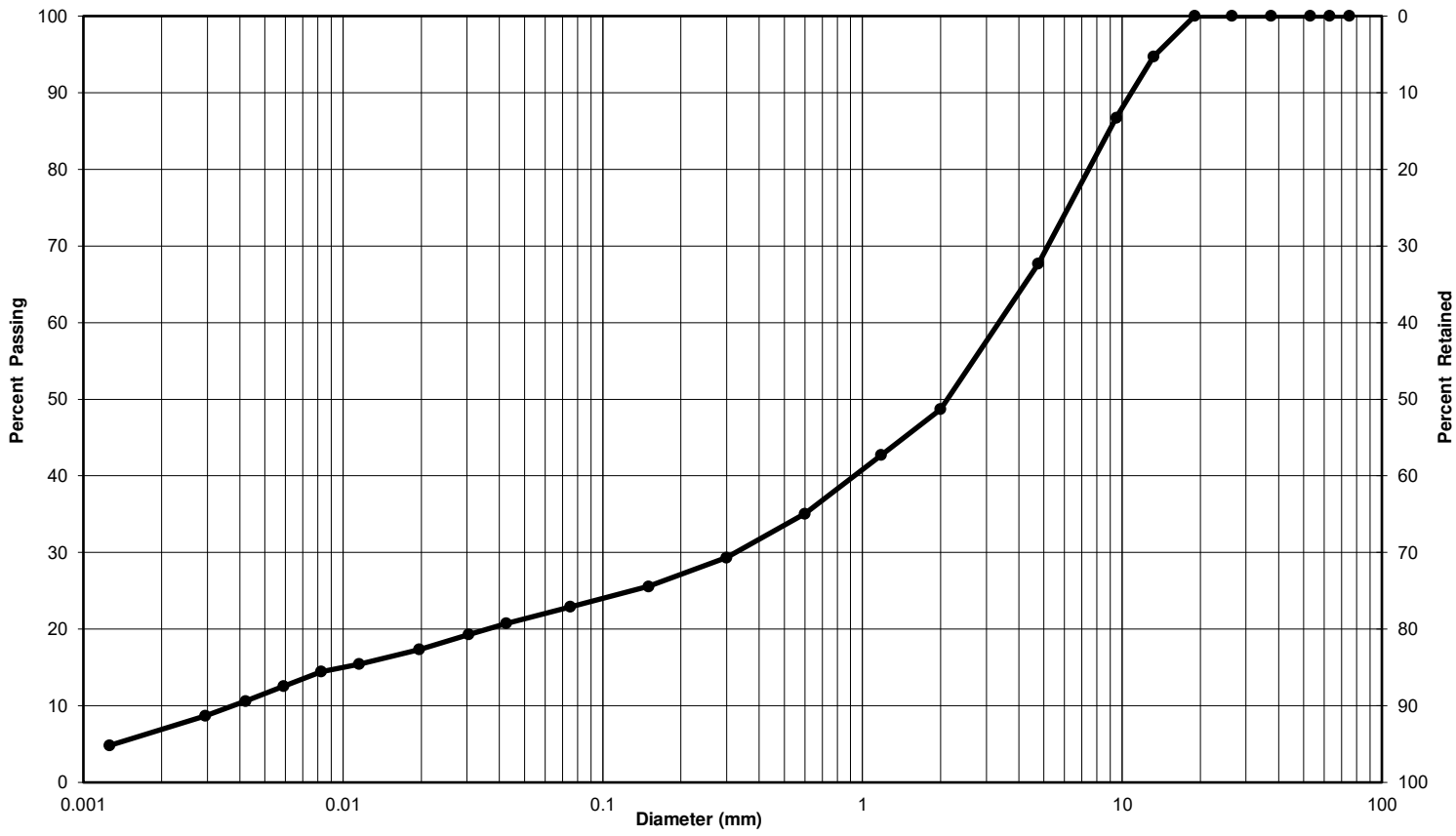
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravelly Sand, some Silt, trace Clay	23	49	28
Clay-size particles (<0.002 mm):			8 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	MW6-21	Sample No.:	SS2
Depth:	0.8-1.1m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

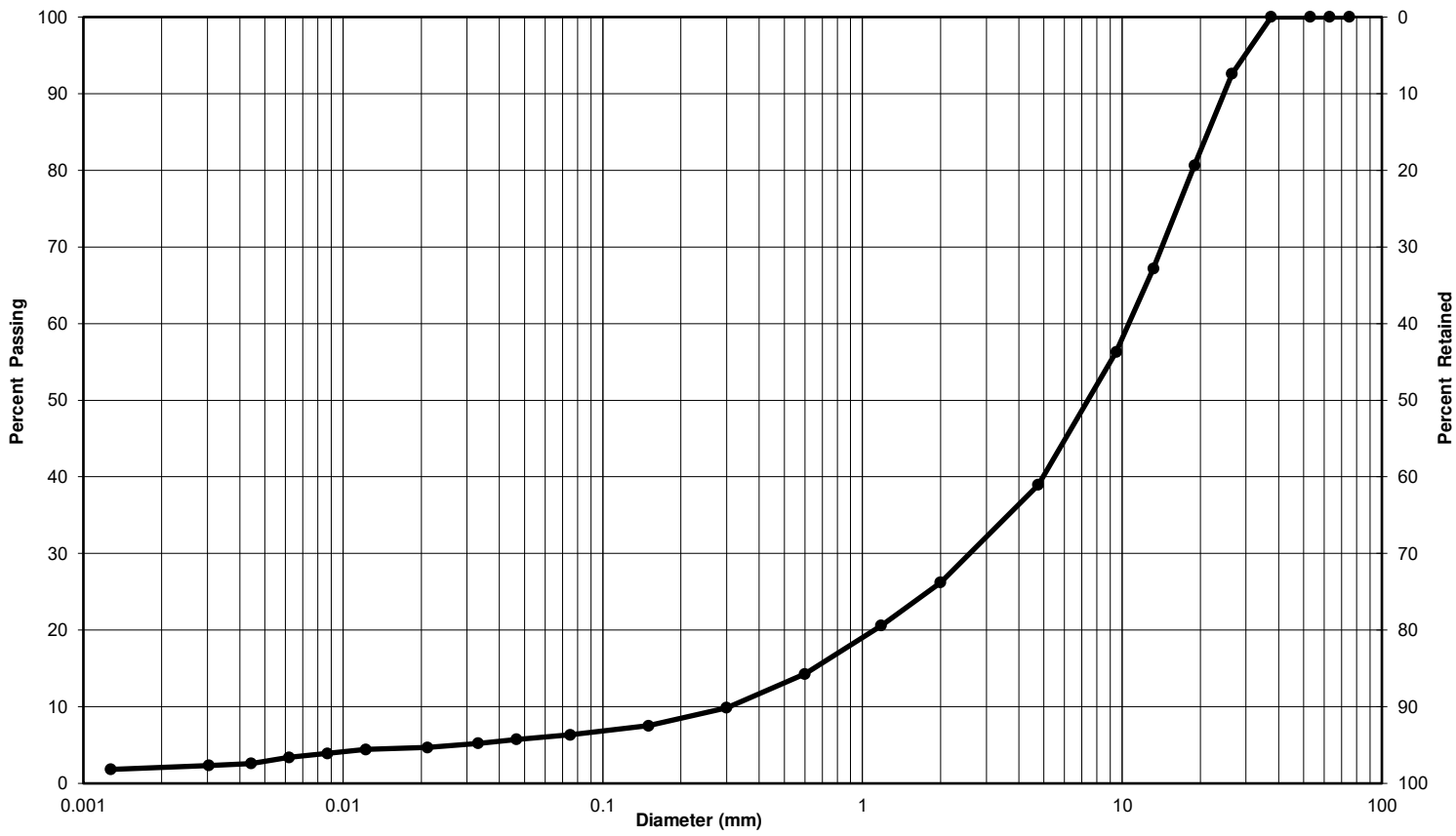
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravelly, Sand, some Silt, trace Clay	32	45	23
Clay-size particles (<0.002 mm):			7 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-21-01
Project, Site:	Proposed Parking Structure Children's Hospital of Eastern Ontario Campus 401 Smyth Road, Ottawa, Ontario	**Project No.:**	11205379-80
Borehole No.:	MW8-21	Sample No.:	Grab
Depth:	0.0-0.3m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy Gravel, trace Silt, trace Clay	61	33	6
			2 %

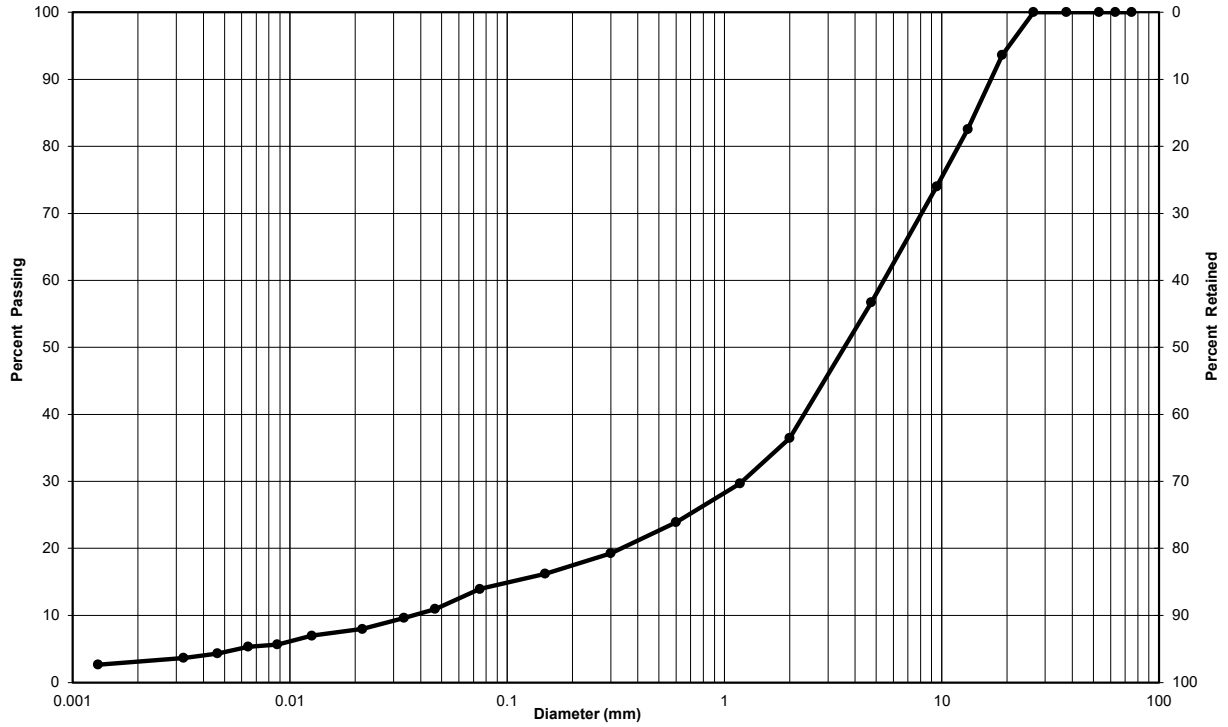
Remarks:

Performed by:	Z. Mathurin	**Date:**	February 10, 2021
Verified by:	E. Bennett	**Date:**	February 17, 2021

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379

Borehole No.:	BH10-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

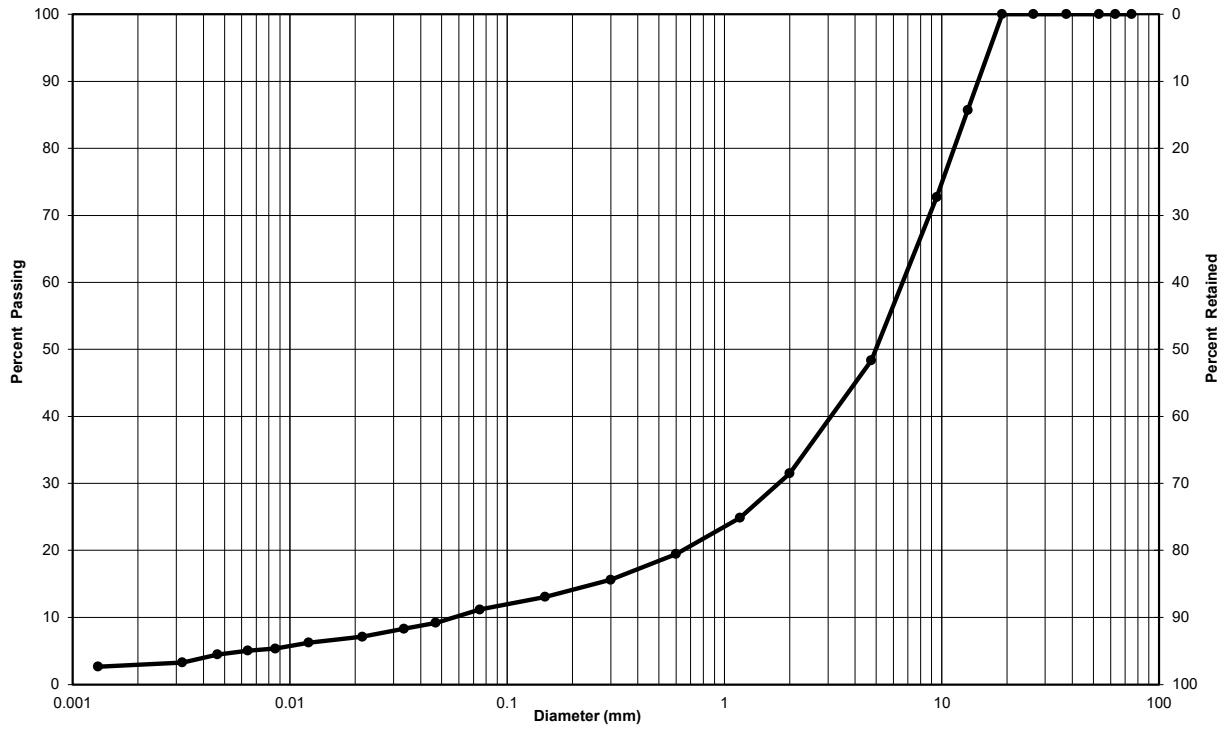
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel and Sand, with Some Silt and Traces of Clay	43	43	14
Silt-size particles (%) :	11		
Clay-size particles (%) (<0.002 mm):	3		

Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 15, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379
Borehole No.:	BH11-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel and Sand, with Traces of Silt and Clay	52	37	11
Silt-size particles (%) :	8		
Clay-size particles (%) (<0.002 mm):	3		

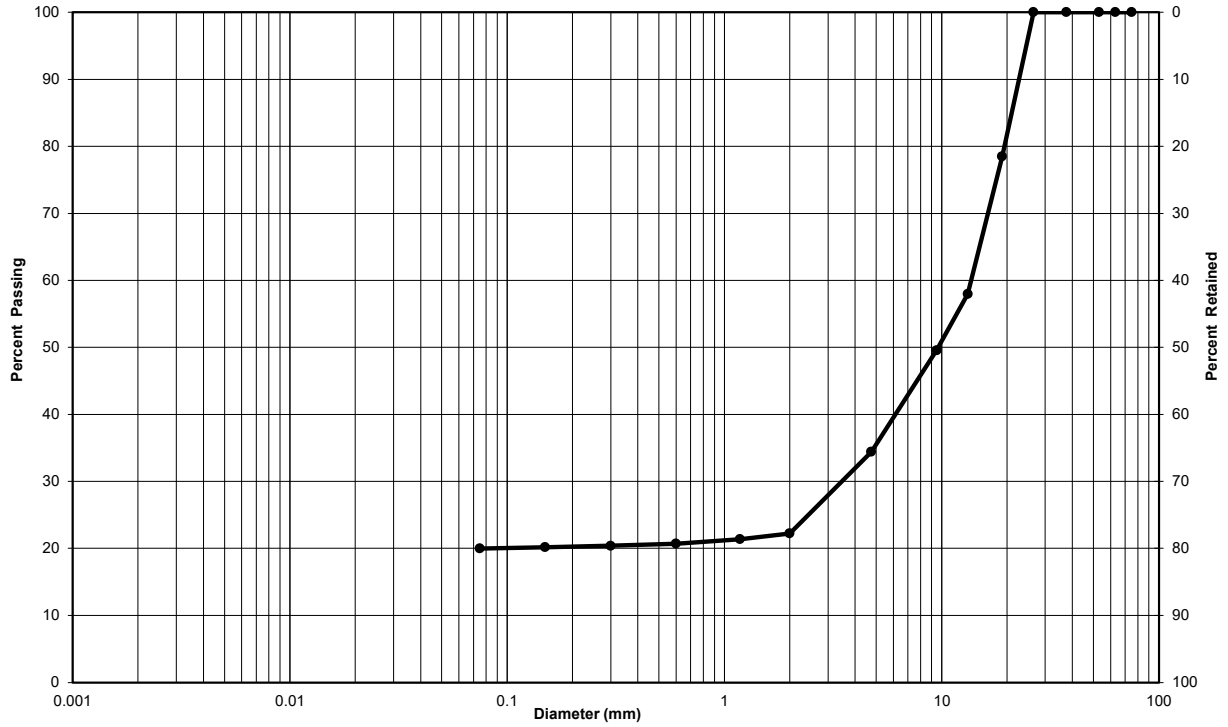
Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 11, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379

Borehole No.:	BH12-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

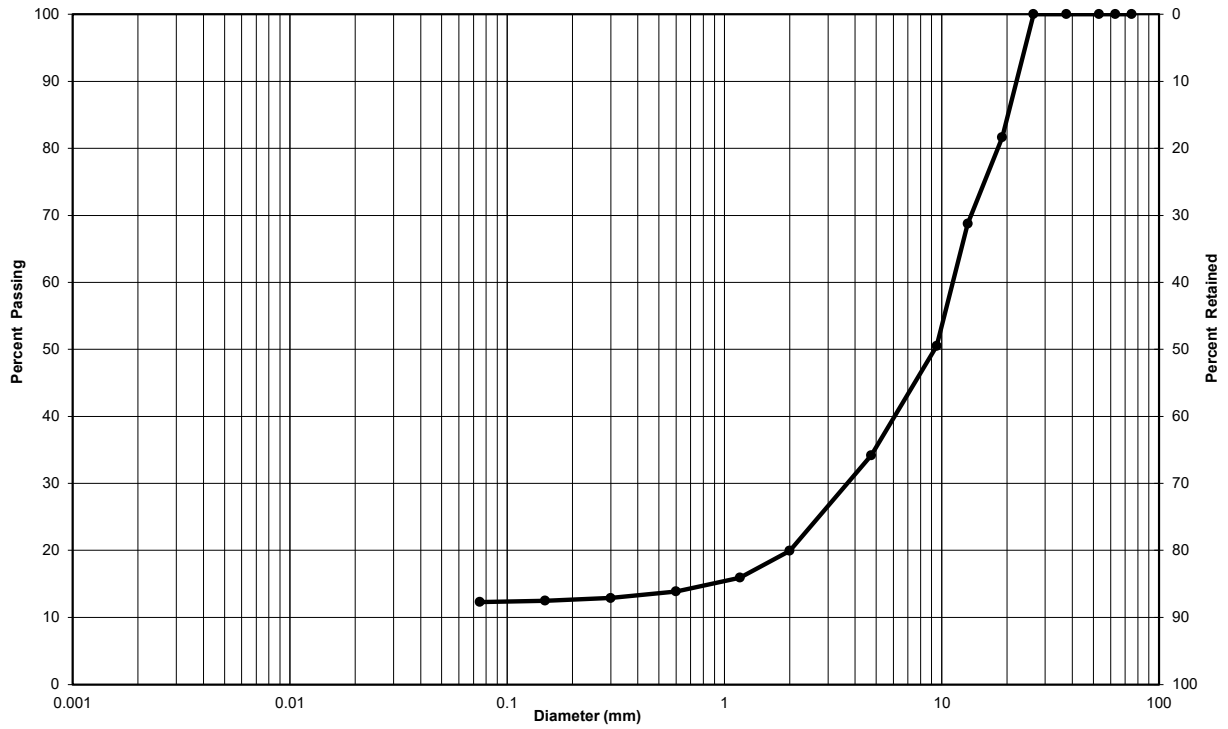
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel, with Some Sand and Silt, Traces of Clay	66	14	20
Silt-size particles (%) :			
Clay-size particles (%) (<0.002 mm):			

Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 11, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379
Borehole No.:	BH14-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

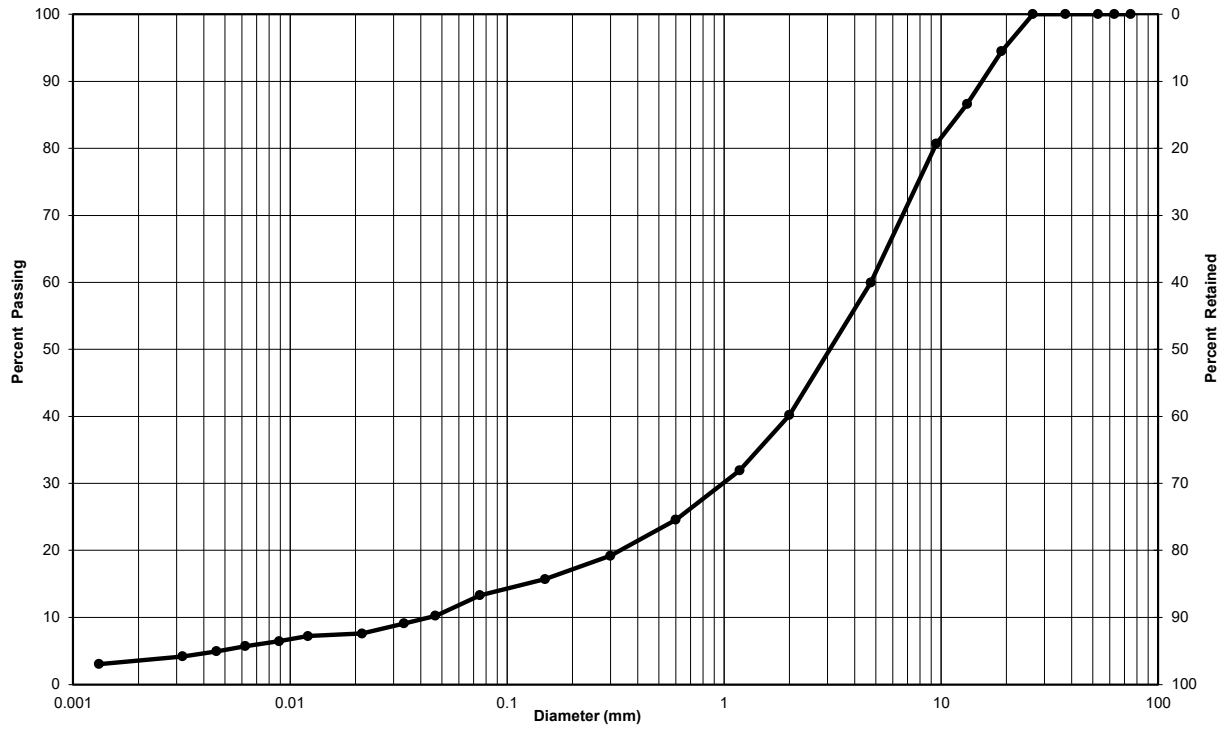
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy Gravel, with Traces of Silt and Clay	66	22	12
Silt-size particles (%) :			
Clay-size particles (%) (<0.002 mm):			

Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 11, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379
Borehole No.:	BH15-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

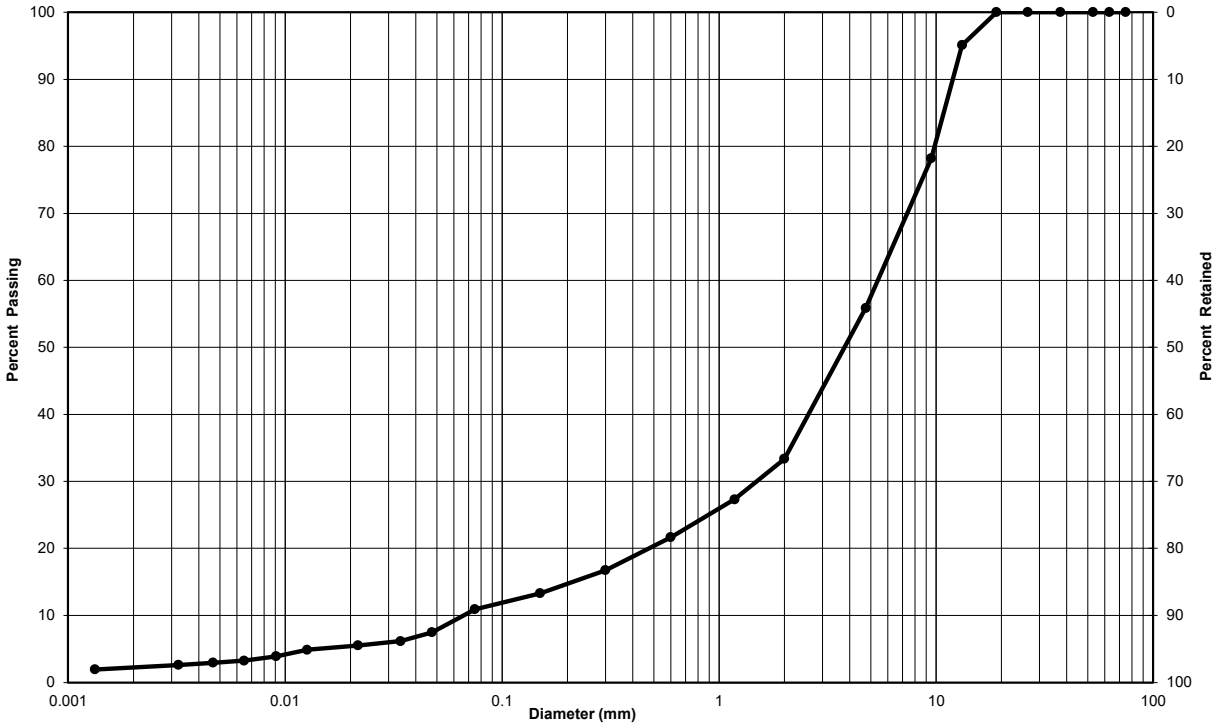
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Gravel, with Some Silt and Traces of Clay	40	47	13
Silt-size particles (%) :	10		
Clay-size particles (%) (<0.002 mm):	3		

Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 11, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379
Borehole No.:	BH16-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Gravel, with Traces of Silt and Clay	44	45	11
Silt-size particles (%) :	9		
Clay-size particles (%) (<0.002 mm):	2		

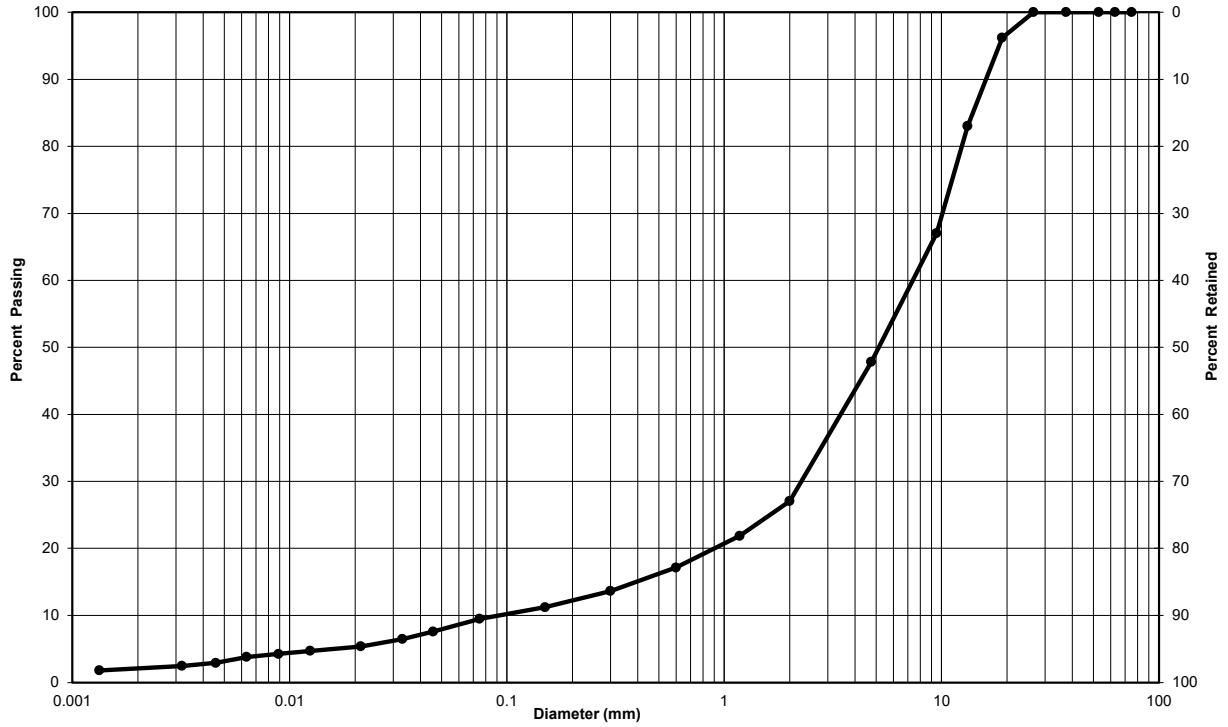
Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 11, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379

Borehole No.:	BH17-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy Gravel, with Traces of Silt and Clay	52	39	9
Silt-size particles (%) :	7		
Clay-size particles (%) (<0.002 mm):	2		

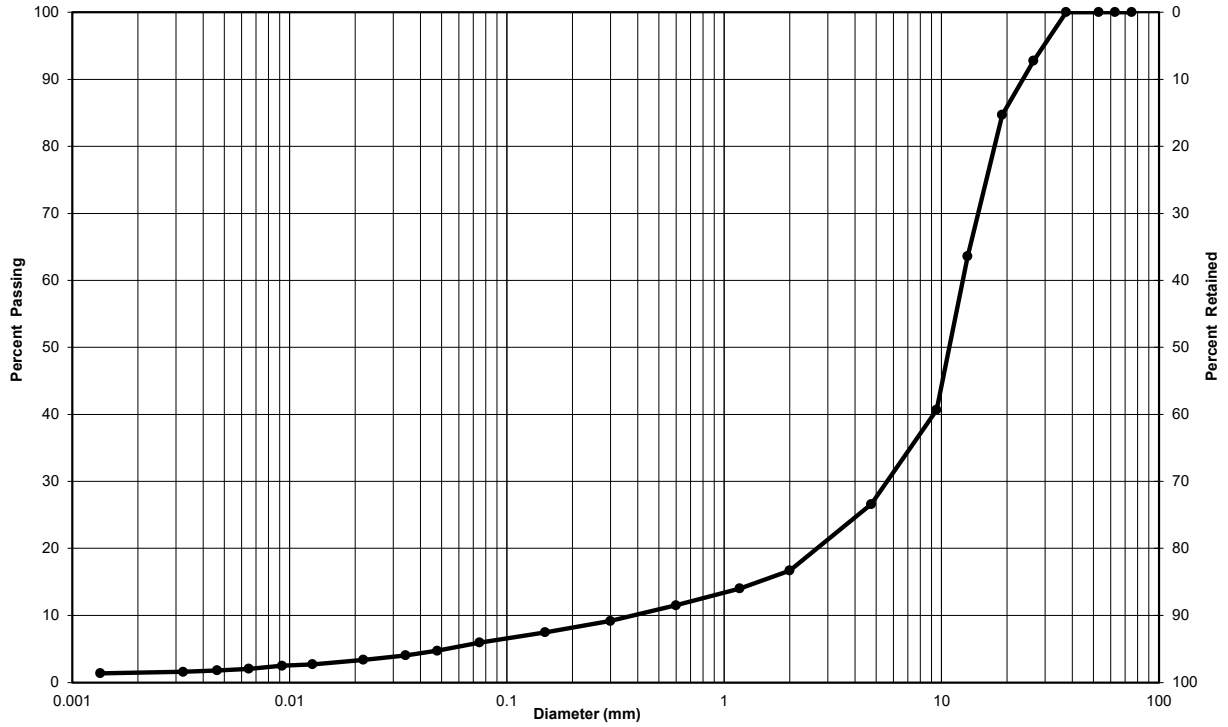
Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 9, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379

Borehole No.:	BH18-22	Sample No.:	SS-1
Depth:	0 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy Gravel, with Traces of Silt and Clay	73	21	6
Silt-size particles (%) :	5		
Clay-size particles (%) (<0.002 mm):	1		

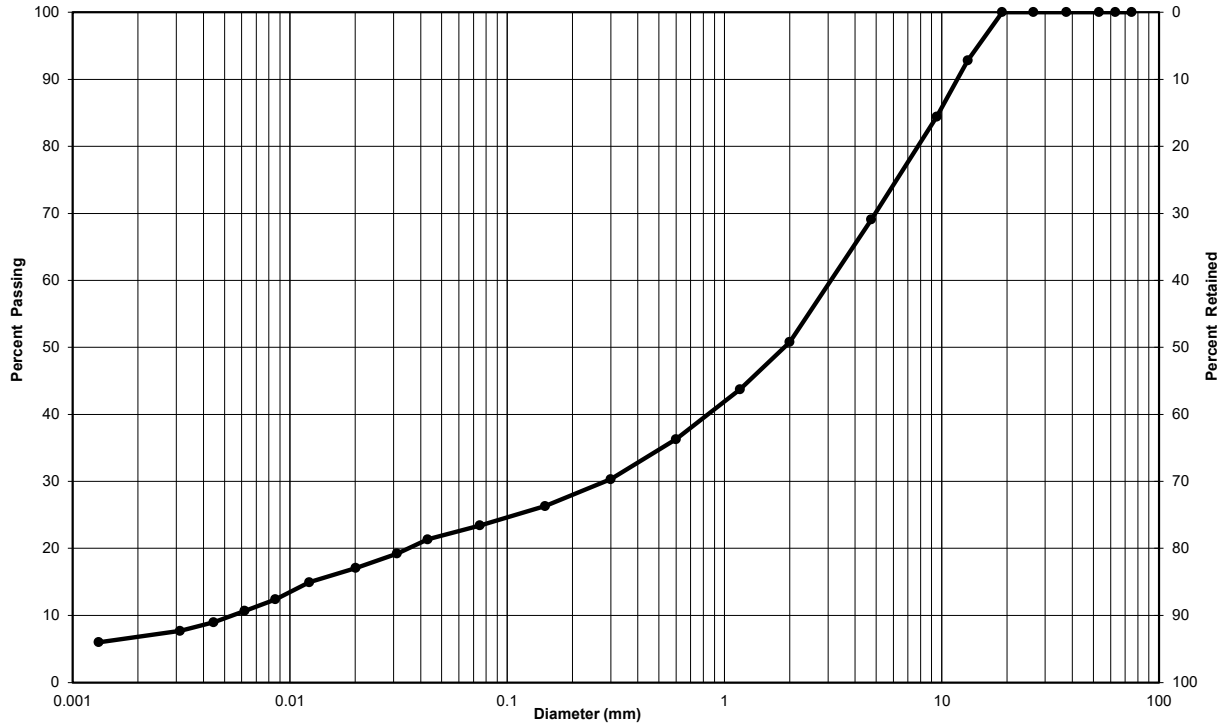
Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 9, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379

Borehole No.:	BH19-22	Sample No.:	SS-2
Depth:	0,76 - 1,37 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Gravel, with Some Silt and Traces of Clay	31	46	23
Silt-size particles (%) :	16		
Clay-size particles (%) (<0.002 mm):	7		

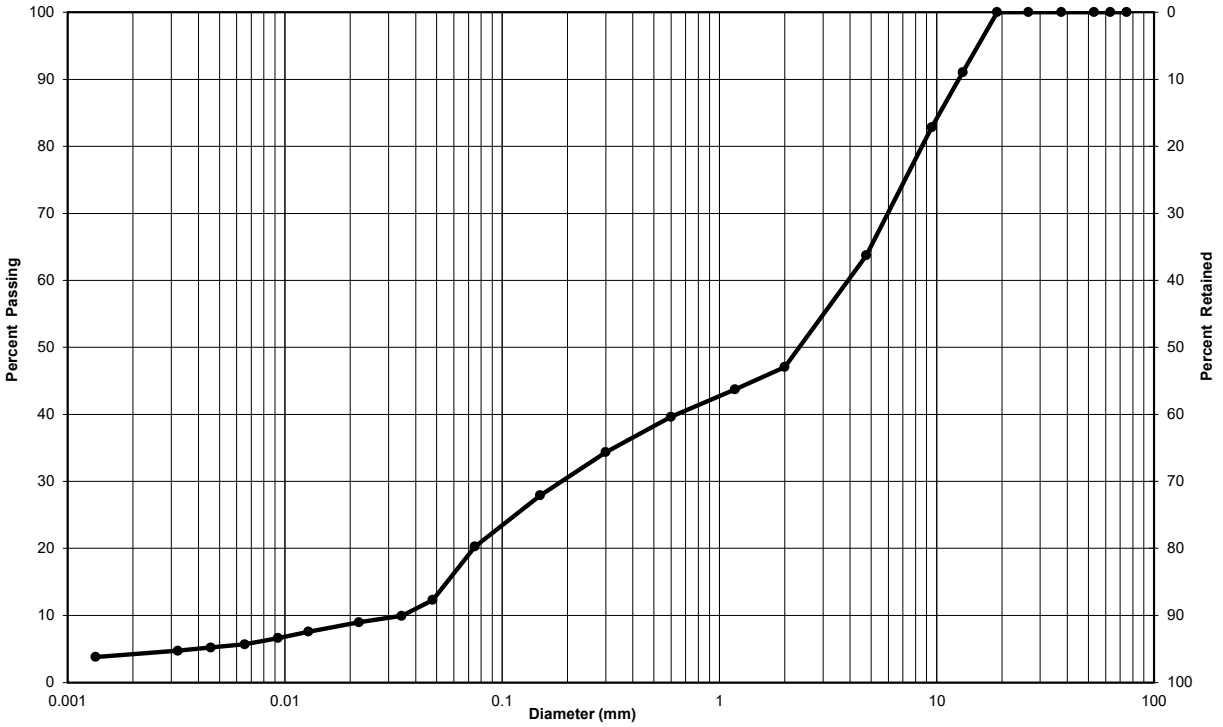
Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 17, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379

Borehole No.:	MW20-22	Sample No.:	SS-1
Depth:	0,00 - 0,61 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

