





Geotechnical Design Report CHEO Integrated Treatment Centre - 1Door4care

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STATEMENT OF LIMITATIONS AND CONDITIONS

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APPENDICES

APPENDIX A

Borehole Location Plan (from GHD Report) Estimated Bedrock Contours Record of Boreholes and Laboratory Test Results



1. INTRODUCTION

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

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 of the scope of this report.

This report has been issued based on a review of the geotechnical investigations conducted by Infrastructure Ontario's Consultant (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 for use of the information.

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

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.

2. BACKGROUND

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 (1Door4Care)" dated October 25, 2022.

The scope of geotechnical investigation included advancing a total of 13 boreholes and 11 monitoring wells, conducting Multi-channel Analysis of Surface Waves (MASW), and geophysical survey using Ground Penetration Radar (GPR).



3. UNDERSTANDING OF SUBSURFACE CONDITIONS

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

A plan showing the location of the footprint 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 A. Furthermore, Appendix A also contains contour maps describing the bedrock surface elevation and the elevation of competent bedrock, and the record of borehole sheets along with the laboratory test results.

In general, the subsurface conditions at the site consisted of topsoil/asphalt generally over non-cohesive fill (predominantly silty sand to silty sand and gravel) which is in turn underlain by non-cohesive native soil (predominantly compact to dense silty sand with gravel, possible glacial till, over shale bedrock. The thickness of the fill at the site varied between 0.4 m and 3.2 m. Where the boreholes extended to the bedrock, the silty sand till extended to depths ranging from 1.4 m to 3.8 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:

Borehole Identification Number	Estimated Depth/Elevation of Bedrock Surface (mbgs/m)	Estimated Elevation of Competent Bedrock Surface (m)	Comment
MW1	3.8 / 78.7	Below 77.1	Outside building area
MW2	3.8 / 78.6	78.3	Outside building area
MW3	3.1 / 78.6	77.5	
MW4	1.5 / 78.8	77.7	
MW5	1.7 / 78.8	Below 77.4	Outside building area
BH6	0.9 / 79.2	Below 77.6	Outside building area
BH7	1.5 / 78.9	Below 78.0	

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)	Comment
BH8	1.5 / 79.3	Below 77.7	
MW9	2.0 / 78.5	76.7	
MW10	2.3 / 77.6	76.1	Outside building area
BH11	1.5 / 79.8	78.8	Outside building area
BH12	2.3 / 79.0	77.5	
BH13	1.1/ 80.3	79.0	Outside building area
BH14	1.0 / 80.1	78.9	Outside building area
MW14	1.6 / 79.6	79.1	
BH16	1.2 / 79.8	79.4	
MW17	1.3 / 79.6	79.1	
BH20	2.2 / 79.0	78.6	
BH21	2.6 / 78.4	78.4	
MW23	3.5 / 79.4	77.9	Proposed tunnel to existing CHEO

* Estimated Elevation due to Auger Refusal

** mbgs: metre below ground surface

The groundwater level measurements in the wells are summarized below:

Borehole	Ground Surface Elev. (m)	Date	Depth to Water (m)	Groundwater Elev. (m)	Main Screened Deposit	Comment
		05-Dec-19	5.0	77.5		
	82.5	13-Dec-19	5.1	77.4	Weathered Shale	-
MW1		15-Jan-20	5.1	77.4		
		26-Feb-20	5.1	77.4		
		08-Apr-20	5.0	77.5		
		09-Jul-20	5.2*	77.3		
		05-Oct-20	5.2*	77.3		
		05-Dec-19	-	-		
MW2	82.4	13-Dec-19	4.6	77.8	vveathered	Shallow Well
		15-Jan-20	4.6	77.8	Shale	

Table 3.2: Groundwater Level Readings at the Site



Borehole	Ground Surface	Date	Depth to Water (m)	Groundwater	Main Screened	Comment
	Elev. (m)		mator (iii)	2.017 ()	Deposit	
		26-Feb-20	4.6	77.8		
		08-Apr-20	4.4	78.1		
		09-Jul-20	4.6	77.8		
		05-Oct-20	4.6	77.8		
		05-Dec-19	5.0	77.5		
		13-Dec-19	5.0	77.4		
		15-Jan-20	5.0	77.4		
		26-Feb-20	5.0	77.5	Shale	Deeper Well
		08-Apr-20	4.9	77.6		
		09-Jul-20	5.0	77.4		
		05-Oct-20	5.0	77.4		
		05-Dec-19	3.8	77.8		
		13-Dec-19	3.8	77.8	Native Soil	
	81.6	15-Jan-20	3.8	77.8		
		26-Feb-20	3.9	77.7		Shallow Well
		08-Apr-20	3.7	77.9		
		09-Jul-20	3.9	77.7		
MW3		05-Oct-20	3.9	77.7		
		05-Dec-19	4.3	77.3		
		13-Dec-19	4.4	77.2		
		15-Jan-20	4.5	77.1		
		26-Feb-20	4.4	77.2	Shale	Deeper Well
		08-Apr-20	4.2	77.4		
		09-Jul-20	4.5	77.1		
		05-Oct-20	4.5	77.1		
		05-Dec-19	-	-		
		13-Dec-19	1.5	78.8		
		15-Jan-20	-	-		Shallow
		26-Feb-20	-	-	Native Soil	Borehole
		08-Apr-20	1.6	78.8		
MW4		09-Jul-20	-	-		
	80.3	05-Oct-20	1.6	78.8		
	00.0	05-Dec-19	3.1	77.3		
		13-Dec-19	3.1	77.2		
		15-Jan-20	-	-		
		26-Feb-20	-	-	Shale	Deep Well
		08-Apr-20	2.9	77.4		
		09-Jul-20	3.2	77.2		
		05-Oct-20	3.2	77.2		



Borehole	Ground Surface	Date	Depth to	Groundwater	Main Screened	Comment
	Elev. (m)		Water (m)	Elev. (m)	Deposit	
		05-Dec-19	-	-		
		13-Dec-19	2.4	78.1		
		15-Jan-20	2.0	78.6	\A/a ath ava d	
MW5	80.5	26-Feb-20	2.5	78.0	Shale	-
		08-Apr-20	2.1	78.4	Onaic	
		09-Jul-20	2.4	78.2		
		05-Oct-20	2.4	78.2		
		05-Dec-19	-	-		
		13-Dec-19	-	-		
		15-Jan-20	-	-	Weathered	
MW9	80.5	26-Feb-20	-	-	Shale	-
		08-Apr-20	2.0	78.5	onalo	
		09-Jul-20	-	-		
		05-Oct-20	2.0	78.5		
		05-Dec-19	2.5	77.4		
	79.9	13-Dec-19	2.5	77.4		
		15-Jan-20	-	-	Weathered	
MW10		26-Feb-20	-	-	Shale	-
		08-Apr-20	2.3	77.5	endre	
		09-Jul-20	2.8	77.1		
		05-Oct-20	2.7	77.1		
		05-Jul-22	1.5	79.7		
		13-Jul-22	-	-		
		21-Jul-22	-	-		
		22-Jul-22	1.6	79.6	Native Soil	Shallow Well
		25-Jul-22	-	-		
		27-Jul-22	-	-		
		28-Jul-22	1.7*	79.6		
MW14	81.2	03-Aug-22	-	-		
	01.2	05-Jul-22	2.9	78.3		
		13-Jul-22	-	-		
		21-Jul-22	2.9	78.3		
		22-Jul-22	-	-	Shale	Deeper Well
		25-Jul-22	-	-	Sildle	Deebei Mell
		27-Jul-22	2.9	78.3		
		28-Jul-22	-	-		
		03-Aug-22	-	-		
MW17	80 0	05-Jul-22	-	-	Native Soil	_
	00.9	13-Jul-22	-	-		-



Borehole	Ground Surface Elev. (m)	Date	Depth to Water (m)	Groundwater Elev. (m)	Main Screened Deposit	Comment
		21-Jul-22	-	-		
		22-Jul-22	1.6*	79.3		
		25-Jul-22	-	-		
		27-Jul-22	-	-		
		28-Jul-22	1.6*	79.3		
		03-Aug-22	-	-		
		05-Jul-22		-		
		13-Jul-22	-	-		
	81.0	21-Jul-22	-	-		
M\\/18		22-Jul-22	1.5	79.5	Notivo Soil	
1010010		25-Jul-22	-	-	Nalive Soli	-
		27-Jul-22	-	-		
		28-Jul-22	-	-		
		03-Aug-22	-	-		
		05-Jul-22	-	-		
		13-Jul-22	5.2	77.7		
		21-Jul-22	-	-		
M\\//23	82.0	22-Jul-22	-	-	Shala	
1010 20	02.9	25-Jul-22	5.3	77.6	Silale	-
		27-Jul-22	-	-		
		28-Jul-22	-	-		
		03-Aug-22	5.2	77.7		

*Reading showed water at/near the bottom of the monitoring well screen, probable false reading

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 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.

It is understood that the proposed structure includes a 7-storey building (L1 to L6 and a Penthouse). Based on the elevation of the boreholes advanced at the site, the ground surface elevation varies between Elev. 79.7 m and 82.9 m (predominantly around Elev. 81 m). Based on correspondence with the designers it is understood that the final grades of the lowest level of the proposed structure will be at about Elev. 80.1 m.

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) 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. Background documents indicate that long term heave due to this mechanism has occurred at some locations on the CHEO property in the past.

4.1 Protection of Expansive Shale Upon Exposure

The shale bedrock at this site has the potential to swell following exposure to oxygen. The general mechanism is considered to be that pyrite (FeS_2) 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/swelling.



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 mm thick.

Construction planning should ensure the shale is not left exposed and uncovered overnight. Where shale is exposed at the base or on the sides of the excavation, the mud slab (with sulphate resistant cement) or shotcrete with a thickness of at least 100 mm should be placed such that the concrete covers the shale.

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

4.2 Site Preparation

The existing fill and loose native soils found at the site are not suitable for the support of foundations, floor slabs, engineered fill and/or controlled fill. These unsuitable in-situ materials, 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.

Following stripping of these unsuitable surficial soils, the prepared subgrade should be confirmed by proof-rolling, inspection and/or field density test measurement under the direct supervision of the geotechnical engineer. The thickness of unsuitable materials may vary between and beyond borehole locations. Therefore, the required extent of stripping of any loose granular soils, softened, upper portions of the native sand soils will need to be determined based on the proof-rolling and inspection. Any loose, softened or poorly performing areas of the subgrade must be sub-excavated and replaced with engineered fill.



Care will be required to ensure that the prepared area extends far enough to encompass the limits of the engineered fill. The engineered fill limits are defined such that the fill extends to at least one metre beyond the outside edge of the founding level of any footing/pad or other settlement sensitive areas and then downward and outward at a slope of one horizontal to one vertical.

The prepared subgrade shall be protected from freezing and/or other potential disturbances such as traffic due to construction equipment.

4.3 Foundation Design

Based on the record of the boreholes and the proposed founding elevations indicated on the latest structural drawings, the foundations of some of the columns for the building will be founded on weathered shale bedrock while some other columns will be supported on drilled shafts (caissons) socketed into the bedrock. While the estimated settlement of shallow foundations (supported on engineered fill after excavation to weathered shale) designed based on the factored geotechnical resistances provided in the following sections may be up to 20 mm, the columns supported on drilled shafts may experience negligible amounts of settlement. The differential settlements between adjacent foundations of different types should be considered/accommodated in the structural/architectural design.

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

Foundation Options	Foundation Options Advantages	
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 0.3 m thick engineered fill on Weathered Bedrock	Allows shallower excavations	Will provide moderate geotechnical resistances at ULS and SLS
Raft/Mat Footing on Competent Bedrock	Allows for high geotechnical bearing capacities at ULS and SLS, reduces the differential settlement	May require deeper excavations and lower founding elevations
Raft/Mat Footing on Weathered Bedrock	Allows for relatively high geotechnical bearing capacities at ULS and SLS, limit the differential settlement, allows shallower excavations	Potential cost differences relative to shallow foundations
Cast-in-Place Reinforced Concrete Piles (Drilled Shafts or Caissons)	Will limit the area of excavation for each column	Potential cost differences relative to shallow foundations

Table 4.1: Foundation Design Options



4.3.1 Spread/Square Footings

The following Table may be used for the design of shallow foundations bearing on 0.3 m to 1.0 m thick engineered fill pad over weathered shale or directly supported on competent bedrock:

Founding Stratum	Footing Size (m)/Type	Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Resistance at SLS (kPa) for 20 mm of Settlement
	2 m wide strip	600	500
	3 m wide strip	650	480
0.3 m to 1.0 m thick	4 m wide strip	700	400
over Weathered Shale	2 m Square	850	800
	3 m Square	880	550
	4 m Square	900	400
	2 m wide strip	1,100	1,100
	3 m wide strip	1,200	1,100
Competent Cholo	4 m wide strip	1,300	1,200
Competent Shale	2 m Square	4 000	1,500
	3 m Square	1,600	1,200
	4 m Square		1,000

Table 4.2: Recommended Geotechnical Resistances at ULS and SLS

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 sound bedrock or weathered bedrock/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 mm of the previously exposed shale (the shale which was exposed during construction of the existing trenches).

4.3.2 Raft/Mat Foundations

Raft/Mat foundations can be supported on 0.3 m to 1.0 m of compacted engineered fill after sub-excavation to weathered bedrock, or can directly be supported on competent bedrock. If supported on weathered bedrock, the engineered fill underlying the foundation must be extended at least 1 m beyond the footprint of the raft.

A modulus of subgrade reaction may be used to represent the soil stiffness for structural design of the rafts. For foundations on weathered or disturbed bedrock the modulus of subgrade reaction, k_{v1} , for a 0.3 m (1 ft.) square plate, is estimated to be about 80 MPa/m. For foundations on competent (sound/undisturbed) bedrock, the k_{v1} for a 0.3 m (1 ft.) square plate is estimated to be 200 MPa/m for both static and seismic conditions.

For design purposes, the value of k_{v1} provided above needs to be modified to account for size effects (i.e., reduced for loaded areas larger than 0.3 m square) as per standard design methods as outlined in the 4th Edition of the Canadian Foundation Engineering Manual (CFEM 2006). The modulus of subgrade reaction for a foundation supported on granular soils with a foundation width of (b) in meters (k_{vb}) may be determined using the following correlation:

$$k_{vb} = k_{v1} ((b+0.3)/2b)^2$$

This results in the value of k_{vb} (modulus for actual foundation dimension) being approximately one quarter of the value of k_{v1} for large foundation widths.

The modulus of subgrade reaction is not a fundamental soil property. It is an approach to analyze soil-structure interaction for design purposes. The modulus of subgrade reaction depends on many factors such as soil type (and variation in soil type), foundation geometry, the location of the foundation under consideration (i.e., center versus edge), size of foundation/loaded area, the rigidity of the foundation and others. In this regard, the value of subgrade reaction varies beneath a given foundation unit; and therefore, there should be additional discussion between Thurber and the structural engineer as design progresses. Given the variability of the site soils and depending on the results obtained by the structural engineer, when using the above values for modulus of subgrade reaction, consideration should be given to carrying out settlement analyses to refine the modulus values and structural design of the foundation.



For design of a mat/raft foundation against sliding on sound bedrock or weathered bedrock/engineered fill an unfactored friction coefficient of 0.7 or 0.55, respectively, may be used in the design.

For estimation of the passive resistance provided by the weathered shale and the competent bedrock against the stems of the raft foundations bulk unit weights of 22 kN/m³ and 24 kN/m³, and passive coefficients of lateral earth pressure of 3.3 and 4.6 may be used in the design (under both permanent and earthquake loading of weathered shale and only permanent loading of competent bedrock). A factored lateral resistance of 300 kPa may be used for estimation of the passive resistances provided by the competent bedrock.

4.3.3 Caissons Socketed into Bedrock

Caissons would be constructed by installing a (temporary or permanent) steel casing (liner) into the top of the bedrock using drilling methods that would allow reliable penetration through potential debris, cobbles and boulders that may be encountered in the fill and till layers and to advance into the bedrock. A socket would then be drilled into bedrock, cleaned, and the casing and socket would be filled with concrete in a single pour after installation of reinforcing steel. The rock socket depth may have to be increased based on lateral resistance requirements. Caissons should be installed in accordance with OPSS.PROV 903. The caisson installation equipment must be able to advance through cobbles and boulders within the till overlying the bedrock. The strength and hardness of the bedrock at this site must be considered when selecting equipment to excavate the rock socket.

Given the risk of the saturated silty sand till layer sloughing, the caisson construction method should include use of temporary or permanent casings (liners) sealed into the bedrock. Ultimately, the contractor will be responsible for selecting the construction means and methods based on cost and risk considerations.

Subcontractors bidding on caisson construction should assess all subsurface data (e.g., record of boreholes, laboratory test results, etc.) and select their means and methods accordingly.

The Contractor shall use appropriate means to clean and inspect the bottom of the excavation of all caissons. The Contractor shall apply means necessary (such as air lift pump or hydraulic pump, etc.) to clean the base of the caissons.

The length of the socket into the bedrock depends on the location of the point of fixity against lateral loads, the compression and uplift loads, and the contractors means and methods in cleaning and inspection of the base of the caissons.



Caissons that rely only on sidewall (shaft) resistance, even if socketed into the bedrock, may be designed using a factored geotechnical resistance in compression at ULS and SLS of 550 kPa and 400 kPa, respectively. The resistances provided in compression should be reduced by 25% for computation of geotechnical resistance of the caissons in tension (against uplift). Rock socket drilling should be conducted after the casings (liners) are properly sealed and seated into the bedrock. Following the completion of the excavation for each caisson (including excavation of the rock socket), each rock socket shall be cleaned and inspected to ensure that the length of socket into sound bedrock is not reduced and to ensure that the quality of the reinforced concrete is not impacted due to presence of sediments (i.e., sediments being mixed with the freshly poured concrete). As such it is recommended that the thickness of the sediment at the base at the time of concreting be less than 75 mm, if the end bearing resistance of the caissons is not relied on.

More stringent criteria for caisson cleaning and inspection will be required if end-bearing resistance of the caissons are to be relied on. In addition, the upper 1.4 m of the bedrock should not be relied on to provide axial resistance, to account for fractured (highly weathered) portion of the bedrock. Consideration should be given to extending the rock sockets deeper than the theoretical (design) lengths to account for potential impact of the socket cleaning on the quality of the concrete.

The geotechnical lateral resistance of the socket in the bedrock may be calculated using ultimate lateral resistance (p_{ult}), in terms of stress, as follows:

For $z \le 3D$, $p_{ult} = (1+1.4 * z / D) * \sigma_{rm}$ (MPa)

For z > 3D, $p_{ult} = 5.2 * \sigma_{rm}$ (MPa)

where: z = depth of socket below competent bedrock surface (m)

D = caisson diameter (m)

 $\sigma_{\rm rm}$ = rock mass strength, recommend 800 kPa

The ultimate lateral resistance, P_{ult} , in terms of forces, may be obtained from the expression, $P_{ult} = p_{ult} * L * D$ (MN), where D is the caisson diameter (m) and L is the length (m) of the caisson segment or element (below top of competent bedrock) used in the analysis. This represents the ultimate load at which the rock fails and will not support any additional load at greater displacement. A resistance factor of 0.5 should be applied to the calculated ultimate lateral resistance.



The spring constant of the socket in the limestone bedrock can be calculated using coefficient of subgrade reaction (k_h) as follows:

$$k_{h} = \frac{0.65E_{M}}{D(1-v_{r}^{2})} \left[\frac{E_{M}D^{4}}{E_{s}I_{s}}\right]^{1/12}$$
 (MN/m³)

where: D	=	caisson diameter (m)
E⊾	1 =	rock mass modulus, recommend 3,700 MPa
Vr	=	0.2, Poisson's ratio of bedrock
Es	=	elastic modulus of caisson concrete (MPa)
ls	=	moment of inertia of a caisson in bending (m ⁴)

The spring constant, K_h , for analysis may be obtained by the expression, $K_h = k_h L D (kN/m)$, where D is the caisson diameter (m), and L is the length (m) of the caisson segment or element used in the analysis.

4.3.4 Tunnel Foundations

An underground cut and cover tunnel will be constructed between the existing CHEO building and the proposed 1Door4Care structure. The proposed finish grade inside the tunnel varies between Elev. 78.8 m and 80.1 m. Based on the record of Boreholes MW1 and MW14 advanced near the location of the proposed tunnel, the foundation of the tunnel is expected to be founded within the shale. Where the shale is exposed under the foundation or on the side walls of the tunnel (during construction) it should be protected from swelling as per the recommendations provided in the previous sections of this report.

The tunnel shall be supported on a 250 mm to 1,000 mm thick engineered fill after sub-excavation to bedrock and/or very dense native silty sand.

Waterproofing shall be provided as per the project Output Specifications.

4.4 Foundation Excavation and Temporary Dewatering

It is anticipated that the finished floor of the building be at about Elev. 80.1 m and that the excavations of the structure be extended to about Elev. 78.0 m. In general, the open-cut excavations will extend through non-cohesive fill (predominantly silty sand to silty sand and



gravel), non-cohesive native soil (predominantly compact to dense silty sand with gravel, possible glacial till), over shale bedrock. The depth to the groundwater table at this site ranged between 1.5 m to 5.3 m below grade at the elevations varied between 77.1 m and 79.3 m. Therefore, seepage is expected into the excavation within the native silty/gravelly sand deposits (moderate to high).

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 0.3 to 1.6 m depth using large hydraulic excavating equipment. Further shale bedrock removal could be accomplished using mechanical methods (such as hoe ramming); however, it is likely that removal of competent shale would be necessary for excavations with their base at or below Elev. 79.0 m.

Provided that the base of excavation is kept at or above Elev. 78 m, groundwater seepage into the excavation is anticipated to be handled by filtered sumps and drains connected to the stormwater gravity drainage system.

4.5 Engineered Fill Pad for Building Footprint

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.



4.6 Grade Raises and Controlled Fill

The placement of controlled fill for paved areas (parking lots and access roads) may be required at the site. The above geotechnical recommendations for engineered fill apply to the placement of controlled fill as well, except that the controlled fill should be compacted to at least 95 percent of SPMDD. However, the upper 300 mm of controlled fill must be compacted to 100 percent of SPMDD. The placement of the controlled fill should be monitored by geotechnical personnel on a regular basis.

4.7 Frost Protection

The depth of frost in Ottawa is about 1.8 m. For the purpose of frost protection in this section, the term foundations include spread footings, deep foundations, pile caps, grade beams, and raft foundations.

- Heated Structures and Buildings: Perimeter and interior foundations and slabs-on-grade 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 (see below for discussion on frost protection options). For interior foundations and slabs-on-grade with a horizontal distance greater than 1.5 m from the perimeter of a heated building, frost protection is not required.
- Unheated Structures and Buildings: All exterior foundations and interior foundations within unheated structures must be protected from frost. All exterior slabs-on-grade and interior slabs-on-grad within unheated structures must be protected from frost

Foundations may be protected from frost by several different methods including:

- **Soil Cover**: placing a minimum of 1.8 m (unless otherwise specified) of soil above the underside of the foundation can typically prevent frost from reaching the soil beneath the foundation. The thickness of clear stone, track ballast, rip-rap or other high-void materials should not be included in the calculation of the soil cover.
- **Insulation:** rigid insulation can be used to protect foundations and slabs-on-on-grade from frost. Careful detailing of the placement of the insulation is essential and it should be noted that the use of insulation may impact the design and construction of other design elements.
- Drained Non-Frost Susceptible Pad: the requirement for soil cover and/or insulation can be waived if the foundations and/or slabs-on-grade are supported on free-draining non frost susceptible fill (e.g., OPSS Granular O or Granular B Type II) extending to below the depth of frost penetration. This fill pad must have a drainage outlet located below the depth



of frost penetration. In determining the depth of frost penetration, the thickness of clear stone, track ballast, rip-rap or other high-void materials should be neglected.