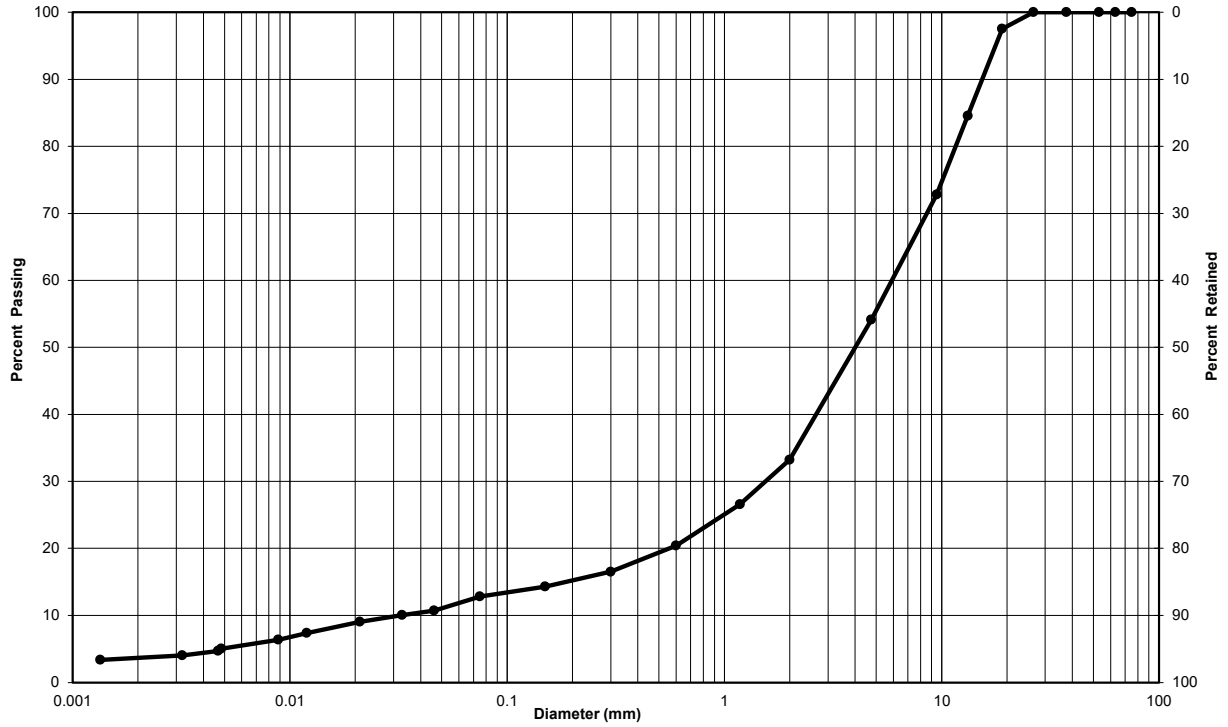
Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Gravel, with Some Silt and Traces of Clay	36	44	20
Silt-size particles (%) :	16		
Clay-size particles (%) (<0.002 mm):	4		

Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 9, 2022
Verified by:		**Date:**	August 24, 2022

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project, Site:	Children Hospital	**Project No.:**	11205379
Borehole No.:	MW20-22	Sample No.:	SS-2
Depth:	0,61 - 1,22 m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel and Sand, Traces of Silt and Clay	46	41	13
Silt-size particles (%) :	9		
Clay-size particles (%) (<0.002 mm):	4		

Remarks: More information is available upon request.

Performed by:	J. Lalonde	**Date:**	August 9, 2022
Verified by:		**Date:**	August 23, 2022

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Infrastructure Ontario	**Lab no.:**	G-20-01
Project/Site:	CHEO Proposed New Parking Garage	**Project no.:**	11205379-80

Borehole no.:	BH3	Sample no.:	SS2	Depth:	0.6-1.2m
Soil description:				Date sampled:	18-Jan-21

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	1	Spatula no.:	1
Sieve no.:	1	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	30	25	20
Water Content:			
Tare no.	S39	S11	S32
Wet soil+tare, g	32.39	33.80	32.26
Dry soil+tare, g	29.85	30.89	29.53
Mass of water, g	2.54	2.91	2.73
Tare, g	21.63	21.65	21.60
Mass of soil, g	8.22	9.24	7.93
Water content %	30.9%	31.5%	34.4%

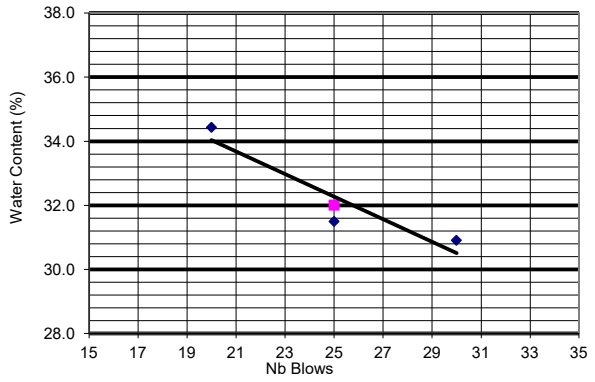
Plastic Limit (PL) - Water Content:		
Tare no.	S37	S18
Wet soil+tare, g	28.17	28.51
Dry soil+tare, g	27.24	27.53
Mass of water, g	0.93	0.98
Tare, g	21.98	22.23
Mass of soil, g	5.26	5.30
Water content %	17.7%	18.5%
Average water content %	18.1%	

Natural Water Content (W^n):		
Tare no.	G	
Wet soil+tare, g	445.80	
Dry soil+tare, g	393.10	
Mass of water, g	52.70	
Tare, g	0.00	
Mass of soil, g	393.10	
Water content %	13.4%	

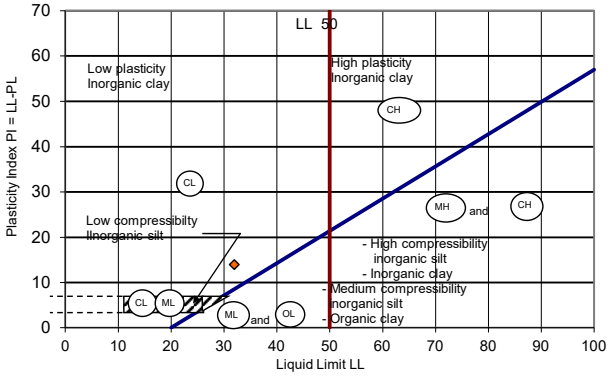
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☐ Dry preparation
- ☑ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
32	18	14	13

Remarks:

Performed by:	Ali Elhaddad	**Date:**	February 12, 2021
Verified by:	E. Bennett	**Date:**	February 18, 2021

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Infrastructure Ontario	**Lab no.:**	G-22-03
Project/Site:	Children Hospital	**Project no.:**	11205379

Borehole no.:	BH13-22	Sample no.:	SS-2	Depth:	0,61 - 1,22 m
Soil Description:				Date sampled:	

Apparatus:	Hand Crank	Balance no.:	8033031049	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-04645	Spatula no.:	1
Sieve no.:	0155690	Glass plate no.:	1		

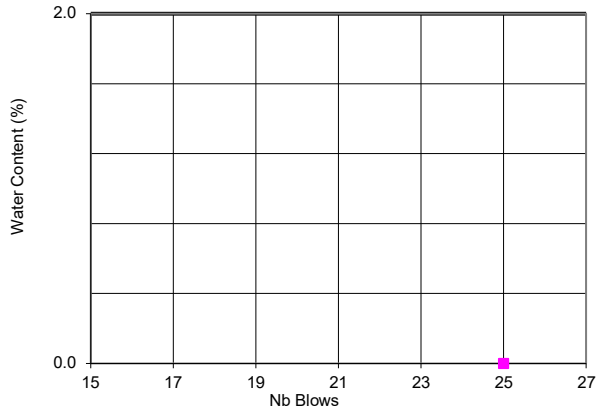
Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows			
Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Plastic Limit (PL) - Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Average water content %			
Natural Water Content (W^n):			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			

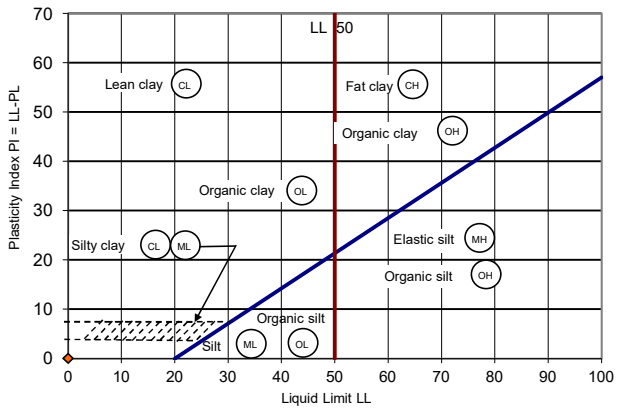
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n

Remarks: Non-Plastic Sample

Performed by:	J. Lalonde	**Date:**	September 13, 2022
Verified by:		**Date:**	September 13, 2022
Laboratory Location:	179 Colonnade Rd. Suite 400, Ottawa, Ontario		

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Infrastructure Ontario	**Lab no.:**	G-22-03
Project/Site:	Children Hospital	**Project no.:**	11205379

Borehole no.:	BH19-22	Sample no.:	SS-2	Depth:	0,76 - 1,37 m
Soil Description:				Date sampled:	

Apparatus:	Hand Crank	Balance no.:	8033031049	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-04645	Spatula no.:	1
Sieve no.:	0155690	Glass plate no.:	1		

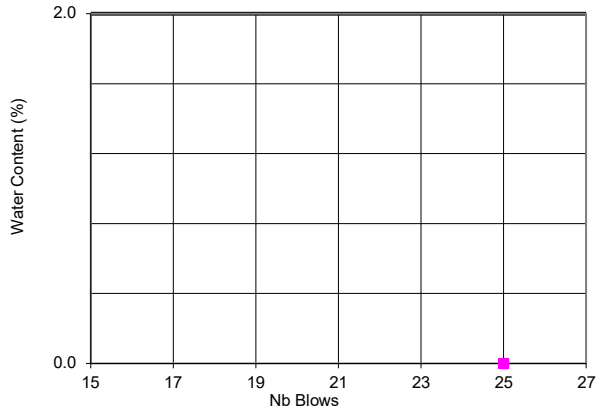
Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows			
Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Plastic Limit (PL) - Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Average water content %			
Natural Water Content (W^n):			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			

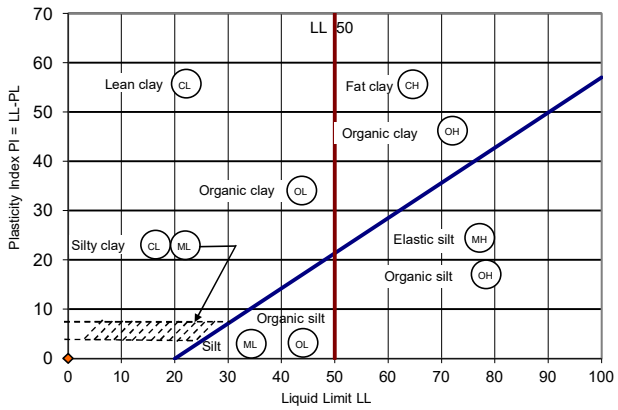
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n

Remarks: Non-Plastic Sample

Performed by:	J. Lalonde	**Date:**	September 13, 2022
Verified by:		**Date:**	September 13, 2022
Laboratory Location:	179 Colonnade Rd. Suite 400, Ottawa, Ontario		

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Infrastructure Ontario	**Lab no.:**	G-22-03
Project/Site:	Children Hospital	**Project no.:**	11205379

Borehole no.:	MW20-22	Sample no.:	SS-2	Depth:	0,61 - 1,22 m
Soil Description:				Date sampled:	

Apparatus:	Hand Crank	Balance no.:	8033031049	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-04645	Spatula no.:	1
Sieve no.:	0155690	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows			
Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			

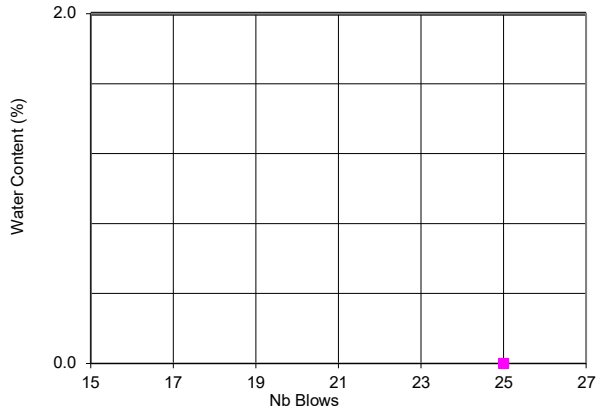
Plastic Limit (PL) - Water Content:		
Tare no.		
Wet soil+tare, g		
Dry soil+tare, g		
Mass of water, g		
Tare, g		
Mass of soil, g		
Water content %		
Average water content %		

Natural Water Content (W^n):		
Tare no.		
Wet soil+tare, g		
Dry soil+tare, g		
Mass of water, g		
Tare, g		
Mass of soil, g		
Water content %		