The use of rigid polystyrene insulation for frost protection of foundations should consider the following:

- Differential frost movements may occur near the outer limits of the extent of the insulation. Where the lateral extent of the insulation terminates beneath soft landscaping this is typically not a problem, however, where it terminates beneath hard features such as asphalt pavement structures, concrete slabs or interlock pathways, differential movement and cracking may occur. In these cases, the use of insulation may not be feasible, or the extent of insulation may need to be extended or granular frost tapers may be required to provide a gradual transition.
- The extent of insulation needs to be coordinated with the layout of services (plumbing, electrical, duct banks, etc.). In addition, where the insulation is adjacent to pavement or track structures, the placement of insulation needs to be coordinated so that it does not block drainage of these structures.
- Polystyrene may dissolve when exposed to petroleum-based hydrocarbon products and should be provided with suitable protection where there is a risk of this exposure.
- The insulation must be able to support the design loads of the overlying structure. Where
 footings are placed directly on rigid insulation, the bearing resistances will be the lesser of
 those available from the insulation or the underlying soil/rock.
- As a general guideline, 25 mm of rigid insulation provides about the same frost protection as 600 mm of soil cover, however, a minimum insulation thickness of 50 mm is recommended for durability reasons. It is also noted that many grades of rigid insulation are not available in sheets less than 50 mm thick.

4.8 Slab-On-Grade

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 (e.g., Section 4.1 and 4.2). 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 300 mm thick compacted to 100% of SPMDD should be placed below the floor slab and surrounding the perimeter walls 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.

The recorded groundwater levels of some of the monitoring wells installed at the site indicate that the water table may be within 1 m of the bottom of the slab. The Output Specifications (OS) for the project requires placement of waterproofing under the slabs for these circumstances. However, if accepted by the owner (CHEO), consideration may be given to the use of free draining granular materials below the slab (which have their underside elevation at or above Elev. 80 m), in conjunction with an under-slab drainage system at the base of the granular layer and surrounding the perimeter walls in lieu of use of waterproofing. The drainage system should be connected to an outlet outside the footprint of the building. In addition, the precipitation within the footprint of the building roofs should be drained outside and away from the perimeter walls, and surface water infiltration from connected service trenches and landscaped areas must be controlled to prevent the water from permeating beneath the slab. The above comments only reflect the geotechnical design of the slabs.

4.9 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.

A perimeter wall drainage system shall be installed to collect groundwater from within the surficial earth fill and native soil layers.

The grade surrounding the foundation walls should be sloped to provide positive drainage away from the foundation walls.



Lateral earth pressures acting on the structure (static conditions) 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/m³), 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.

Loading Condition	OPSS Granular A or Granular B Type II Φ = 35°, γ = 22.0 kN/m ³	OPSS Granular B Type I or Type III Φ = 32°, γ = 21.0 kN/m ³
Active, Ka	0.27	0.31
At-Rest, K₀	0.43	0.47
Passive, K _p	3.7	3.3

Table 4.3: Lateral Earth Pressure Coefficients

The earthquake-induced dynamic pressure distribution, which is to be added to the static earth pressure distribution, is a linear distribution with maximum pressure at the top of the wall and minimum pressure at its toe (i.e., an inverted triangular pressure distribution).

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



			$P_h(d) = K \gamma' d + (K_{AE} - K) \gamma' (H-d)$
where:	P _h (d)	=	Lateral earth pressure at depth d (kPa);
	K	=	Static at rest earth pressure coefficient, K_0 to be used for restrained walls;
	K =		Static active earth pressure coefficient, K_{a} to be used for non-restrained walls;
	K _{AE}	=	Seismic active earth pressure coefficient;
	γ'	=	Effective unit weight of the backfill soil (kN/m ³);
	d	=	Depth below the top of the wall (m); and
	н	=	Total height of the wall above the bedrock surface (m).

The seismic active pressure coefficients (K_{AE}) provided in the table below may be used in the design. These seismic active earth pressure coefficients assume that the back of the wall is vertical and the ground surface behind the wall is flat.

Table 4.4:	Seismic	Active	Earth	Pressure	Coefficients
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	Site PGA for Vs	K _{AE}			
Wall Type	of 1,300 m/s (2475 Year Earthquake)	OPSS Granular A or Granular B Type II Φ = 35°, γ = 22.0 kN/m ³	OPSS Granular B Type I or Type III Φ = 32°, γ = 21.0 kN/m ³		
Non-restrained Wall	0.21	0.29	0.33		
Restrained Wall	0.31	0.45	0.50		

4.10 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 1,500 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.



4.11 Cement Type

The results of corrosivity assessment of the in-situ soil and/or bedrock samples have been included in GHD's report. The test results indicate that the in-situ soil/bedrock have a negligible to moderate (predominantly negligible with the exception of one bedrock sample) potential for sulphate attack as per CSA A23.1.

However, the foundations of the building will be found on at least 200 mm thick engineered fill (as per Section 4.6 and Table 4.1 of this report) and the exterior retaining walls will be backfilled with OPSS Granular A or Granular B Type II. Design of the foundations and below grade walls of the proposed structure may consider CSA Type MS or MH cements provided that the imported materials to be in direct contact with concrete are tested for sulphate content to verify that the above-stated recommendations for the cement type remain valid. Where the foundations and/or exterior walls are poured directly in contact with shale, consideration should be given to the use of CSA Type MS or HS cements.

4.12 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 free 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.

4.13 Pavement Structures

References should be made to the GHD's Geotechnical Investigation Report (1Door4Care) for design and construction of Pavement structures at the site.



5. CLOSURE

This report was issued 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.

Upon review of the available subsurface data Thurber recommended conducting a supplemental geotechnical investigation. The investigation was meant to assess geotechnical related risks some of which have been outlined below:

- The elevation of weathered and competent bedrock varies at the site, and one of the purposes of the supplemental investigation was to further delineate those elevations. The foundation subcontractor may encounter bedrock at different elevations from the design assumptions during construction which may result in changes in the foundation design of the building.
- The supplemental geotechnical investigation would have confirmed the shale type. Without the supplemental investigation and based on a review of some of the past histories of the nearby sites, it must be assumed that the shale bedrock has the swelling potential and protection against swelling shall be applied immediately upon exposure of any bedrock.

It is understood that due to planning reasons such as tight schedule, EllisDon has elected to finalize the design and construction based on the currently available data only and address the associated risks during construction.

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



Nina Warrier, P. Eng., P. Geo. Geotechnical Engineer



Date: *August 30, 2024* File: *36182* Mehdi Mostakhdemi, M.Sc., P. Eng. Review Engineer



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.

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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, interpretations 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.



APPENDIX A

Borehole Location Plan (from GHD Report) Estimated Bedrock Contours Record of Boreholes and Laboratory Test Results



METRES

Pilename: N:ICAITorontolProjects/662/11205379/Digital_Design/ACAD 2018/Figures/RPT014/11205379-GHD-00-00-RPT-EN-D101_WA-014.dwg
Plot Date: 23 September 2022 11:09 AM

SHALLOW OVERBURDEN/BEDROCK MONITORING WELL LOCATION (GHD, 2022)

INVESTIGATIVE LOCATION PLAN



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. Image ©2022 Google (Imagery Date 6/8/2018).



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Notes on Borehole and Test Pit Reports

Soil description :

GHD PS-020.01 - Notes on Borehole and Test Pit Reports - Rev.0 - 07/01/2015

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 sv	stem)			Termino	logy		
Clay	< 0.002 mm	,	,				.,		
Silt	0.002 to 0.075 mm						1 100/		
Sand	0.075 to 4.75 mm	fine	0 075 to 4 25 mm		"tra "soi	ce" me"	1-10% 10-20%		
Gand	0.075 10 4.75 mm	medium	0.425 to 2.0 mm		adie	ective (silty_sand)	v) 20-35%		
		coarse	2.0 to 4.75 mm		"an	d"	35-50%		
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm			4			
Cobbles Boulders	75 to 300 mm >300 mm	course							
Relative density of granular soils		Standa inde	Standard penetration index "N" value		Consistency of cohesive soils		Undraine strengt	Undrained shear strength (Cu)	
		(BLO)	WS/ft – 300 mm)				(P.S.F)	(kPa)	
					Ve	ery soft	<250	<12	
V	ery loose		0-4			Soft	250-500	12-25	
	Loose		4-10			Firm	500-1000	25-50	
0	Compact		10-30			Stiff	1000-2000	50-100	
	Dense		30-50		Ve	ery stiff	2000-4000	100-200	
Ve	ery dense		>50			Hard	>4000	>200	
	Rock quality	designatio	n			STRATIGRAPH			
"RQI	0" (%) Value		Quality		53333333		•		
	<25	,	Very poor			00	\sim		
	25-50		Poor		Sand	Gravel	Cobbles& boulders	Bedrock	
	50-75		Fair						
	75-90		Good			111			
	-90		Excellent		Silt	Clay	Organic soil	Fill	
Samples: Type and Numl The type of sam SS: Split spoon SSE, GSE, AGE	ber Iple recovered is shown o E: Environmental sampling	n the log by t	the abbreviation listed he ST: S PS: P	reafter. The num helby tube iston sample (Ost	bering of samples is erberg)	sequential for each Ar R G	type of sample. G: Auger C: Rock core S: Grab sample		
Recovery The recovery, sl	hown as a percentage, is	the ratio of le	ength of the sample obtai	ned to the distance	e the sampler was o	driven/pushed into th	he soil		
RQD									
The "Rock Qual the run.	ity Designation" or "RQD"	value, expre	essed as percentage, is t	he ratio of the tota	al length of all core fr	agments of 4 inche	s (10 cm) or more to th	ne total length o	
IN-SITU TEST	rs:								
N: Standard penetration index R: Refusal to penetration				N _c : Dynamic cone penetration index Cu: Undrained shear strength Pr: Pressure meter		dex 1	k: Permeab ABS: Absorption (F	ility Packer test)	
LABORATOR	RY TESTS:								
								O.V.: Organic	
Ip: Plasticity inde	ex	H: Hy	drometer analysis	A: Atterber	g limits	C: Consolidati	on	vapor	
W _I : Liquid limit		GSA:	Grain size analysis	w: Water c	ontent	CS: Swedish f	all cone		
Wp: Plastic limit				γ: Unit weig	ght	CHEM: Chem	ical analysis		



Strength (ISRM)

Terms	Grade	Description	Uncon Compressive S (MPa)	fined Strength (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 Spa	acing		
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				

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								ENCI	_050	RE NO	D.: _		1	
		CHD		BOREHOLE No.:			MW	1		В	OR	EH	OLE	E R	EP	OF	۲۶
		Cint		ELEVATION:		82.	<u>53 m</u>				F	Page:	_1_	of	_1	-	
	CLIENT:	Infra Prel Onta	astructure Ontario (I. iminary Geotechnica ario Campus	O.) al Investigation - Childrei	ו's	Hospital	of Ea	astern			GENI SS	<u>)</u> - SF	PLIT S	POC	N		
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ate: 1	DESCRIBED E	BY: <u>R. V</u>	′. Tillaart	CHECKED BY:		A. Sorc	our			⊥L Ţ	AU	- Al - W	JGER ATER	LEV	EL		
ŭ	DATE (START	.): <u>Nov</u>	ember 26, 2019	DATE (FINISH):	_	Novem	ber 2	6, 201	9								
₩+Hď	NORTHING:	502	7668.515	EASTING:		448936	6.947										
SOIL LOG WITH GRA	Depth Elevation	(m) BGS Stratigraphy	DESCR SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shea Sena W _p W ₁	ar test sitivity Water Atterb "N" Va ws / 12	(Cu) (S) conter erg lim lue 2 in30	nt (%) its (% cm)	△ F □ L)	ield .ab	
Ë	Feet Metres 82.	53	GROUN	D SURFACE			%			Ν	10 :	20 30	40 50	60 7	0 80 9	0	
V02.GLB Rep	2 - 0.08 82. 1	46	<u> TOPSOIL</u> : 75 mm FILL : SILTY SAND, som fragments, wood p	ne gravel, asphalt ne gravel, asphalt nieces, brown, moist,		SS1	58	16	1-1-3-10	4	• c)		0.	31 m		
D_GEOTECH	$\begin{array}{c} 3 \\ \\ 4 \\ \\ \\ \\ \\ \\ -$		cobble fragments		X	SS2	50	9	4-4-4-6	8				Ben	tonite	, , ,	
rary File: GHI	6 - 2.0 7 - 2.0		NATIVE : SM-SILTY SAND fragments, grey, m Gravel : 26%, San	with gravel, cobble noist, compact d : 58%, Silt : 11%,	M	SS3	62	6	5-4-7-32	11				2.	10 m		
ED.GPJ Lib	8 + 20		Clay : 5% cobble fragments		X	SS4	67	7	22-16-14-11	30	-0			_#2	Sand		
05379 - REVIS	10 <u>-</u> 3.0 11 <u>-</u> 12 <u>-</u>		very dense		X	SS5	67	8	6-17-33-23	50							
11205379/1120	+ 3.81 78. 13 4.0 14 		SHALE, complete	y weathered, grey	X	SS6	75	6	17-32-50/ 100mm	50+	0		•	S	creen		
0\112053\	15 16 17 17				X	SS7	55	4	39-50/ 125mm	50+	0		•				
R\11\112	18 <u>-</u> 5.47 77. 19 <u>-</u>	06	END OF BOREHO	LE :	×	SS8	20	2	50/ 125mm	50+			•	5.	47 m		
ile: N:\CA\MISSISSAUGA - 111 BRUNEL\LEGACY\LOG DATABASE\&-CHAF	$\begin{array}{c} 20 & - & 6.0 \\ 21 & - & \\ 22 & - & \\ 23 & - & 7.0 \\ 24 & - & \\ 25 & - & \\ 26 & - & 8.0 \\ 27 & - & \\ 28 & - & \\ 29 & - & 9.0 \\ 30 & - & \\ 31 & - & \\ 32 & - & \end{array}$		NOTE : - End of Borehole - Borehole was dry - 50 mm diameter installed at 5.47 m - Groundwater lew bgs on December - Groundwater lew bgs on January 15 - Groundwater lew bgs on February 2 - Groundwater lew bgs on April 08, 20 - Groundwater lew bgs on July 09, 20 - Groundwater lew bgs on October 05 - bgs donates 'belo	at 5.47 m bgs y upon completion monitoring well bgs el measured at 5.04 m 5, 2019 el measured at 5.06 m 13, 2019 el measured at 5.14 m 5, 2020 el measured at 5.10 m 6, 2020 el measured at 4.98 m 020 el measured at 5.15 m 20 el measured at 5.16 m 5, 2020 pw ground surface'													