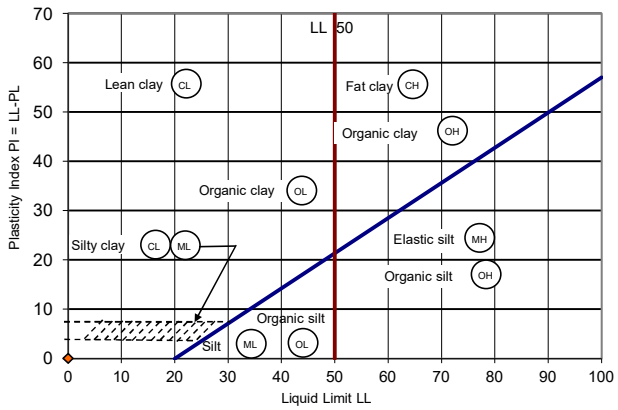
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n

Remarks: Non-Plastic Sample

Performed by:	J. Lalonde	**Date:**	September 13, 2022
Verified by:		**Date:**	September 13, 2022
Laboratory Location:	179 Colonnade Rd. Suite 400, Ottawa, Ontario		

Moisture Content of Soils
(ASTM D 2216)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project/Site:	Children's Hospital	**Project No.:**	11205379

Apparatus Used for Testing **Oven No.:** B23-04645 **Scale No.:** 8033031049

BH No.:					BH10-22	BH10-22	BH11-22	BH11-22
Sample No.:					SS1	SS2	SS1	SS2
Depth:					0,0-2,0	2,0-3,3	0,0-2,0	2,0-4,0
Container no.					32	25	28	4
Mass of container + wet soil (g)					70.50	70.00	75.70	72.80
Mass of container + dry soil (g)					68.90	66.80	74.40	68.10
Mass of container (g)					14.80	14.60	14.70	14.80
Mass of dry soil (g)					54.1	52.2	59.7	53.3
Mass of water (g)					1.6	3.2	1.3	4.7
Moisture content (%)					3.0	6.1	2.2	8.8
BH No.:	BH12-22	BH12-22	BH14-22	BH14-22	BH15-22	BH15-22	BH16-22	BH16-22
Sample No.:	SS1	SS2	SS1	SS2	SS1	SS2	SS1	SS2
Depth:	0,0-2,0	2,0-4,0	0,0-2,0	2,0-4,0	0,0-2,0	2,0-3,5	0.0-2,0	2,0-4,0
Container no.	42	15	14	35	18	9	13	23
Mass of container + wet soil (g)	83.70	74.40	79.40	74.00	61.00	62.70	78.90	58.40
Mass of container + dry soil (g)	81.60	71.80	77.90	71.10	59.50	60.20	77.00	55.40
Mass of container (g)	14.60	14.80	14.80	15.10	15.00	14.70	14.80	15.10
Mass of dry soil (g)	67.0	57.0	63.1	56.0	44.5	45.5	62.2	40.3
Mass of water (g)	2.1	2.6	1.5	2.9	1.5	2.5	1.9	3.0
Moisture content (%)	3.1	4.6	2.4	5.2	3.4	5.5	3.1	7.4

Remarks:

Performed By:	J A Baptiste	**Date:**	July 27, 2022
Verified by :		**Date:**	August 3, 2022

Moisture Content of Soils
(ASTM D 2216)

Client:	Infrastructure Ontario	**Lab No.:**	G-22-03
Project/Site:	Children's Hospital	**Project No.:**	11205379

Apparatus Used for Testing **Oven No.:** B23-04645 **Scale No.:** 8033031049

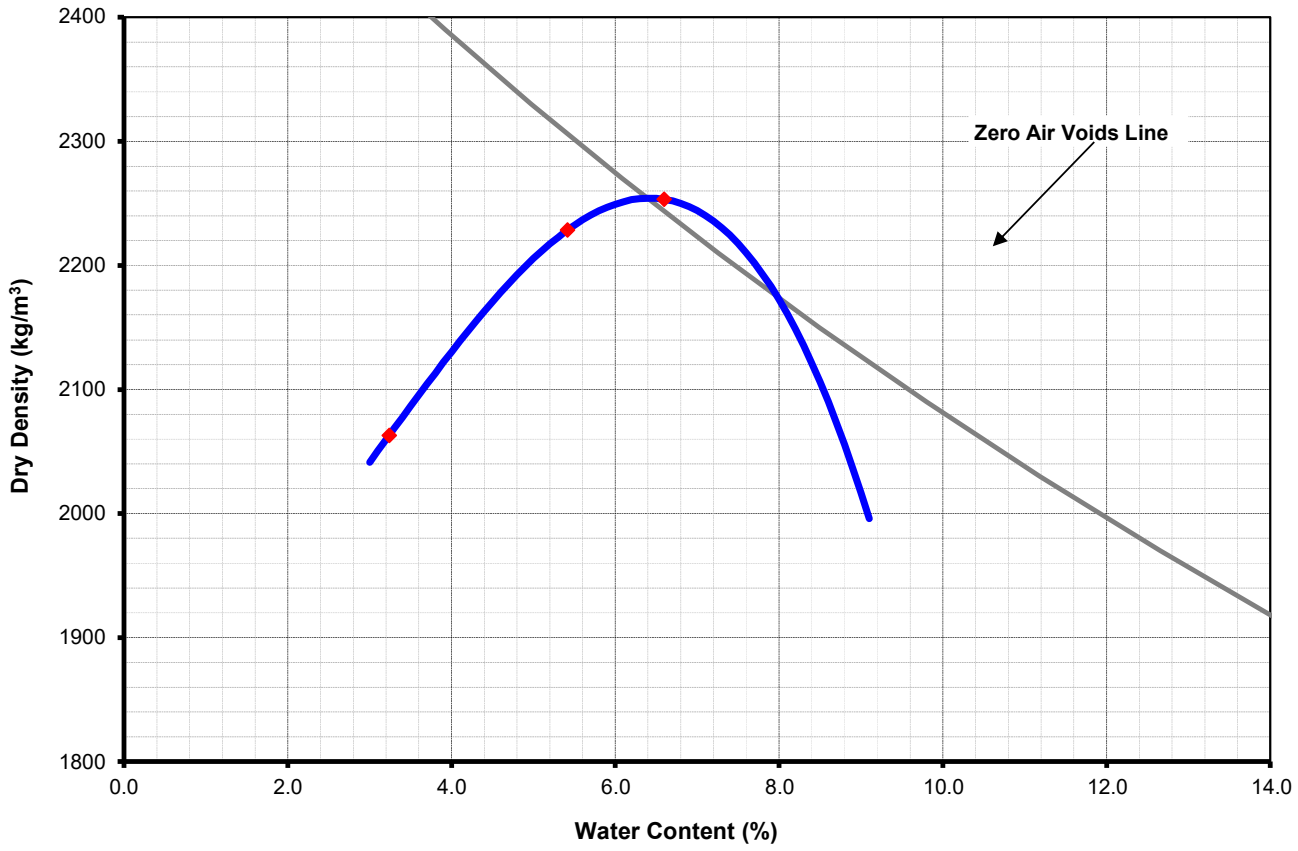
MW No.:	BH9-22	BH9-22						
Sample No.:	SS1	SS2						
Depth:	0,0-2,0	2,5-4,5						
Container no.	9	32						
Mass of container + wet soil (g)	59.30	55.60						
Mass of container + dry soil (g)	56.90	54.30						
Mass of container (g)	14.70	14.90						
Mass of dry soil (g)	42.2	39.4						
Mass of water (g)	2.4	1.3						
Moisture content (%)	5.7	3.3						
MW No.:	BH14	BH20-22	BH20-22					
Sample No.:	SS3B	SS1	SS2					
Depth:	2,4-5,1	0,5-2,5	2,5-4,5					
Container no.	23	16	28					
Mass of container + wet soil (g)	54.30	48.50	58.60					
Mass of container + dry soil (g)	52.60	47.00	56.40					
Mass of container (g)	15.00	14.90	14.90					
Mass of dry soil (g)	37.6	32.1	41.5					
Mass of water (g)	1.7	1.5	2.2					
Moisture content (%)	4.5	4.7	5.3					

Remarks:

Performed By:	J A Baptiste	**Date:**	July 27, 2022
Verified by :		**Date:**	August 3, 2022

Standard Proctor Test (ASTM D698)

Client :	Infrastructure Ontario	**Lab No :**	A-22-02
Project/Site :	Children Hospital	**Project No :**	11205379



Prepared Sample:	Dry	0	Moist	x			Assumed G_s:	2.70
ASTM D698 Test Method:	A	0	B	0	C	x	Type of Hammer:	Manual
		4.75 mm		9.50 mm		19.0 mm		

Soil Type:	Crushed Stone
Material:	
Proposed Use:	
Sample Identification:	BH11-22
Sample Location:	
Aggregate Supplier / Pit Name:	In Place
Sample Date:	
Sampled By:	D. Ash

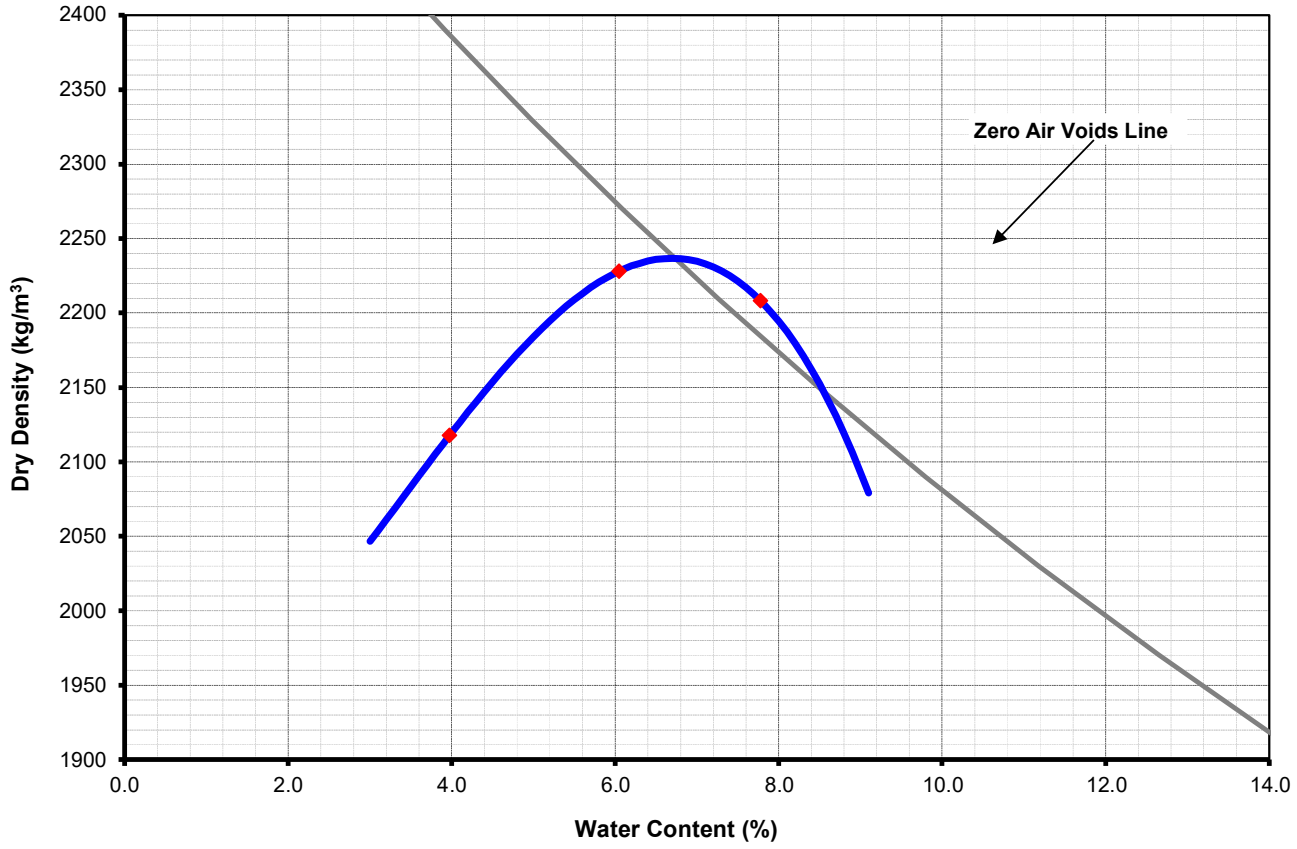
Max. Dry Density:	**2254**	**kg/m³**
Optimum Moisture:	**6.4**	**%**
% Retained on 19.0 mm:	**2.8**	**%**
Corrected Dry Density:	**2254**	**kg/m³**
Corrected Opt. Moist.:	**6.4**	**%**

Remarks :

Performed by :	J. Lalonde	**Date :**	September 2, 2022
Verified by :		**Date :**	September 6, 2022

Standard Proctor Test (ASTM D698)

Client :	Infrastructure Ontario	**Lab No :**	A-22-02
Project/Site :	Children Hospital	**Project No :**	11205379



Prepared Sample:	Dry	0	Moist	x			Assumed G_s:	2.70
ASTM D698 Test Method:	A	0	B	0	C	x	Type of Hammer:	Mechanical
		4.75 mm		9.50 mm		19.0 mm		

Soil Type:	Crushed Stone
Material:	
Proposed Use:	
Sample Identification:	BH18-22
Sample Location:	
Aggregate Supplier / Pit Name:	In Place
Sample Date:	
Sampled By:	D. Ash

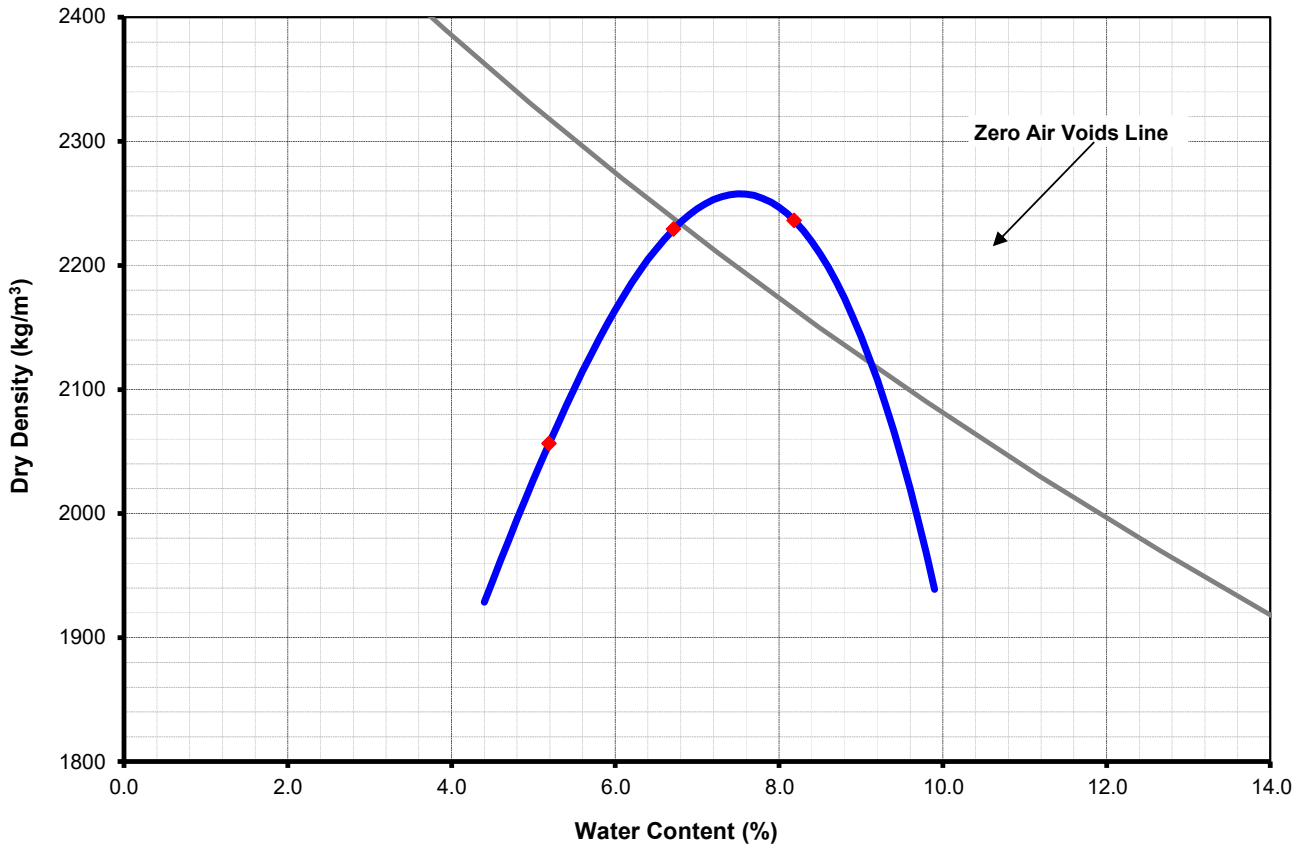
Max. Dry Density:	**2237**	**kg/m³**
Optimum Moisture:	**6.7**	**%**
% Retained on 19.0 mm:	**7.2**	**%**
Corrected Dry Density:	**2265**	**kg/m³**
Corrected Opt. Moist.:	**6.2**	**%**

Remarks :

Performed by :	J. Lalonde	**Date :**	September 9, 2022
Verified by :		**Date :**	September 13, 2022

Standard Proctor Test (ASTM D698)

Client :	Infrastructure Ontario	**Lab No :**	A-22-02
Project/Site :	Children Hospital	**Project No :**	11205379



Prepared Sample:	Dry	0	Moist	x			Assumed G_s:	2.70
ASTM D698 Test Method:	A	0	B	0	C	x	Type of Hammer:	Mechanical
		4.75 mm		9.50 mm		19.0 mm		

Soil Type:	Crushed Stone
Material:	
Proposed Use:	
Sample Identification:	MW9-22
Sample Location:	
Aggregate Supplier / Pit Name:	In Place
Sample Date:	
Sampled By:	D. Ash

Max. Dry Density:	**2258**	**kg/m³**
Optimum Moisture:	**7.5**	**%**
% Retained on 19.0 mm:	**10.3**	**%**
Corrected Dry Density:	**2297**	**kg/m³**
Corrected Opt. Moist.:	**6.7**	**%**

Remarks :

Performed by :	J. Lalonde	**Date :**	September 7, 2022
Verified by :		**Date :**	September 13, 2022

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project : Proposed Parking Structure
Children's Hospital of Eastern Ontario Campus
401 Smyth Road, Ottawa, Ontario

Project N° : 11205379-80

Sample N° : MW3-21 RC1

Depth : 4.88-5.03m

Sampling Date : January 14-15 / 2021

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	63	63	63	63.0	(mm)
Length :	117	117	117	117.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.3	0.2	0.3	0.3	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.15	0.15	0.15	(°)

Mass : 965.2 (g) Volume: 364718 (mm^3)

Density : 2646 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.6 (MPa/sec)

Type of Fracture : 3

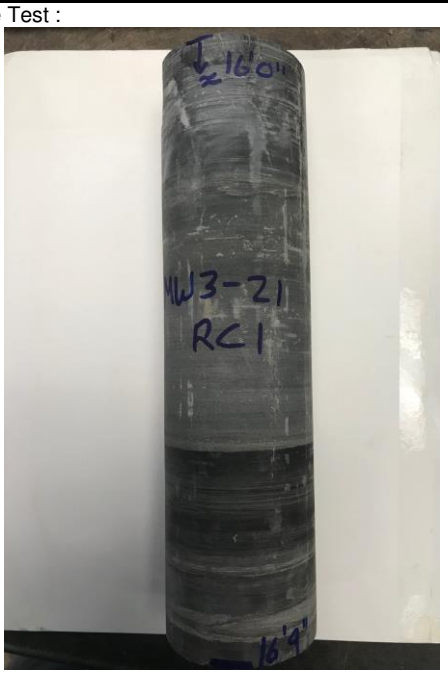
Test Duration (2-15 Minutes) : 3.5 (minutes)

Maximum Applied Load : 251.98 ☑ kN ☐ lbs

Compressive Strength : 80.8 (MPa)

View of Specimen

Before Test :



After Test :

Remarks :

Analysed by : Ali Elhaddad **Date :** February 8, 2021

Verified by : E. Bennett **Date :** February 17, 2021

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project : Proposed Parking Structure
Children's Hospital of Eastern Ontario Campus
401 Smyth Road, Ottawa, Ontario

Project N° : 11205379-80

Sample N° : MW3-21 RC2

Depth : 6.4-6.55m

Sampling Date : January 14-15 / 2021

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	63	63	63	63.0	(mm)
Length :	74	74	74	74.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.2	0.2	0.2	0.2	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.1	0.1	0.1	0.15	(°)

Mass : 612 (g) Volume: 230676 (mm^3)

Density : 2653 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.6 (MPa/sec)

Type of Fracture : 3

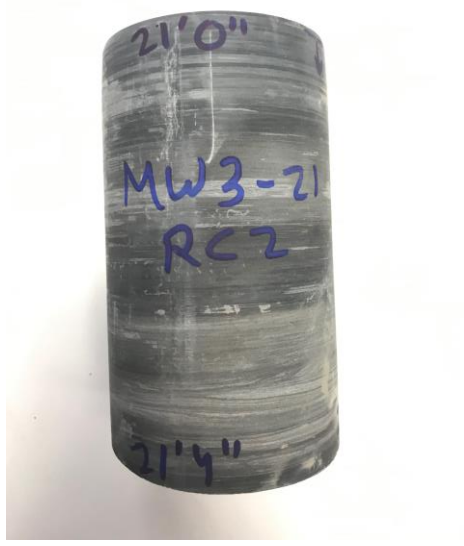
Test Duration (2-15 Minutes) : 4 (minutes)

Maximum Applied Load : 335.49 ☑ kN ☐ lbs

Compressive Strength : 107.6 (MPa)

View of Specimen

Before Test :



After Test :

Remarks :

Analysed by : Ali Elhaddad **Date :** February 8, 2021

Verified by : E. Bennett **Date :** February 17, 2021

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project N° : 11205379-80

Project : Proposed Parking Structure
Children's Hospital of Eastern Ontario Campus
401 Smyth Road, Ottawa, Ontario

Sample N° : MW3-21 RC3

Depth : 7.92-8.07m

Sampling Date : January 14-15 / 2021

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	63	63	63	63.0	(mm)
Length :	78	78	78	78.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.3	0.2	0.3	0.3	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.1	0.15	0.1	0.15	(°)

Mass : 656.6 (g) Volume: 243145 (mm^3)

Density : 2700 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.6 (MPa/sec)

Type of Fracture : 3

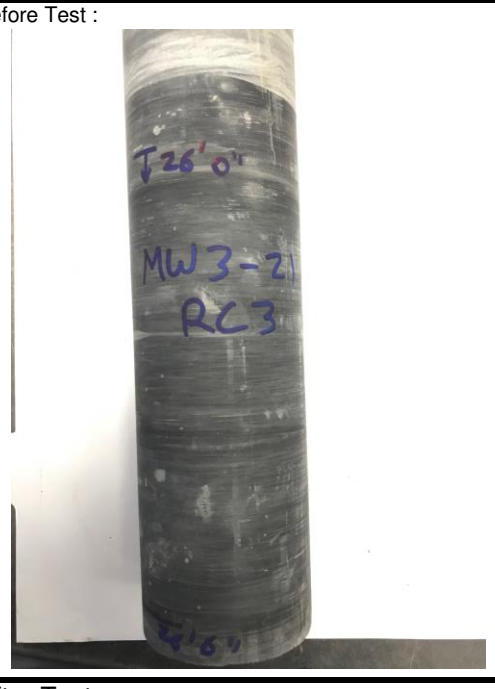
Test Duration (2-15 Minutes) : 3.5 (minutes)

Maximum Applied Load : 260.09 ☑ kN ☐ lbs

Compressive Strength : 83.4 (MPa)

View of Specimen

Before Test :



After Test :

Remarks :

Analysed by : Ali Elhaddad **Date :** February 8, 2021

Verified by : E. Bennett **Date :** February 17, 2021

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project : Proposed Parking Structure
Children's Hospital of Eastern Ontario Campus
401 Smyth Road, Ottawa, Ontario

Project N° : 11205379-80

Sample N° : MW3-21 RC5

Depth : 9.63-9.75m

Sampling Date : January 14-15 / 2021

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	63	63	63	63.0	(mm)
Length :	91	91	91	91.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.2	0.3	0.3	0.3	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.15	0.15	0.15	(°)

Mass : 736.3 (g) Volume: 283669 (mm^3)

Density : 2596 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.6 (MPa/sec)

Type of Fracture : 3

Test Duration (2-15 Minutes) : 4 (minutes)

Maximum Applied Load : 251.57 ☑ kN ☐ lbs

Compressive Strength : 80.7 (MPa)

View of Specimen

Before Test :

After Test :

Remarks :

Analysed by : Ali Elhaddad **Date :** February 8, 2021

Verified by : E. Bennett **Date :** February 17, 2021

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project N° : 11205379-80

Project : Proposed Parking Structure
Children's Hospital of Eastern Ontario Campus
401 Smyth Road, Ottawa, Ontario

Sample N° : MW6-21 RC2

Depth : 4.75-4.88m

Sampling Date : January 14-15 / 2021

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	63	63	63	63.0	(mm)
Length :	86	86	86	86.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.3	0.3	0.3	0.3	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.15	0.15	0.15	(°)

Mass : 702.4 (g) Volume: 268083 (mm^3)

Density : 2620 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.6 (MPa/sec)

Type of Fracture : 3

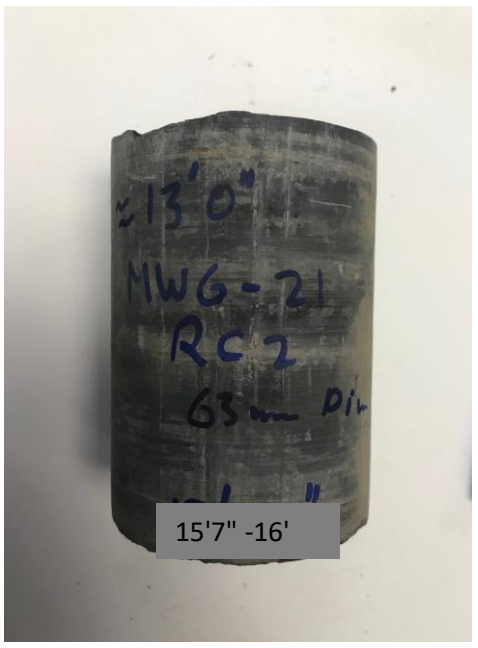
Test Duration (2-15 Minutes) : 4 (minutes)