	REFEREN	CE No.	:	11205379								ENCLOSURE No.: 2
		G			BOREHOLE No.:			MW	2		В	OREHOLE REPORT
					ELEVATION:		82.	43 m				Page: <u>1</u> of <u>2</u>
	CLIENT:		Infra	structure Ontario (I.	0.)	<u>n'a</u>	Hoopito	l of E	actorn		LE	GEND
Ŋ	PROJECT	:	Onta	ario Campus	a mesugation - Childre	ns	nospila		astern		\boxtimes	SS - SPLIT SPOON
	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST - SHELBY TUBE AU - AUGER PROBE
uate:	DESCRIBE	ED BY:	<u>R.</u> V	′. Tillaart	CHECKED BY:		A. Sord	bur			Ţ	- WATER LEVEL
WELL	DATE (ST	ART):	Nov	ember 26, 2019	DATE (FINISH)	: _	Novem	ber 2	7, 201	9		
+HLARY	NORTHIN	G:	502	7646.036	EASTING:		448956	6.593				
	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) $\underset{W_p, W_i}{\longleftarrow}$ Atterberg limits (%) \blacksquare "N" Value (blows / 12 in30 cm)
Ë	Feet Metres	82.43		GROUN	D SURFACE			%			Ν	10 20 30 40 50 60 70 80 90
UZ.GLB Kep	0.08 1 <u>1</u> 2 <u>-</u>	82.35		√TOPSOIL : 75 mm FILL : SANDY SILT, som moist_compact	ne gravel, brown,		SS1	54	6	4-5-5-7	10	○● 0.31 m—
	3			loose			SS2	67	12	4-2-3-3	5	● ○
<u>у гие:</u> ын <u></u>	$5 - \frac{1}{2} 1.52$ $6 - \frac{1}{2}$ $7 - \frac{1}{2} 2.0$	80.91		NATIVE : SM-SILTY SAND fragments, brown,	with gravel, cobble moist, compact		SS3	67	7	6-6-8-6	14	1.52 m
GPJ LIDIAL	7			Clay : 7% clay pocket	u . 40%, Siit . 13%,		SS4	67	30	13-5-8-8	13	
'9 - KEVISED	10 3.0 11			very dense		X	SS5	75	10	26-50/ 150mm	50+	
12021 1/8/20	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	78.62 78.31		SHALE, completel _ Auger refusal	y weathered, grey		SS6	17	5	50/ 100mm	50+	O Screen Screen Screen
1ZU2311/2021	14 — 15 — 16 —			SHALE-BEDROCI laminated, interbe limestone/siltstone weathered to fresh	K, clay seams, ds of e (hard layers), highly n, weak to moderately		RC1	90		15		
1/02	10 5.0 17			strong, grey		Ŧ	RC2	80		0		
-11.12-CHARVI 111.12	$ \begin{array}{c} $						RC3	97		79		5.34 m
TILUG UATABASE	$\begin{array}{c} 21 \\ 22 \\ -1 \\ 23 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \\ -$											Bentonite
NUNELILEGAC	24 25 26 						RC4	98		98		7.93 m
	27 <u>+</u> 28 <u>+</u> 29 <u>+</u>						RC5	99		99		
	30 – 9.0 31 – 31 – 4											
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	0	HD		BOREHOLE No.:	_		MW	12		В	OF	REH	10	LE	R	EPC	RT
				ELEVATION:		82.	43 m					Page	э: _	2	of	2	
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ate:)	DESCRIBED BY:	R. \	/. Tillaart	CHECKED BY:		A. Soro	our			Ţ	70	_ `	WAT	TER	LEVE	L.	
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APH+V	NORTHING:	502	7646.036	EASTING:		448956	593										
SOIL LOG WITH GR.	Depth Elevation (m) BGS	Stratigraphy	DESCF SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Sh Se O⊥v w _p v (bl	ear te nsitivi Wa Atte , N ^T ows /	st (C ty (S ter co rbero Value 12 in	:u)) ontent g limit	:(%) s (%) cm)	∆ Fiel □ Lab	d
;;;o	Feet Metres 82.43		GROUN	ID SURFACE			%			N	10	20 3	60 40	50 6	30 70	80 90	
GEOTECH_V02.GLB Re	34					RC6	95		88						11.2	8 m-	
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	REFERENCE N	0.:	11205379								ENCLOSURE No.: 3
				BOREHOLE No.:	_		MW	3		В	OREHOLE REPORT
		GHD		ELEVATION:		81.	58 m			_	Page: <u>1</u> of <u>2</u>
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11/17	LOCATION:	401	Smyth Road, Ottaw	a, Ontario							AU - AUGER PROBE
Date:	DESCRIBED BY	∕: <u>R.\</u>	/. Tillaart	CHECKED BY:		A. Sord	our			Ţ	- WATER LEVEL
VELL	DATE (START):	Nov	vember 28, 2019	DATE (FINISH):	_	Novem	ber 29	9, 201	9		
V+H4X	NORTHING:	502	7642.051	EASTING:	_	448935	.546		1		
SOIL LOG WITH GF	Depth Elevation (m) RGS	Stratigraphy	DESCF SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	$ \begin{array}{llllllllllllllllllllllllllllllllllll$
;;;	Feet Metres 81.5	8	GROUN	ID SURFACE			%			Ν	10 20 30 40 50 60 70 80 90
V02.GLB Rep	$\begin{array}{c} 0 \\ 1 \\ - \\ 2 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$		TOPSOIL : 100 m FILL : SANDY SILT, trac wood pieces, grey	m/ e gravel, trace rootlets, /brown, frozen, loose	X	SS1	50	12	5-3-4-4	7	• 0.31 m-
D_GEOTECH_	3 <u>-</u> 1.0 4 <u>-</u> 5 <u>-</u>		SAND and GRAV compact Gravel : 43%, Sar (Fines) : 5%	EL, brown, moist, Id : 52%, Clay & Silt		SS2	46	5	5-9-9-5	18	0.90 m Bentonite 1.21 m #2 Sand
rary File: GH	$\begin{array}{c} & - & - & - \\ 6 & - & - & - \\ 6 & - & - & 2.0 \\ 7 & - & - & - \end{array}$	3 💥	NATIVE : SM-SILTY SAND fragments, brown/	with gravel, cobble grey, moist, loose to	X	SS3	50	10	3-2-4-4	6	
ED.GPJ LIB	8 9		Gravel : 16%, Sar Clay : 8%	ld : 59%, Silt : 17%,	X	SS4	42	11	5-5-9-14	14	
5379 - REVIS			SHALE, complete	ly weathered, grey	X	SS5	33	5	14-17-28-20	45	
79\1120			no recovery		-	SS6	0		50/ 25mm	50+	
\1120\112053\112053	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		SHALE-BEDROC of limestone/siltsto highly weathered moderately strong	K, laminated, interbeds one (hard layers), to fresh, weak to , grey		RC1	80		71		4.57 m Bentonite 5.03 m
OG DATABASE\8-CHAR\11	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$					RC2	99		86		
A - 111 BRUNEL/LEGACY/L	24 25 26 8.0 27 28					RC3	100		96		Screen
File: N:\CA\MISSISSAUG	29 - 9.0 30 - 9.0 31 - 32 - 9					RC4	100		100		

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		CHD		BOREHOLE No.:	_		MW	13		В	OF	REI	ΗС)LE	ΞF	RE	PC	RT
		GIL		ELEVATION:		81.	<u>58 m</u>					Pag	e: _	2	0	f _	2	
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e: 11/		· R \	/ Tillaart	CHECKED BY		A Sor	our				AU	-		GER			Ξ	
L Dat	DATE (START)	. <u></u> Nov	ember 28, 2019	DATE (FINISH)		Novem	ber 2	9 201	19	.		-	vvA					
H+WEI			7040.054			440000		.,										
GRAPI	NORTHING:	502	7642.051	EASTING:		448935	.546			c	Sh	ear te	est (C	Cu)			 ∆ Fiel	d
SOIL LOG WITH	Depth Elevation (m) BGS	Stratigraph	DESCF SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraio	Se ○ w _p v (bl	nsitiv Wa Atte "N" ows /	ity (S ter c erber Value 12 ir	S) conter g lim e n30	nt (%) its (% cm)) 6)	∃ Lab	
:: Dort:	Feet Metres 81.5	3	GROUN	ID SURFACE			%			N	10	20 3	30 40	0 50	60 7	08	0 90	1 14 (14 1774)
e: GHD_GEOTECH_V02.GLB R	34		END OF BOREHO	<u>LE :</u>		RC5	100		86						-11	.43		
File: N:\CAMISSISSAUGA - 111 BRUNEL\LEGACYLOG DATABASE\8-CHAR\11\112011206379\11205379-REVISED.GPJ Library File: GF	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		END OF BOREHO NOTE : - End of Borehole - Borehole was dm - Rock coring from - S0 mm diameter monitoring wells in 11.43 m bgs respe Shallow Monitorin - Groundwater lev bgs on December - Groundwater lev bgs on January 15 - Groundwater lev bgs on January 15 - Groundwater lev bgs on January 15 - Groundwater lev bgs on April 08, 20 - Groundwater lev bgs on April 08, 20 - Groundwater lev bgs on January 15 - Groundwater lev bgs on July 09, 20 - Groundwater lev bgs on October 05 Deep Monitoring V - Groundwater lev bgs on December - Groundwater lev bgs on December - Groundwater lev bgs on January 15 - Groundwater lev bgs on January 15 - Groundwater lev bgs on January 15 - Groundwater lev bgs on April 08, 20 - Groundwater lev bgs on April 08, 20 - Groundwater lev bgs on April 08, 20 - Groundwater lev bgs on January 15 - Groundwater lev bgs on July 09, 20 - Groundwater lev bgs on October 05 - bgs donates 'bell - shallow and deel installed in separal each other - No methane gas drilling/coring	ALE : at 11.43 m bgs y upon completion h 4.11 m bgs shallow and deep nstalled at 4.57 m and actively bg Well el measured at 3.76 m 5, 2019 el measured at 3.83 m 13, 2019 el measured at 3.87 m 25, 2020 el measured at 3.87 m 26, 2020 el measured at 3.66 m 020 el measured at 3.91 m 20 el measured at 3.91 m 20 el measured at 4.28 m 5, 2019 el measured at 4.28 m 5, 2019 el measured at 4.28 m 5, 2020 Vell el measured at 4.45 m 5, 2020 el measured at 4.45 m 5, 2020 el measured at 4.45 m 5, 2020 el measured at 4.47 m 5, 2020 el measured at 4.47 m 5, 2020 ow ground surface' p monitoring wells the holes adjacent to was detected during														

	REFEREN	CE No.	:	11205379						<u> </u>		ENC	LOSU	IRE	No.:			1	
		G			BOREHOLE No.:	_		MW	4		В	OR	EH	OL	E	RE	EPO	ORT	Г
					ELEVATION:		80.	34 m				F	Page:	_1	_ (of _	2		
_	CLIENT:	:	Infra Preli Onta	astructure Ontario (I. iminary Geotechnica ario Campus	O.) al Investigation - Childre	n's	Hospita	l of Ea	astern			<mark>GENI</mark> SS	2 - SI	PLIT	SPC	ON			
1111	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST	- Sł	HELE					
ate:	DESCRIBE	ED BY:	R. V	. Tillaart	CHECKED BY:		A. Sord	our			⊥⊔ Ţ	AU	- W	ATE	R LE	EVE	L		
	DATE (ST	ART):	Dec	ember 2, 2019	DATE (FINISH):	:	Decem	ber 3,	2019)									
א+ דעל	NORTHIN	G:	5027	7621.964	EASTING:		448917	.848											
	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	IPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	She Sen O W _p W₁ (blo	ar test sitivity Water Atterb "N" Va ws / 12	(Cu) (S) r cont erg li lue 2 in3	ent (% mits (0 cm)	%) %)	∆ Fi∈ □ La	əld b	
100	Feet Metres	80.34		GROUN	D SURFACE			%			Ν	10	20 30	40 5	0 60	70	80 90	1 0.11	
	$1 - \frac{1}{2}$ $2 - \frac{1}{2}$ $- \frac{1}{2}$ $- \frac{1}{2}$ $- \frac{1}{2}$ $- \frac{1}{2}$ $- \frac{1}{2}$	80.26		→ TOPSOIL : 75 mm FILL : SILTY CLAY, trace brown, frozen, firm	e sand and gravel, n, moist		SS1	50	25	4-3-4-4	7	•	0		(Be	0.31 	l m- nite-		Ť
קבטובט_	3 - 1.0 4 - 1.0 4 - 1.0	70.00		NATIVE : SM-SILTY SAND, brown, moist, com Gravel : 11%, San	some clay and gravel, pact d : 59%, Sllt : 20%,	X	SS2	58	15	4-7-10-25	17				#	0.86 2 S	òm= and- ⊨ een		
ary rue: Gn	5 1.52 6 7 2.0 7	70.02		∖Clay : 10% SHALE, completel	/ y weathered, grey	X	SS3	100	5	50/ 100mm	50+				· · ·	1.78	3 m=		
סבט.טרט בוט ר		77.65		auger refusal SHALE-BEDROCI of limestone/siltsto	K, laminated, interbeds ne (hard layers),														
9/11/2000/9 - REVIS	10 - 11 - 12 - 12 - 13 - 14 0			highly weathered t moderately strong	o fresh, weak to , grey		RC1	88		39									
2007111-0007111-	14 -1 15 -1 16 -1 5.0						RC2	100		78						Scr	een		
AR\1 \1 ZU	$17 - \frac{1}{12}$ $18 - \frac{1}{12}$ $19 - \frac{1}{12}$ $19 - \frac{1}{12}$ 6 0																		
	$\begin{array}{c} 20 \\ -1 \\ 21 \\ -1 \\ -1 \\ 22 \\ -1 \\ -1 \\ -1$						RC3	99		83									
LILEGAUT ILUG	23 + 7.0 24 + 25 + 25 +						RC4	100		100									
	26 - 8.0 27 - 8.0															7.93	3 m-		
11 - AəU	28 + 8.38	71.96		END OF BOREHO	<u>LE :</u>											8.38	3 m=		
AUDUA	29 - 10 - 9.0			NOTE : - End of Borehole	at 8.38 m bos														
	31 <u>-</u> 32 <u>-</u> <u>-</u>			 Borehole was dry Rock coring from 50 mm diameter monitoring wells in 	2.69 m bgs 2.69 m bgs shallow and deep stalled at 1.78 m and														

_	REFEREN	ICE No.		11205379								EN	CLO	SUF	KE N	0.: _		_4	
		G			BOREHOLE No.:			MW	4		В	OI	RE	нс	DL	ER	REP	OF	₹T
					ELEVATION:		80.	34 m					Pag	je:	2	of	_2		
20	CLIENT:	· <u>·</u>	Infra Prel Onta	astructure Ontario (I. iminary Geotechnica ario Campus	O.) al Investigation - Childrer	ו's	Hospital	of Ea	astern	· · · · · ·		GEI SS	<u>ND</u> -	SP	LIT S	SPOC	DN		
11/17/	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST AU	-	SH	ELB GER	Y IU RPRC	BE DBE		
ate:	DESCRIBE	ED BY:	<u>R.</u> V	/. Tillaart	CHECKED BY:		A. Sorc	our			Ţ		-	WA	TEF	RLEV	'EL		
/ELL D	DATE (ST	ART):	Dec	ember 2, 2019	DATE (FINISH):		Decem	ber 3	, 2019)									
APH+V	NORTHIN	G:	502	7621.964	EASTING:		448917	.848			-								
SOIL LOG WITH GR	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	St Se O w _p (b	hear t ensitiv Wa A A A A tt N N Iows	est (vity (ater o erbe Valu / 12 i	Cu) S) conte rg lim e in30	nt (%) nits (%) cm)	△ F □ L)	⁻ield _ab	
Ë	Feet Metres	80.34		GROUN	D SURFACE			%			Ν	1(0 20	30 4	0 50	60 7	0 80 9	i 0	
Rep	33 —			7.93 m bgs respection Shallow Monitorin	ctively a Well												_		
2.GLB	34 —			- Borehole was dry	on December 5, 2019														
н 20	35 —			bgs on December	13, 2019							$\left \right $					_		
OTEC	36 11.0			 Frozen/Iced cond 2020 	dition on January 15,														
GE	37			- Frozen/iced conc 2020	lition on February 26,												_		
HD ::	38			- Groundwater leve	el measured at 1.56 m														
ry File	39			- Borehole was dry	y on July 09, 2020							$\left \right $			$\left \right $		-	\square	
Libraı	40			- Groundwater level bgs on October 05	el measured at 1.55 m 5, 2020														
Ъ	41 —			Deep Monitoring V	Vell el measured at 3 09 m											_	_	\square	
SED.G	42			bgs on December	5, 2019														
REVIS	43			bgs on December	13, 2019							\square					-	\square	
379 -	44 —			- Frozen/Iced cond 2020	dition on January 15,														
11205	45			- Frozen/iced cond	lition on February 26,												_	\square	
5379\	46 — 14.0			- Groundwater leve	el measured at 2.93 m														
\1120	47 —			bgs on April 08, 20)20 el measured at 3.18 m							\vdash			$\left \right $		-	\square	
2053	48 —			bgs on July 09, 20 - Groundwater leve	20 el measured at 3.18 m														
-/11	4915.0			bgs on October 05	5, 2020							\square						\square	
\1120	50			- shallow and deep	p monitoring wells														
	51			each other	te holes adjacent to							\vdash			$\left \right $		+	\vdash	
HAR/	⁵² – 16.0			- No methane gas drilling/coring	was detected during														
E\8-C	53																		
ABAS	54 —																_		
DAT	55																		
Y/LOG	5617.0																_		
GAC	57 —																		
EL/LE	58											П					-	\square	
BRUN	59 - 18.0											⊢							
- 111	60 +											H					+	$\left \right $	
NGA	61 +																		
SISSA	62 + 19.0											H				-	+	$\left \right $	
4\MIS	63 +																		
N:/C/	64 🕂											\vdash	_	_	\mathbb{H}	+	+	H	
File:	65 🕂																		

r	REFEREN	ICE NO.		11205379								ENGLOSURE NO 5	
		6			BOREHOLE No.:	_		MW	5		В	OREHOLE REPORT	
		9	m		ELEVATION:		80.	54 m			_	Page: <u>1</u> of <u>1</u>	
	CLIENT:	:	Infra Preli Onta	istructure Ontario (I. iminary Geotechnica ario Campus	O.) Il Investigation - Childre	n's	Hospita	ofEa	astern		<u>LE0</u>	EGEND SS - SPLIT SPOON	
1/17/2(LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST - SHELBY TUBE	
ate: 1	DESCRIB	ED BY:	R. V	. Tillaart	CHECKED BY:		A. Sord	our			∐L ▼	- WATER LEVEL	
Ŭ	DATE (ST	ART):	Dece	ember 4, 2019	DATE (FINISH):	: _	Decem	ber 4	, 2019)	_		
PH+WE	NORTHIN	G:	5027	7604.917	EASTING:		448917	.805					
SOIL LOG WITH GR	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	IPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear test (Cu) \triangle Field Sensitivity (S) \square Lab \bigcirc Water content (%) $\stackrel{\blacksquare}{\Psi_{p}}$ Atterberg limits (%) \bullet "N" Value (blows / 12 in30 cm)	
: U	Feet Metres	80.54		GROUN	D SURFACE			%			Ν	10 20 30 40 50 60 70 80 90	
V02.GLB Rep	0 0.05 1 +_ 1 2 +_ 1	80.49		ASPHALT : 50 mm FILL : SAND and GRAVE very dense	n/ EL, grey/brown, frozen,		SS1	67	7	65-85-13-16	98	O 0.31 m	
GEOTECH	3 0.91 1.0 4	79.63		NATIVE : SM-SILTY SAND, very dense	grey/brown, moist,	-X	SS2	46	9	16-50/ 125mm	50+	• • • • • • • • • • • • • • • • • • •	
IN FILE: GHD	5 - 1.70 6 - 2.0 7 - 2.0	78.84		Gravel : 8%, Sand <u>: 10%</u> SHALE, completel	: 62%, Silt : 20%, Clay / y weathered, grey	-X	SS3	41	6	25-50/ 100mm	50+		
D.GPJ Libra	8 8 9					X	SS4	40	5	9-50/ 100mm	50+		
- REVISEI	10 <u>-</u> 3.0 <u>-</u> 3.10 11 <u>-</u>	77.44			LE :	×	SS5	0		50/ 50mm	50+	• 3.05 m 3.10 m	
le: N:\Ca\MISSISSAUGA - 111 BRUNEL\LEGACYLOG DATABASE\&CHAR\111120\112053-11205379\11205379 -	$\begin{array}{c} 12 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 15 \\ 16 \\ 17 \\ 16 \\ 17 \\ 18 \\ 19 \\ 19 \\ 10 \\ 17 \\ 10 \\ 17 \\ 10 \\ 17 \\ 10 \\ 17 \\ 10 \\ 17 \\ 10 \\ 10$			NOTE : - End of Borehole - Borehole was dry - 50 mm diameter installed at 3.05 m - Borehole was dry - Groundwater leve bgs on December - Groundwater leve bgs on January 15 - Groundwater leve bgs on April 08, 20 - Groundwater leve bgs on April 08, 20 - Groundwater leve bgs on July 09, 20 - Groundwater leve bgs on October 05 - bgs donates 'belo	at 3.10 m bgs v upon completion monitoring well bgs o on December 5, 2019 el measured at 2.42 m 13, 2019 el measured at 1.97 m , 2020 el measured at 2.50 m 6, 2020 el measured at 2.10 m 20 el measured at 2.38 m 20 el measured at 2.35 m , 2020 bw ground surface'								