Maximum Applied Load : 294.5 ☑ kN ☐ lbs

Compressive Strength : 94.5 (MPa)

View of Specimen

Before Test :



After Test :

Remarks :

Analysed by : Ali Elhaddad **Date :** February 8, 2021

Verified by : E. Bennett **Date :** February 17, 2021

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project N° : 11205379-80

Project : Proposed Parking Structure
Children's Hospital of Eastern Ontario Campus
401 Smyth Road, Ottawa, Ontario

Sample N° : MW6-21 RC4

Depth : 6.65-6.81m

Sampling Date : January 14-15 / 2021

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	63	63	63	63.0	(mm)
Length :	82	82	82	82.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.3	0.3	0.3	0.3	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.15	0.15	0.15	(°)

Mass : 676.1 (g) Volume: 255614 (mm^3)

Density : 2645 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.6 (MPa/sec)

Type of Fracture : 3

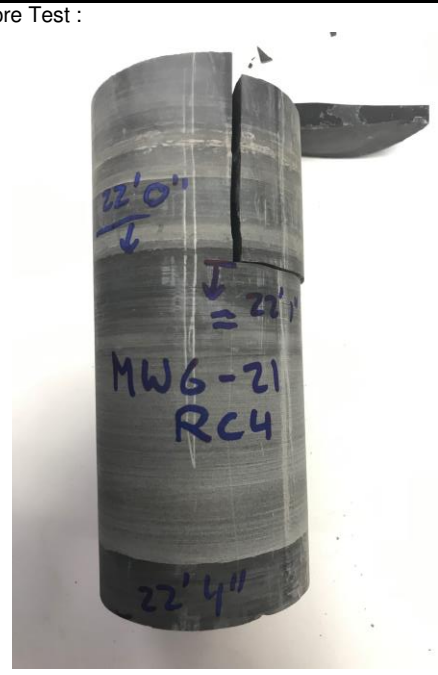
Test Duration (2-15 Minutes) : 4 (minutes)

Maximum Applied Load : 311.75 ☑ kN ☐ lbs

Compressive Strength : 100.0 (MPa)

View of Specimen

Before Test :



After Test :

Remarks :

Analysed by : Ali Elhaddad **Date :** February 8, 2021

Verified by : E. Bennett **Date :** February 17, 2021

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project N° : 11205379-80

Project : Proposed Parking Structure
Children's Hospital of Eastern Ontario Campus
401 Smyth Road, Ottawa, Ontario

Sample N° : MW6-21 RC5

Depth : 7.98-8.10m

Sampling Date : January 14-15 / 2021

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	63	63	63	63.0	(mm)
Length :	93	93	93	93.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.3	0.3	0.3	0.3	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.15	0.15	0.15	(°)

Mass : 776.4 (g) Volume: 289904 (mm^3)

Density : 2678 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.6 (MPa/sec)

Type of Fracture : 4

Test Duration (2-15 Minutes) : 5 (minutes)

Maximum Applied Load : 318.7 ☑ kN ☐ lbs

Compressive Strength : 102.2 (MPa)

View of Specimen

Before Test :

After Test :

Remarks :

Analysed by : Ali Elhaddad **Date :** February 8, 2021

Verified by : E. Bennett **Date :** February 17, 2021

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project : Children's Hospital

Project N° : 11205379

Sample N° : MW9-22 r.1

Depth : 3,20 - 3,31 m

Sampling Date :

Testing Apparatus Used :

Loading device N° 9130

Caliper N° 1

Technical Data

				Average	
Diameter :	63.09	63.09	63.21	**63.13**	(mm)
Length :	109.59	108.25	109.84	**109.23**	(mm)
Straightness (0.5mm maximum) (S1) :	0.4	0.4	0.4	**0.4**	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	**Ok**	(µm)
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.20	0.20	**0.18**	(°)

Mass : 913.8 (g) Volume: 341893 (mm^3)

Density : 2673 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.58 (MPa/sec)

Type of Fracture : Multiple Fracture

Test Duration (2-15 Minutes) : 123 (seconds)

Maximum Applied Load : 222.24 (kN)

Compressive Strength : 71.0 (MPa)

View of Specimen

Before Test :

After Test :

Remarks :

Analysed by : J. Lalonde **Date :** 8/18/2022

Verified by : **Date :** 8/25/2022

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project : Children's Hospital

Project N° : 11205379

Sample N° : MW9-22 r.2

Depth : 4,04 - 4,14 m

Sampling Date :

Testing Apparatus Used :

Loading device N° 9130

Caliper N° 1

Technical Data

				Average	
Diameter :	63.18	63.20	63.00	**63.13**	(mm)
Length :	96.49	95.36	95.29	**95.71**	(mm)
Straightness (0.5mm maximum) (S1) :	0.1	0.1	0.2	**0.1**	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	**Ok**	(µm)
Parallelism (0.25 ° maximum) (FP2) :	0.05	0.10	0.10	**0.08**	(°)

Mass : 798.9 (g) Volume: 299563 (mm^3)

Density : 2667 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.48 (MPa/sec)

Type of Fracture : Multiple Fracture

Test Duration (2-15 Minutes) : 118 (seconds)

Maximum Applied Load : 175.67 (kN)

Compressive Strength : 56.1 (MPa)

View of Specimen

Before Test :

After Test :

Remarks :

Analysed by : J. Lalonde **Date :** 8/18/2022

Verified by : **Date :** 8/25/2022

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project : Children's Hospital

Project N° : 11205379

Sample N° : BH13-22 r.3

Depth : 3,61 - 3,71 m

Sampling Date :

Testing Apparatus Used :

Loading device N° _9130____

Caliper N° _1_____

Technical Data

				Average	
Diameter :	63.00	63.09	63.15	**63.08**	(mm)
Length :	100.38	100.26	100.38	**100.34**	(mm)
Straightness (0.5mm maximum) (S1) :	0.2	0.3	0.2	**0.2**	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	**Ok**	(µm)
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.15	0.15	**0.15**	(°)

Mass : 831.5 (g) Volume: 313579 (mm^3)

Density : 2652 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.33 (MPa/sec)

Type of Fracture : Multiple Fracture

Test Duration (2-15 Minutes) : 108 (seconds)

Maximum Applied Load : 112.31 (kN)

Compressive Strength : 35.9 (MPa)

View of Specimen

Before Test :

After Test :

Remarks :

Analysed by : J. Lalonde **Date :** 8/18/2022

Verified by : **Date :** 8/25/2022

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Infrastructure Ontario

Project : Children's Hospital

Project N° : 11205379

Sample N° : MW23-22 r.2

Depth : 6,93 - 7,03 m

Sampling Date :

Testing Apparatus Used :

Loading device N° _9130____

Caliper N° _1_____

Technical Data

				Average	
Diameter :	63.11	63.04	63.06	**63.07**	(mm)
Length :	100.32	100.27	100.42	**100.34**	(mm)
Straightness (0.5mm maximum) (S1) :	0.2	0.1	0.2	**0.2**	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	**Ok**	(µm)
Parallelism (0.25 ° maximum) (FP2) :	0.10	0.15	0.15	**0.13**	(°)

Mass : 845.1 (g) Volume: 313469 (mm^3)

Density : 2696 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.39 (MPa/sec)

Type of Fracture : Multiple Fracture

Test Duration (2-15 Minutes) : 121 (seconds)

Maximum Applied Load : 146.16 (kN)

Compressive Strength : 46.8 (MPa)

View of Specimen

Before Test :

After Test :

Remarks :

Analysed by : J. Lalonde **Date :** 8/18/2022

Verified by : **Date :** 8/25/2022

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **GHD LIMITED**
455 Phillip St
WATERLOO, ON N2V1C2
(519) 884-0510
ATTENTION TO: **Jennifer Balkwill**
PROJECT: **11205379-RPT8**
AGAT WORK ORDER: **21Z712939**
SOIL ANALYSIS REVIEWED BY: **Nivine Basily, Inorganics Report Writer**
DATE REPORTED: **Mar 01, 2021**
PAGES (INCLUDING COVER): **5**
VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes
VERSION 1:Excluding Sulphide in Soil analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 21Z712939

PROJECT: 11205379-RPT8

CLIENT NAME: GHD LIMITED

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2021-02-19 **DATE REPORTED: 2021-03-01**

						SAMPLE DESCRIPTION:	11205379-BH4-21-SS2-0.7-1.0m		11205379-MW6-21-SS2-0.7-1.0m	11205379-BH7-21-SS2-0.7-1.0m		11205379-MW8-21-SS2-1.1-1.3m
						SAMPLE TYPE:	Soil		Soil	Soil		Soil
						DATE SAMPLED:	2021-01-18		2021-01-13	2021-01-19		2021-01-18
Parameter	**Unit**	**G / S**	**RDL**	**Date Prepared**	**Date Analyzed**		**2122180**	**RDL**	**2122181**	**2122182**	**RDL**	**2122183**
Chloride (2:1)	µg/g		4	2021-02-24	2021-02-24		440	2	253	69	4	562
Sulphate (2:1)	µg/g		4	2021-02-24	2021-02-24		439	2	395	6	4	195
pH (2:1)	pH Units		NA	2021-02-24	2021-02-24		6.35	NA	7.4	7.23	NA	7.95
Electrical Conductivity (2:1)	mS/cm		0.005	2021-02-24	2021-02-24		1.21	0.005	0.936	0.163	0.005	1.40
Resistivity (2:1) (Calculated)	ohm.cm		1	2021-02-24	2021-02-24		826	1	1070	6130	1	714
Redox Potential 1	mV		NA	2021-02-23	2021-02-23		428	NA	389	429	NA	377
Redox Potential 2	mV		NA	2021-02-23	2021-02-23		446	NA	394	416	NA	379
Redox Potential 3	mV		NA	2021-02-23	2021-02-23		432	NA	397	414	NA	377

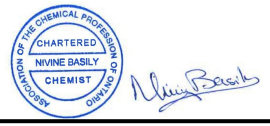
Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

2122180-2122183 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.
Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.
Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Dilution required, RDL has been increased accordingly.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



AGAT Laboratories

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http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 21Z712939

PROJECT: 11205379-RPT8

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Mar 01, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	2129123		42	42	0.0%	< 2	93%	70%	130%	102%	80%	120%	104%	70%	130%
Sulphate (2:1)	2129123		3	3	NA	< 2	100%	70%	130%	107%	80%	120%	106%	70%	130%
pH (2:1)	2122180	2122180	6.35	6.38	0.5%	NA	100%	90%	110%						
Electrical Conductivity (2:1)	2122180	2122180	1.21	1.40	14.6%	< 0.005	105%	80%	120%						
Redox Potential 1	1						100%	90%	110%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
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TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 21Z712939

PROJECT: 11205379-RPT8

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	modified from MSA PART 3, CH 14 and SM 2510 B	EC METER
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	modified G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	modified G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	modified G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE

ILG BIK

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 21Z712939

Cooler Quantity: One bag-noice

Arrival Temperatures: 18.6 | 18.6 | 18.5
(Tule pack) 4.0 | 4.6 | 4.8

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: GHD Limited
Contact: Jennifer Balkwill
Address: 455 Phillip St Unit 100A, Waterloo, ON, N2L 3X2
Phone: 519-340-4286 Fax:
Reports to be sent to:
1. Email: jennifer.balkwill@ghd.com
2. Email:

Regulatory Requirements: (Please check all applicable boxes)

☐ Regulation 153/04 — Table (Indicate One): ☐Ind/Com ☐Res/Park ☐Agriculture; Soil Texture (Check One): ☐Coarse ☐Fine

☐ Excess Soils R406 — Table (Indicate One)

☐ Regulation 558

☐ CCME

☐ Sewer Use: ☐Sanitary ☐Storm — Region

☐ Prov. Water Quality Objectives (PWQO)

☐ Other — Indicate One

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT (Most Analyses) ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 11205379-RPT8
Site Location:
Sampled By:
AGAT ID #: PO: 73522893

Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information: Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

Code	Matrix
B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Analysis columns: Field Filtered - Metals, Hg, CrVI, DOC (Y/N); O. Reg 153: Metals & Inorganics; Metals - ☐ CrVI, ☐ Hg, ☐ HWSB; BTEX, F1-F4 PHCs, Analyze F4G if required ☐ Yes ☐ No; PAHs; Total PCBs ☐ Aroclor; VOC; O. Reg 558: Landfill Disposal Characterization TCLP: TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs; O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs; Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4; Salt - EC/SAR; Corrosivity; Potentially Hazardous or High Concentration (Y/N)