	REFEREN	CE No.	:	11205379								ENCLO	SURE	No.: _	6	
		6			BOREHOLE No.	:		BH	6		B	ORE	HOL	.E R	EPC	ORT
					ELEVATION:		80.	04 m				Pag	je: <u>1</u>	of	1	
1	CLIENT:	:	Infra Prel Onta	astructure Ontario (I. iminary Geotechnica ario Campus	O.) al Investigation - Childre	en's	Hospita	l of Ea	astern		LEC	<mark>GEND</mark> SS -	SPLIT	SPOC	N	
7//L/L	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST -	SHEL		BE	
ate:	DESCRIBE	ED BY:	R. V	′. Tillaart	CHECKED BY:		A. Sord	bur			⊥⊔ Ţ	- 40	WATE	RLEV	'EL	
	DATE (STA	ART):	Dec	ember 2, 2019	DATE (FINISH)	: _	Decem	ber 2	, 2019)						
APH+W	NORTHIN	G:	502	7626.342	EASTING:		448896	6.247								
SUL LUG WITH GR	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	LIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear t Sensitiv O Wa W _p W ₁ Att (blows)	est (Cu) vity (S) ater con erberg l Value / 12 in3	tent (%) imits (% 30 cm)	△ Fie □ Lat	ld D
:100	Feet Metres	80.04		GROUN	D SURFACE			%			N	10 20	30 40 5	60 60 7	0 80 90	-
UZ.GLB Kel	1 <u>-</u> 1 <u>-</u> 0.40 2 <u>-</u>	79.64		FILL : SAND and GRAVE ∖dense NATIVE :	EL, grey, frozen, very /	4	SS1	75	8	49-50-18-6	68	0				_
	3 0.86 1.0 4	79.18		SM-SILTY SAND, grey/brown, moist, SHALE, completel	some clay, very dense / y weathered, grey	7	SS2	50	6	12-46-50/ 75mm	50+	0				-
FIIE: GHU_($5 - \frac{1}{1}$ $6 - \frac{1}{1}$ $- \frac{1}{2}$		իկիկիկի			X	SS3	20	3	50/ 125mm	50+	0		•		
U LIDIALY	7 2.43	77.61	111111			×	SS4	20	3	50/ 125mm	50+	0				-
ZUD3/9 - KEVISED.GP	9			END OF BOREHO NOTE : - End of Borehole - Borehole was dry - bgs donates 'belo	L <u>E:</u> at 2.43 m bgs / upon completion /w ground surface'											-
11/8/00/211/00	13 4.0 14 15															-
11ZU02TT	16 5.0 17															-
CHAR/TI	10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -															-
JA I ABASE/8-	$21 - \frac{1}{1}$ $22 - \frac{1}{1}$															_
J DOJ VOG L	23 <u>-</u> 7.0 24 <u>-</u> 															-
	$25 - \frac{1}{26}$ $26 - \frac{1}{26} - 8.0$															
1 L L - AOU	27 28 															
AVINUSUSSA	29															
	31 - <u>-</u> 															
Ъ	+															

,	REFEREN	CE No.	:	11205379								ENCLO	DSUR	E No.:			
					BOREHOLE No.			BH	7		B	ORF	нс) F	RFF	DC	RT
		6	HD		ELEVATION:		80.	40 m			2	Pa	ige:	1	of <u>1</u>	_	
0	CLIENT:	:	Infra Prel Onta	astructure Ontario (l. iminary Geotechnica ario Campus	0.) Il Investigation - Childre	n's	Hospita	l of Ea	astern			<mark>gend</mark> ss	- SPL	IT SP	DON		
7//L/LI	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST	- SHE	ELBY T SER PI			
ate:	DESCRIBE	ED BY:	R. V	′. Tillaart	CHECKED BY:		A. Sord	bur			Ţ	/10	- WA	TER LI	EVEL		
	DATE (STA	ART):	Nov	ember 29, 2019	DATE (FINISH)	: _	Novem	ber 2	9, 201	9							
APH4W	NORTHING	G:	502	7643.798	EASTING:		448912	2.466									
SUL LUG WITH GK	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL ANI	IPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear Sensit O W W _p W ₁ A • "N (blows	test (C livity (S /ater c tterber V Value (12 ir	Cu) 5) ontent (g limits 9 n30 cm	∧ □ (%) (%)	Field Lab	
Ë	Feet Metres	80.40		GROUN	D SURFACE			%			Ν	10 20	30 40	50 60	70 80	90	
VUZ.GLB Kep		70.04		FILL : SAND and GRAVE grey, moist, compa	EL, cobble fragments, act	X	SS1	58	2	5-7-8-5	15						
GEOLECH	3 <u>-</u> 1.0 4 <u>-</u>	79.64		NATIVE : SM-SILTY SAND, grey/brown, moist, Gravel : 3%. Sand	some clay, dense : 54%. Silt : 30%. Clay	X	SS2	55	7	4-15-22-50/ 75mm	37	0					
V FIIE: GHU	5 <u>-</u> 1.52 6 <u>-</u> 2.0	78.88		<u>∖: 13%</u> SHALE, completel	y weathered, grey		SS3	46	4	38-50/ 125mm	50+	0		•			
JPJ LIDIAL	7 8 2.43	77.97		END OF BOREHO		×	SS4	21	3	50/ 125mm	50+	0		•			
ELILEGACYLOG DA ABASE/8-CHARVI 1/11 20/1 12093/11 2093/3/1 12093/3 - REVISEL	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$			NOTE : - End of Borehole : - Borehole was dry - bgs donates 'belo	at 2.43 m bgs upon completion ow ground surface'												
FIIE: N:\CA\MISSISSAUGA - 111 BKUNEL	26 8.0 27 8.0 28 9.0 30 9.0 31 32 32																

REFERENCE No	.:11205379								ENC	LOSU	IRE No	o.:	8	
		BOREHOLE No.:	_		BH	8		B	OR	EH	OLE	E RI	EPO	RT
		ELEVATION:		80.	32 m					Page:	_1_	of	1	
CLIENT: PROJECT:	Infrastructure Ontario (I Preliminary Geotechnic Ontario Campus	.O.) al Investigation - Childre	n's	Hospital	of Ea	astern		LEC	<mark>gen</mark> ss	<u>D</u> - SI	PLIT S	POON	1	
	401 Smyth Road, Ottaw	/a, Ontario							ST	- SI			E ≥⊏	
DESCRIBED BY:	R. V. Tillaart	CHECKED BY:		A. Sord	ur			Ţ	70	- W	ATER	LEVE	L	
DATE (START):	December 2, 2019	DATE (FINISH):	: _	Decem	ber 2,	, 2019)							
	5027623.431	EASTING:		448936	.551									
Depth Elevation (m) BGS	SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	She Ser ○ ₩ _p w (blc	ear test isitivity Water Atterb "N" Va ws / 12	(Cu) (S) r conten berg limi lue 2 in30	nt (%) its (%) cm)	∆ Fiel □ Lab	t
Feet Metres 80.82	GROUN	ID SURFACE			%			N	10	20 30	40 50	60 70	80 90	
	FILL : SAND with gravel moist, compact	, trace organics, grey,	M	SS1	50	9	6-4-5-6	9	•					-
$\begin{array}{c} & -1 & 0.76 \\ 3 & -1 & 1.0 \\ 3 & -1 & 1.0 \\ 4 & -1 & \\ 5 & -1 & \end{array}$	NATIVE : SM-SILTY SAND, compact Gravel : 8%, Sand	grey/brown, moist, I : 59%, Silt : 22%, Clay	X	SS2	75	10	2-5-6-45	11		H				-
1 - 1.52 - 79.30 - 1.52 - 79.30 - 1 - 1.52 - 79.30 - 1 - 1.52 - 79.30 - 1 - 1.52 - 79.30	SHALE, complete	ly weathered, grey	X	SS3	41	5	40-50/ 100mm	50+	0					-
			X	SS4	12	2	50/ 75mm	50+	0		•			
	END OF BOREHO	<u>LE :</u>	×	SS5	12	5	50/ 75mm	50+	0		•			-
12 13 4.0	NOTE : - End of Borehole - Borehole was dr	at 3.13 m bgs y upon completion												-
14	- bgs donates 'bel	ow ground surface'												-
														-
														-
									\square					-
									Ħ					1
														_
29 - 29 - 2									\vdash	+ +	+ +			-
										++				-
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_	REFEREN	ICE No.	:	11205379								ENC	LOSL	JRE N	0.:		9	
		G			BOREHOLE No.:	_		MW	9		В	OR	EH	OL	ΕF	REF	0 0	RT
					ELEVATION:		80.	52 m				-	Page:	_1	0	f <u>1</u>	_	
0	CLIENT:	:	Infra Prel Onta	astructure Ontario (I. iminary Geotechnica ario Campus	O.) al Investigation - Childre	n's	Hospita	l of Ea	astern		<u>LE</u>	GEN SS	<u>D</u> - SI	PLIT	SPO	NC		
7/71/1	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST ALL	- SI			IBE		
ate:	DESCRIBE	ED BY:	R. V	/. Tillaart	CHECKED BY:		A. Sor	bur			Ţ	/ 10	- W	ATE	R LE'	/EL		
VELL VELL	DATE (ST	ART):	Dec	ember 3, 2019	DATE (FINISH)	: _	Decem	ber 3	, 2019)								
V+H'A	NORTHIN	G:	502	7678.629	EASTING:		448898	8.487										
	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	IPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	She Ser O W _p W (blo	ear test sitivity Wate Atterk "N" Va	: (Cu) (S) r conte berg lin lue 2 in30	ent (% hits (%) cm)	△ □) 6)	Field Lab	
Ë	Feet Metres	80.52		GROUN	D SURFACE			%			Ν	10	20 30	40 50	60	70 80	90	
UZ.GLB Kep				FILL : SAND and GRAVI compact	EL, grey, moist,		SS1	58	3	24-18-6-4	24	0	•			.31 r	n	
	3 - 0.76 3 - 1.0 4 - 5 - 1.0	79.76		NATIVE : SM-SILTY SAND, cobble fragments, to dense	some clay and gravel, brown, moist, compact		SS2	58	6	4-8-7-17	15	0			0	.11 r San	e nd	
y FIIE: GH	6 <u> </u>	78.54		Clay : 13%	y weathered, grey	X	SS3	76	9	7-8-26-50/ 75mm	34				(Scree .83 r	n n=	
FU LIDIA	8		իկկկկկ		,,	X	SS4	100	5	49-50/ 50mm	50+	0						
- KEVISED.G	10 <u>-</u> 3.0			no recovery		×	SS5	0		50/ 50mm	50+			•	E	3ackf		
- 6/20211V	$ \begin{array}{c} + \\ 12 - \\ - \\ - \\ 3.81 \\ 13 - 4 0 \end{array} $	76.71					SS6	0		50/ 0mm	50+			•	3	.81 r	n —	
				END OF BOREHO	<u>LE :</u>													
	16 <u>-</u> <u>-</u> <u>-</u> 17 <u>-</u> 5.0			 End of Borenole Borehole was dry 50mm diameter r installed at 1.83 m 	at 3.81 m bgs / upon completion nonitoring well bas													
071.L\L				- Borehole was dry - Borehole was dry 2019	v on December 5, 2019 v on December 13,													
=\8-CHAK/1	19 - 6.0			- Borehole was dry - Groundwater leve bgs on April 08, 20	/ on January 15, 2020 el measured at 1.98 m)20 / on July 09, 2020													
DATABASI	22			- Groundwater level bgs on October 05 - bgs donates 'belo	el measured at 2.00 m 5, 2020 bw ground surface'													
ACYLOG	23 <u>-</u> 7.0 24 <u>-</u>				-													
NEL/LEG	25 — 26 — 0.0																	
111 BKU	27 - 8.0																	
AUGA -	28																+	
221221	30 - 9.0																	
N:/CA/M	31													+			+	
	32 —																	

	REFEREN	ICE No.	:	11205379								ENC	LOSU	JRE N	lo.: _		10		
		G			BOREHOLE No.:	_		MW	10		В	OR	EH	OL	ER	EP	OF	٦٢	
					ELEVATION:		79.	86 m				I	Page:	_1	_ of	_1_	-		
	CLIENT:	·	Infra Preli Onta	structure Ontario (I. iminary Geotechnica ario Campus	D.) I Investigation - Childre	n's	Hospita	of Ea	astern			GEN SS	<u>D</u> - S	PLIT	SPOC)N			
1/17/2	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST	- S	HELB		3E			
ate: 1	DESCRIBE	ED BY:	R. V	. Tillaart	CHECKED BY:		A. Sord	our			Ţ	70	- W	ATE	R LEV	EL			
ELL D	DATE (ST	ART):	Dec	ember 2, 2019	DATE (FINISH):	_	Decem	ber 2	, 2019)									
V+Hd	NORTHIN	G:	5027	7644.571	EASTING:		448886	.323											
SOIL LOG WITH GR	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL ANI	IPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	She Ser O W _p W ₁	ear test nsitivity Wate Attert "N" Va ws / 12	t (Cu) (S) r conte perg lir alue 2 in30	ent (%) nits (%) cm)	△ F □ L)	ield .ab		
ä	Feet Metres	79.86		GROUN	D SURFACE			%			Ν	10	20 30	40 50	60 7) 80 9	0		N-74
V02.GLB Rep		70.10		FILL : SAND and GRAVE	EL, grey, frozen, dense	X	SS1	58	3	24-37-11-3	48	0			0.	31 m			
GEOTECH	3 <u>-</u> 1.0 4 <u>-</u>	79.10		NATIVE : SM-SILTY SAND v grey/brown, moist, Gravel : 26%, San	vith gravel, compact/loose d : 47%, Silt : 18%,	X	SS2	42	9	5-3-7-10	10		H		0. Ben	90 m			
Iry File: GHD	5 <u>-</u> 6 <u>-</u> 7 <u>-</u> 2.0			Clay : 9% clay pocket			SS3	42	28	2-3-5-7	8				1. #2	98 m Sand			
D.GPJ Libra		77.57		SHALE, completel	y weathered, grey	X	SS4	57	6	45-6-37-50/ 125mm	43	0							
79 - REVISEI	10 <u>-</u> 3.0 11 <u>-</u>					X	SS5	16	3	50/ 100mm	50+	0			s	creen			
5379\112053	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	76.05		END OF BOREHO	<u>.E :</u>		SS6	0		50/ 50mm	50+			•	3.	81 m			
File: N:\CAIMISSISSAUGA - 111 BRUNEL\LEGACYLOG DATABASE\8-CHAR\11\1120\112053-\1120537	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$			NOTE : - End of Borehole : - Borehole was dry - 50mm diameter r installed at 3.81 m - Groundwater leve bgs on December - Groundwater leve bgs on April 08, 20 - Groundwater leve bgs on April 08, 20 - Groundwater leve bgs on July 09, 20 - Groundwater leve bgs on October 05 - bgs donates 'belo	at 3.81 m bgs rupon completion nonitoring well bgs el measured at 2.45 m 5, 2019 el measured at 2.49 m 13, 2019 el measured at 2.33 m 20 el measured at 2.79 m 20 el measured at 2.74 m , 2020 ew ground surface'														

	REFEREN	ICE No.	:	11205379								ENCLOSURE No.: 11
		6			BOREHOLE No.	:		BH1	1		B	OREHOLE REPORT
					ELEVATION:		81.	<u>32 m</u>			_	Page: <u>1</u> of <u>1</u>
	CLIENT:		Infra	astructure Ontario (I.	0.)						LEC	GEND
	PROJECT	:	Prel Onta	iminary Geotechnica ario Campus	al Investigation - Childre	en's	Hospita	of Ea	astern	l	\boxtimes	SS - SPLIT SPOON
1/1/2/	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST - SHELBY TUBE
ate:	DESCRIBE	ED BY:	<u>R.</u> V	′. Tillaart	CHECKED BY	:	A. Soro	our			⊥⊔ Ţ	- WATER LEVEL
	DATE (ST	ART):	Dec	ember 4, 2019	DATE (FINISH): _	Decem	ber 4	, 2019)		
N+H-1	NORTHIN	G:	502	7617.468	EASTING:		448987	.177				
	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	IPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) \blacksquare Atterberg limits (%) \blacksquare "N" Value (blows / 12 in30 cm)
Ë	Feet Metres	81.32		GROUN	D SURFACE			%			Ν	10 20 30 40 50 60 70 80 90
IZ.GLB Rep	$\begin{array}{c} & - & 0.08 \\ 1 & - & - \\ 2 & - & - \\ \end{array}$	81.24		ASPHALT : 75 mn FILL : SAND and GRAVE	EL, brown, frozen,	\mathbb{Z}	SS1	67	8	16-17-7-5	24	
	² - 0.76 3 - 1.0 4 -	80.56		compact NATIVE : SM-SILTY SAND, brown/grey, moist	some clay,	X	SS2	55	8	16-17-24-32	41	
י פאח פו	5 <u>-</u> 1.52	79.80		SHALE, completel	y weathered, grey		SS3	36	9	2050/ 125mm	50+	
orary FII6	7 - 2.0		կկկկ							1201111		
	8 <u>-</u> 2.49	78.83			E.		SS4	33	2	30-50/ 50mm	50+	
	10 3.0			NOTE :								
/ A - KE	11 -			- End of Borehole - Borehole was dry	at 2.49 m bgs vupon completion							
				- bgs donates 'belo	ow ground surface'							
18/5002	13 <u>-</u> 4.0 14 <u>-</u>											
11/5C	15 —											
NZI I/	16 - 5.0											
-11/	17 18											
L L/Y	19 —											
N-CHA	20 6.0											
ABASE	21											
ואח פע	23 - 7.0											
ACYLL	24 –											
9 = L/LEG	25 —											
BRUNE	26 <u>+</u> 8.0											
	28 -											
SAUG	29 -											
NISSIM	30 - 9.0											
N:/CA/	31 - 1											
Г.	32 -											

REFERENCE No.:	11205379								ENCLOSURE No.: 12
6		BOREHOLE No.:			BH1	2		B	OREHOLE REPORT
5		ELEVATION:		81.	27 m			_	Page: <u>1</u> of <u>1</u>
CLIENT:	Infrastructure Ontario (I. Preliminary Geotechnica Ontario Campus	O.) al Investigation - Childre	n's I	Hospital	of Ea	astern	I	LEC	<u>SEND</u> SS - SPLIT SPOON
LOCATION:	401 Smyth Road, Ottaw	a, Ontario							
DESCRIBED BY:	R. V. Tillaart	CHECKED BY:		A. Sord	ur			Ţ	- WATER LEVEL
DATE (START): _	December 4, 2019	DATE (FINISH)		Decem	ber 4,	2019)		
NORTHING:	5027580.895	EASTING:		448953	.963				
Depth Elevation (m) BGS	Stratigraphy DESCE SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear test (Cu) Sensitivity (S) ○ Water content (%) ↓ Atterberg limits (%) ● "N" Value (blows / 12 in30 cm)
Feet Metres 81.27	GROUN	D SURFACE			%			N	10 20 30 40 50 60 70 80 90
$ \begin{array}{c} 0 \\ 1 \\ 2 \\ - \\ 2 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$	ASPHALT : 75 mr FILL : SAND and GRAV dense	n/ EL, brown, moist,	\mathbb{N}	SS1	58	5	25-30-14-8	44	
$3 - 0.84 \\ - 1.0 \\ 4 - 1 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ - 1.0 \\ -$	NATIVE : SM-SILTY SAND brown/grey, moist Gravel : 18%, San	with gravel, some clay, compact to dense d : 52%, Silt : 19%,		SS2	75	4	3-5-15-33	20	
	Clay : 11%		M	SS3	76	11	7-15-17-50/ 75mm	32	
	SHALE, complete	y weathered, grey	X	SS4	38	7	38-50/ 75mm	50+	
10 <u>-</u> 3.0			-	SS5	0		50/ 25mm	50+	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	END OF BOREHO	<u>LE :</u>		SS6	0		50/ 0mm	50+	→ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓
14	NOTE : - End of Borehole - Borehole was dr - bgs donates 'bel	at 3.81 m bgs / upon completion ow ground surface'							
$ \begin{array}{c} 19 \\ 20 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$									
21 + 22 + 7.0									
26 – 8.0 27 – 8.0									
28 — 29 — 4 9 0									
30									
32 -									

REFERENCE No.: 11205379								ENCLOSURE No.: 13
CUD	BOREHOLE No.:			BH1	3		B	OREHOLE REPORT
GHD	Elevation:		81.	<u>37 m</u>			_	Page: <u>1</u> of <u>1</u>
CLIENT: Infrastructure Ontario (I.	0.)	a'e	Hocnital	ofE	actorn		LEC	GEND
PROJECT: Ontario Campus	a mesugation - Childre	15	riospital		astern		\boxtimes	SS - SPLIT SPOON
LOCATION:401 Smyth Road, Ottaw	a, Ontario							ST - SHELBY TUBE AU - AUGER PROBE
DESCRIBED BY: <u>R. V. Tillaart</u>	CHECKED BY:		A. Sorc	our			Ţ	- WATER LEVEL
DATE (START): December 4, 2019	DATE (FINISH):	_	Decem	ber 4	, 2019)		
NORTHING: 5027562.877	EASTING:		448996	.612				
ADSEAD Depth Depth BGS (m) BGS	RIPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear test (Cu) △ Field Sensitivity (S) □ Lab ○ Water content (%) ↓ ↓ ↓ Atterberg limits (%) ● "N" Value (blows / 12 in30 cm)
Feet Metres 81.37 GROUN	D SURFACE			%			Ν	10 20 30 40 50 60 70 80 90
ASPHALT : 75 mn	n _/	M	SS1	83	6	16-12-12-9	24	
2 2 SAND and GRAVI	EL, brown, frozen,	Δ	001	00	Ŭ	10 12 12 0		
3 1.07 80.61 NATIVE : 4 1.07 80.30 SM-SILTY SAND,	some clay, very dense	4	SS2	71	7	10-12-50/ 125mm	50+	
5 - SHALE, completel	y weathered, grey		SS3	33	4	15-50/ 100mm	50+	0
		\times	SS4	12		50/	50+	
<u>8 – 2.37</u> 79.00 <u>END OF BOREHO</u>	<u>LE :</u>					75mm		
NOTE :								
Image: 11 - End of Borehole Image: 11 - End of Borehole	at 2.37 m bgs / upon completion							
3 12 - bgs donates 'belo	ow ground surface'							
16 5.0								
20 - 6.0								
29 + 0								
§ 31 <u>−</u>								

,	REFEREN	CE No.	:	11205379								ENCLOSURE No.: 15
		6			BOREHOLE No.			BH1	4		B	OREHOLE REPORT
					ELEVATION:		81.	<u>17 m</u>				Page: <u>1</u> of <u>1</u>
n	CLIENT: _	:	Infra Preli Onta	astructure Ontario (I. iminary Geotechnica ario Campus	O.) al Investigation - Childre	en's	Hospita	l of Ea	astern	1	<u>LE0</u>	GEND SS - SPLIT SPOON
7//1/1	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							ST - SHELBY TUBE
ate:	DESCRIBE	ED BY:	<u>R.</u> V	′. Tillaart	CHECKED BY:		A. Sord	bur			⊥⊔ Ţ	- WATER LEVEL
	DATE (STA	ART):	Dec	ember 4, 2019	DATE (FINISH)	: _	Decem	ber 4	, 2019)		
N+H-1-	NORTHING	G:	5027	7560.884	EASTING:		448919	.434				
OIL LUG WITH GR	Depth	Elevation (m) BGS	Stratigraphy	DESCR SOIL AN	IPTION OF D BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) $\blacksquare_{w_p} W_i$ Atterberg limits (%) \blacksquare "N" Value (blows / 12 in30 cm)
Ë	Feet Metres	81.17		GROUN	D SURFACE			%			Ν	10 20 30 40 50 60 70 80 90
VUZ.GLB Kep	2 <u>-</u> 0.08 1 <u>-</u> 2 <u>-</u>	81.09		ASPHALT : 75 mn FILL : SAND and GRAVI compact	EL, brown, frozen,	\mathbb{Z}	SS1	83	6	29-14-6-2	20	
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	80.36 80.16		, NATIVE : ∖SM-SILTY SAND, ∖brown/grey, moist,	some clay, very dense	Ā	SS2	100	9	15-36-50/ 25mm	50+	
FIIE: GHU	5 6 2.0			SHALE, completel	y weathered, grey	X	SS3	45	7	36-50/ 125mm	50+	○ ●
J LIDFALY	7 <u>-</u> 2.32 8 <u>-</u> 2.32	78.85				-	SS4	0		50/ 25mm	50+	• • • • • • • • • • • • • • • • • • •
104/11/15/15/20104 - 111 BRUNEL/EEGACT/EOG DATABASE(8-CHAR/11111201120031112003-4112003/8- REVISED/GF	$\begin{array}{cccccccccccccccccccccccccccccccccccc$			END OF BOREHO NOTE : - End of Borehole - Borehole was dry - bgs donates 'belo	LE : at 2.32 m bgs / upon completion ow ground surface'							
LIE. N	32 —											