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Corrosivity
		AM PM				
11205379- BH4-21 – SS2 - 0.7-1.0m	2021-01-18	AM PM	1	Soil	Corrosivity	☑
		AM PM				
11205379- MW6-21 – SS2 - 0.7-1.0m	2021-01-13	AM PM	1	Soil	Corrosivity	☑
11205379- BH7-21 – SS2 - 0.7-1.0m	2021-01-19	AM PM	1	Soil	Corrosivity	☑
11205379- MW8-21 – SS2 - 1.1-1.3m	2021-01-18	AM PM	1	Soil	Corrosivity	☑
		AM PM				
		AM PM				
		AM PM				
		AM PM				
		AM PM				

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
			Bernthelette (signature)	21/2/19	8h00
(signature)	21/2/19	10h00	Emma Rao (signature)	Feb 20/21	11:24am

Page ____ of ____

Nº:

Document ID: DIV-78-1511.018

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: August 24, 2020

CERTIFICATE OF ANALYSIS

Work Order	: **WT2214174**	Page	: 1 of 5
Client	: **GHD Limited**	Laboratory	: Waterloo - Environmental
Contact	: Rick Hawthorne	Account Manager	: Rick Hawthorne
Address	: 455 Phillip Street Waterloo ON Canada N2L 3X2	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 11205379-100	Date Samples Received	: 14-Sep-2022 10:30
PO	: 735-004287	Date Analysis Commenced	: 15-Sep-2022
C-O-C number	: ----	Issue Date	: 16-Sep-2022 16:35
Sampler	: CLIENT		
Site	: ----		
Quote number	: 11205379-100-SSOW 735-004287		
No. of samples received	: 8		
No. of samples analysed	: 8		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Greg Pokocky	Supervisor - Inorganic	Inorganics, Waterloo, Ontario
Joseph Scharbach		Centralized Prep, Waterloo, Ontario
Walt Kippenhuck	Team Leader - Inorganics	Inorganics, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.
Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
µS/cm	Microsiemens per centimetre
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetre (resistivity)
pH units	pH units

>: greater than.
<: less than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
FR5	*As per applicable reference method(s), soil:water ratio for Fixed Ratio Leach was modified to 1:5 due to high soil organic content*

Analytical Results

WT2214174-001

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- BH16-SS2
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	2650 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	10.4	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	436	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	8.26	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	380	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	1300	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	498	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

WT2214174-002

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- BH20-SS2
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	422 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	10.1	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	419	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	7.78	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	2370	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	19.6	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	173	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

WT2214174-003

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- MW17-SS1
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	231 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	<0.25	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	419	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	8.26	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	4330	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	8.6	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	54	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

WT2214174-004

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- MW18-SS3
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	1310 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	8.45	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	398	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	8.16	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	760	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	734	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	215	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

WT2214174-005

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- BH11-22-SS2
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	2540 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	6.72	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	393	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	7.28	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	390	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	1420	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	219	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

WT2214174-006

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- BH16-22-SS2
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	430 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	6.03	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	354	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	7.85	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	2320	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	83.2	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	116	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

WT2214174-007

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- BH17-22-SS2
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	622 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	7.97	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	350	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	7.47	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	1610	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	609	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	94	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

WT2214174-008

Sub-Matrix:**Soil**
(Matrix: **Soil/Solid)**

Client sample ID: 11205379- MW09-22
Client sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis Date	QCLot
Physical Tests								
conductivity (1:2 leachate)	----	5560 FR5,	10.0	µS/cm	E100-L	16-Sep-2022	16-Sep-2022	648051
moisture	----	6.16	0.25	%	E144	-	15-Sep-2022	648057
oxidation-reduction potential [ORP]	----	371	0.10	mV	E125	15-Sep-2022	15-Sep-2022	648056
pH (1:2 soil:CaCl2-aq)	----	6.81	0.10	pH units	E108A	15-Sep-2022	15-Sep-2022	648054
resistivity	----	180	100	ohm cm	EC100R	-	16-Sep-2022	-
Leachable Anions & Nutrients								
chloride, soluble ion content	16887-00-6	611	5.0	mg/kg	E236.Cl	16-Sep-2022	16-Sep-2022	648053
sulfate, soluble ion content	14808-79-8	6500	20	mg/kg	E236.SO4	16-Sep-2022	16-Sep-2022	648052

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2214174**	Page	: 1 of 11
Client	: **GHD Limited**	Laboratory	: Waterloo - Environmental
Contact	: Rick Hawthorne	Account Manager	: Rick Hawthorne
Address	: 455 Phillip Street Waterloo ON Canada N2L 3X2	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 11205379-100	Date Samples Received	: 14-Sep-2022 10:30
PO	: 735-004287	Issue Date	: 16-Sep-2022 16:35
C-O-C number	: ----		
Sampler	: CLIENT		
Site	: ----		
Quote number	: 11205379-100-SSOW 735-004287		
No. of samples received	: 8		
No. of samples analysed	: 8		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- BH11-22-SS2	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- BH16-22-SS2	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- BH16-SS2	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- BH17-22-SS2	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- BH20-SS2	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- MW09-22	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- MW17-SS1	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap										
11205379- MW18-SS3	E236.Cl	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- BH11-22-SS2	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- BH16-22-SS2	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- BH16-SS2	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- BH17-22-SS2	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- BH20-SS2	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- MW09-22	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- MW17-SS1	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap										
11205379- MW18-SS3	E236.SO4	14-Sep-2022	16-Sep-2022	30 days	3 days	✓	16-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- BH11-22-SS2	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- BH16-22-SS2	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- BH16-SS2	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- BH17-22-SS2	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- BH20-SS2	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- MW09-22	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- MW17-SS1	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap										
11205379- MW18-SS3	E100-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	30 days	2 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- BH11-22-SS2	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- BH16-22-SS2	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- BH16-SS2	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- BH17-22-SS2	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- BH20-SS2	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- MW09-22	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- MW17-SS1	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
11205379- MW18-SS3	E144	14-Sep-2022	----	----	----		15-Sep-2022	----	----	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- BH11-22-SS2	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- BH16-22-SS2	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- BH16-SS2	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- BH17-22-SS2	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- BH20-SS2	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- MW09-22	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- MW17-SS1	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap										
11205379- MW18-SS3	E125	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	180 days	1 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- BH11-22-SS2	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- BH16-22-SS2	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- BH16-SS2	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- BH17-22-SS2	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- BH20-SS2	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- MW09-22	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- MW17-SS1	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap										
11205379- MW18-SS3	E108A	14-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	30 days	1 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	648051	1	8	12.5	5.0	✓
Moisture Content by Gravimetry	E144	648057	1	8	12.5	5.0	✓
ORP by Electrode	E125	648056	1	8	12.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	648054	1	8	12.5	5.0	✓
Water Extractable Chloride by IC	E236.Cl	648053	1	8	12.5	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	648052	1	8	12.5	5.0	✓
Laboratory Control Samples (LCS)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	648051	2	8	25.0	10.0	✓
Moisture Content by Gravimetry	E144	648057	1	8	12.5	5.0	✓
ORP by Electrode	E125	648056	1	8	12.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	648054	1	8	12.5	5.0	✓
Water Extractable Chloride by IC	E236.Cl	648053	2	8	25.0	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	648052	2	8	25.0	10.0	✓
Method Blanks (MB)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	648051	1	8	12.5	5.0	✓
Moisture Content by Gravimetry	E144	648057	1	8	12.5	5.0	✓
Water Extractable Chloride by IC	E236.Cl	648053	1	8	12.5	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	648052	1	8	12.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L Waterloo - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A Waterloo - Environmental	Soil/Solid	MOEE E3137A	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode.
ORP by Electrode	E125 Waterloo - Environmental	Soil/Solid	APHA 2580 (mod)	Oxidation Redution Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 Waterloo - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl Waterloo - Environmental	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO4 Waterloo - Environmental	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Resistivity Calculation for Soil Using E100-L	EC100R Waterloo - Environmental	Soil/Solid	APHA 2510 B	Soil Resistivity (calculated) is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Waterloo - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A Waterloo - Environmental	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 Waterloo - Environmental	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 Waterloo - Environmental	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.
Distillation for Acid Volatile Sulfide in Soil	EP396-L Waterloo - Environmental	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.

QUALITY CONTROL REPORT

Work Order	: **WT2214174**	Page	: 1 of 4
Client	: GHD Limited	Laboratory	: Waterloo - Environmental
Contact	: Rick Hawthorne	Account Manager	: Rick Hawthorne
Address	: 455 Phillip Street Waterloo ON Canada N2L 3X2	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 11205379-100	Date Samples Received	: 14-Sep-2022 10:30
PO	: 735-004287	Date Analysis Commenced	: 15-Sep-2022
C-O-C number	: ----	Issue Date	: 16-Sep-2022 16:35
Sampler	: CLIENT		
Site	: ----		
Quote number	: 11205379-100-SSOW 735-004287		
No. of samples received	: 8		
No. of samples analysed	: 8		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Greg Pokocky	Supervisor - Inorganic	Waterloo Inorganics, Waterloo, Ontario
Joseph Scharbach		Waterloo Centralized Prep, Waterloo, Ontario
Walt Kippenhuck	Team Leader - Inorganics	Waterloo Inorganics, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 648051)											
WT2214174-006	11205379- BH16-22-SS2	conductivity (1:2 leachate)	----	E100-L	10.0	µS/cm	430	438	1.84%	20%	----
Physical Tests (QC Lot: 648054)											
WT2214174-008	11205379- MW09-22	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	6.81	6.82	0.147%	5%	----
Physical Tests (QC Lot: 648056)											
WT2214174-007	11205379- BH17-22-SS2	oxidation-reduction potential [ORP]	----	E125	0.10	mV	350	430	20.5%	25%	----
Physical Tests (QC Lot: 648057)											
WT2214174-008	11205379- MW09-22	moisture	----	E144	0.25	%	6.16	6.68	8.05%	20%	----
Leachable Anions & Nutrients (QC Lot: 648052)											
WT2214174-006	11205379- BH16-22-SS2	sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	116	118	1	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 648053)											
WT2214174-006	11205379- BH16-22-SS2	chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	83.2	83.3	0.136%	30%	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 648051)						
conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 648057)						
moisture	----	E144	0.25	%	<0.25	----
Leachable Anions & Nutrients (QCLot: 648052)						
sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 648053)						
chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 648051)									
conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1409 µS/cm	98.8	90.0	110	----
Physical Tests (QCLot: 648054)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 648057)									
moisture	----	E144	0.25	%	50 %	101	90.0	110	----
Leachable Anions & Nutrients (QCLot: 648052)									
sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	5000 mg/kg	100	70.0	130	----
Leachable Anions & Nutrients (QCLot: 648053)									
chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	5000 mg/kg	101	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 648051)									
	RM	conductivity (1:2 leachate)	----	E100-L	3239 µS/cm	100	70.0	130	----
Physical Tests (QCLot: 648056)									
	RM	oxidation-reduction potential [ORP]	----	E125	475 mV	102	80.0	120	----
Leachable Anions & Nutrients (QCLot: 648052)									
	RM	sulfate, soluble ion content	14808-79-8	E236.SO4	217 mg/kg	98.5	60.0	140	----
Leachable Anions & Nutrients (QCLot: 648053)									
	RM	chloride, soluble ion content	16887-00-6	E236.Cl	673 mg/kg	94.1	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

COC Number: 22 -

Page of

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Environmental Division
Waterloo
Work Order Reference
WT2214174

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report	Reports / Recipients	Turnaround Time (TAT) Requeste
Company:	GHD Limited	Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)	☐ Routine [R] if received by 3pm M-F - no surcharges ap
Contact:	Jennifer Balkwill	Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A	☐ 4 day [P4] if received by 3pm M-F - 20% rush surchar
Phone:	519-340-4286	☐ Compare Results to Criteria on Report - provide details below if box checked	☐ 3 day [P3] if received by 3pm M-F - 25% rush surchan
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	☑ 2 day [P2] if received by 3pm M-F - 50% rush surcharg
Street:	455 Phillip Street, Unit 100A	Email 1 or Fax jennifer.balkwill@ghd.com	☐ 1 day [E] if received by 3pm M-F - 100% rush surcharg
City/Province:	Waterloo, Ontario	Email 2	☐ Same day [E2] if received by 10am M-S - 200% rush su
Postal Code:	N2L 3X2	Email 3	Additional fees may apply to rush requests on w
Invoice To	Same as Report To ☑ YES ☐ NO	Invoice Recipients	Date and Time Required for all E&P TATs:
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX	For all tests with rush TATs requested, ple
Company:		Email 1 or Fax	Analysis
Contact:		Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	11205379-100	Major/Minor Code:	Routing Code:
PO / AFE:	735-003472-1	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (ALS use only):	JD	ALS Contact:	Sampler:

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINER	Indicate Filtered (F), Preserved (P) or Filtere ...se (F/P) below	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes
						Corrosivity			
	11205379 - BH10-SS2					X			
	11205379 - BH20-SS2								
	11205379 - MW17-SS1								
	11205379 - MW18-SS3								
	11205379 - BH11-22-SS2								
	11205379 - BH16-22-SS2								
	11205379 - BH17-22-SS2								
	11205379 - MW09-22								

Drinking Water (DW) Samples[1] (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☑ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				20.4			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by:	Date: 2022-09-13	Time:	Received by:	Date:	Time:	Received by:	Date: 14-Sep-22	Time: 10:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

FEB 2022 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.