ſ	REFERENCE	No.:	11205379								ENCLOSURE No.: 14	
				BOREHOLE No.:	_		MW	14		B	OREHOLE REPORT	
				ELEVATION:		81	.2 m				Page: <u>1</u> of <u>2</u>	
	CLIENT: Infr	astructur	re Ontario (I.O.)	PROJECT: _P	reli	minary (Geote	chnica	al Investigat	ion	LEGEND	
	LOCATION:	401	Smyth Road, Ottaw	a, Ontario							SS - SPLIT SPOON	
	DRILLING RIG	: Trac	ck Drill Rig	DRILLING MET	HO	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	s ST - SHELBY TUBE	
	DESCRIBED B	SY: <u>S. V</u>	Vallis	CHECKED BY:	_	A. Kha	ndeka	ır			▼ - WATER LEVEL	
771	DATE (START)): <u>5 Ju</u>	ıly 2022	DATE (FINISH)	_	5 July 2	2022					
3/I: :)/S	NORTHING:	502	7581.3 m	EASTING:	_	448971	l.5 m			1		
GRAPH+WELL US	Depth	(m) Stratigraphy	DESCR SOIL AN	LIPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) W_{p} M, Atterberg limits (%) \bigcirc "N" Value (blows / 12 in30 cm)	
	Feet Metres 81.	.2	GROUN	D SURFACE				%			10 20 30 40 50 60 70 80 90	Tor I
S/ & SUIL LUG			ASPHALT : 75 mn FILL : SW-SM-SAND an moist, compact	n/ d GRAVEL, brown,	X	SS1	100	4	3-8-9-8	17	0.2 m - 3 m	
	3 <u>1</u> 0.8 80. 3 <u>1</u> 1.0 4 <u>1</u>	4	NATIVE : SM-SILTY SAND, brown/black, mois	some clay, t, loose to very dense	X	SS2	100	8	3-2-4-8	6	Screen	
פרפ	5 <u>-</u> 1.6 79. 6 <u>-</u>	6	SHALE-BEDROCI	K, weathered, grey		SS3	100	10	50/ 100mm	50+	1.5 m	
	7 - 2:0 79. 8 9 3.0 11		SHALE-BEDROCI shale partings, ver with calcites, mode weathered, thinly b moderately fractur strong clay seams	K, shattered limestone, tical fractures infilled erately to highly bedded, highly to ed, grey, very weak to		RC1	77		0			
KEA.GPJ LIDIARY FILE: 1	$ \begin{array}{c} 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16 \\ 16$					RC2	65		43		4.6 m=	
ABASE/112033/9 - 1040 AF	$ \begin{array}{c}$					RC3	100		57			
	$22 - \frac{1}{23} - 7.0$ $24 - \frac{1}{25} - \frac{1}{26}$ $26 - \frac{1}{26} - \frac{1}{26}$		shale layers			RC4	87		67		7.6 m=	
IN.ICAN UNUNI UN NUTER I 3/00	27					RC5	100		98		8.2 m	

REFERENCE No.: 11205379								ENC	LOS	URE	No.:		14	1
	BOREHOLE No .:			MW	14		B	OR	EF	IOI	_E I	RE	PO	RT
GHD	ELEVATION:		81	.2 m			_		Page	: _2	2	of _	2	
CLIENT: Infrastructure Ontario (I.O.)	PROJECT: Pr	elir	ninary (Geote	chnica	al Investigat	ion	LE	GEI	ND				
LOCATION:401 Smyth Road, Ottaw	a, Ontario							\boxtimes	SS	-	SPLI	T SF	voon	I
DRILLING RIG: Track Drill Rig	DRILLING METH	HOI	D: 203	mm C	D Ho	llow Stem A	ugers		ST RC	-	SHEL	BY		Ξ
DESCRIBED BY: <u>S. Wallis</u>	CHECKED BY:		A. Kha	ndeka	ır			Ţ		-	WAT	ERI		L
DATE (START): <u>5 July 2022</u>	DATE (FINISH):		5 July 2	2022										
NORTHING: 5027581.3 m	EASTING:		448971	l.5 m	1	1	1							
Depth Depth Depth Depth Contraction (m) (m) (m)	RIPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	She Sen O W _p W ₁	ar tes sitivit Wate Atter "N" V ws / 1	st (Cu) y (S) er con berg l alue 2 in) itent (% limits (' 30 cm)	5) %)	∆ Fielo ∃ Lab	F
Feet Metres 81.2 GROUN	D SURFACE				%			10	20 30	0 40 9	50 60	708	0 90	
			RC6	100		88								
														-
36 <u>11.8</u> 70.2		I										1.0		
	<u>LE :</u>									-		+		-
38 - NOTE :														1
39	at 10.98 m bgs ı 2.08 m bgs													-
40 - Deep and Shallo 5 - Deep and Shallo installed at 7.62 m	w monitoring well and 1.52 m bgs									-				-
41 – respectively	ow ground surface']
² 42 → 13.0 Groundwater leve	el measurements													-
2 43 – (Deep) 2 44 – Date Del	oth (m) Elev (m)													_
44 - 07/21/2022 2	87 78.36 90 78.33									_		-		-
46 – 14.0 Groundwater leve	el measurements													-
47 – (Shallow) Date Det	oth (m) Elev (m)													-
	63 79.58 65 79.56												_	-
49														-
													_	-
52 - 16.0														-
														-
													_	-
5 5 <u>-</u> 17.0														-
														-
§ 59 – 18.0														-
														-
									+	+	+			-
													\square]
														1
									+	-	+			-
														1

DORTHOLE No: BH15 DERCHOLE REPORT LEVATION: B12m Page 1 of 1 CLIENT: Infrastructure Ontario (1.0.) PROJECT: Preliminary Gedeethnical Investigation Page 1 of 1 CLIENT: Infrastructure Ontario (1.0.) PROJECT: Preliminary Gedeethnical Investigation Page 1 of 1 DRILLING RIG: Track Dall Rig DRILLING METHOD: 203mm OD Hollow Stem Auges S \$\$ SPLIT SPOON DRECENCE DB: O.A.h. CHECKED DP: A.A.H. CHECKED DP: A.G. Hold Karr DATE (START): 16 July 2022 DATE (PINSH): 16 July 2022 ONTHINS: SBC 200 (000 (000 (000 (000 (000 (000 (000	_	REFEREN	ICE No.	:	11205379								ENC	LOS	URE	No.: _		15	
ELEVATION: bl 2m Page: 1 d CLIENT: Infrastructure Ontario (LO.) PROJECT: Preliminary Geotechnical Investigation Image: Client Cli						BOREHOLE No.			BH1	5		B	OF	REF	IOL	E F	REP	POF	۲۲
CLENT: Infrastructure Ontario (L.G.) PROJECT: Preliminary Geotechnical Investigation LECEND DCLLING: 401 Smyth Road, Ottawa, Ontario DRILING RET Track Anil Rig DRILING METHOD: 203mm OD Hollow Stem Augent SS - SPLIT SPOON DESCRIEDED VID. Ach CHECKED BY: A Khandekar - +ROCK CORE						ELEVATION:		81	.2 m			_	•••	Page	: _1	o	f _1	_	•••
LOCATION: 401 Shyth Road, Ottawa, Ontario Set 11 SPOCM DRILLING RIG: Track Drill Rig DRILLING RIG: Set 11 SPOCM DESCRIBED 8Y: D. Alm CHECKED BY: A. Knandekar DATE (STRAT): 16 July 2022 DATE (FINISH): 16 July 2022 NORTHING: S007585.6 m EASTING: 448950.5 m Geo Big DESCRIPTION OF SOIL AND BEDROCK Big		CLIENT:	Infrast	tructur	re Ontario (I.O.)	PROJECT: _F	reli	minary	Geote	chnica	al Investigat	ion	L	EGEI	ND				
DRLLING RIG: Track Drill Rg DRILLING METHOD: 203mm OD Holow Stem Auges Image: Stem Construction Stellast Total DATE (START): 16.July 2022 DATE (FINISH): 16.July 2022 WATER LEVEL NORTHING: 502755.6 m EASTING: 448950.6 m Stem Augestick Stem Stem Right (Stem Rec) Stem Augestick Attinue total Attinue		LOCATIO	N:	401	Smyth Road, Ottaw	a, Ontario							\geq] ss	- :	SPLIT	SPO	ON	
DESCRIBED BY: D. An. CHECKED BY: <u>A. Khandekar</u>		DRILLING	RIG:	Trac	ck Drill Rig	DRILLING MET	ΉО	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers		ST RC		SHELI ROCK	BY TI	JBE RF	
DATE (\$TART): 19.July 2022 DATE (FINISH): 16.July 2022 NORTHING: 5027586.6 m EASTINC: 44880.5 m Solution Clab g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g g		DESCRIBI	ED BY:	<u>D.</u> A	Ash	CHECKED BY:	_	A. Kha	ndeka	ar			ļ	2	- '	WATE	RLE	VEL	
NORTHINC: 5027585.6 m EASTING: 448950.5 m E B B DESCRIPTION OF SOIL AND BEDROCK B B Bows prof B B Share thet C(1) CM Water content (%) CM Water content (%) C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C	77	DATE (ST	ART):	16 J	July 2022	DATE (FINISH)	: _	16 July	2022	2									
End End DESCRIPTION OF SOIL AND BEDROCK Bit of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second sec	1/8/L	NORTHIN	G:	502	7585.6 m	EASTING:		448950).5 m		I	1							
Pet Metres 812 GROUND SURFACE % 10.20.30.40.50.60.70.80.90 1 -0.1 81.1	GRAPH+WELL UA	Depth	Elevation (m)	Stratigraphy	DESCR SOIL ANI	IPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shi Sei O W _P W (blo	ear tes nsitivit Wate Atter "N" V ows / 1	st (Cu) y (S) er cont berg li 'alue 2 in3	ent (%) mits (%	△ □)	Field Lab	
1 0.1 81.1 ASPHAL 1: /s mm 1 0.5 80.5 SS1 71 3 10.78.5 15 0 2 0.6 80.5 SS3 SS1 71 3 10.78.5 15 0 0 3 -1.0 SM-GRAVELLY SMD some sit, trace day, nown, most, compact Gravet : 25%, Sand: 47%, Sit: 9%, Clay, 2% SS2 42 6 2-24.5 6 0 0 4 - SM-GRAVELLY SAND some sit, trace day, nown, most, compact Gravet : 25%, Sand: 46%, Sit: 19%, Clay, 100, nown, 1		Feet Metres	81.2		GROUN	D SURFACE				%			10	20 30	0 40 5	0 60 7	0 80 9	90	
1 - 0.5 80.6 SW-SM-SAND and GRAVELL, trace sit, trace Grave 1: 43%, Sand 1:47%, Sitt :8%, Clay With Clay in the second second most compact Grave 1:25%, Sand 1:40%, Sitt :8%, Clay With Clay in the second se	L L UG	0.1 	81.1		FILL :	<u> </u>	1//												
2 0.6 80.6 -2% 3 -1.0 -1.0 SS2 42 6 2-24-5 6 4 -1.0 -1.0 SS2 42 6 2-24-5 6 5 -1.5 -1.5 SS3 100 9 9-14-11-50/ 25 0 10 6 -1.8 79.4 Borehole terminated due to spoon and auger refusal SS3 100 9 9-14-11-50/ 25 0 10 7 -2.0 -2.5 -5.6 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 -5.7 <t< td=""><td>03/9 201</td><td>1</td><td></td><td></td><td>SW-SM-SAND and trace clay, brown, Gravel 43% San</td><td>d GRAVEL, trace silt, moist, compact d · 47%_Silt · 8%_Clav</td><td>Ŵ</td><td>SS1</td><td>71</td><td>3</td><td>10-7-8-5</td><td>15</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	03/9 201	1			SW-SM-SAND and trace clay, brown, Gravel 43% San	d GRAVEL, trace silt, moist, compact d · 47%_Silt · 8%_Clav	Ŵ	SS1	71	3	10-7-8-5	15							
3 - 1.0 SM-GRAVELLY SAND, some sill, tace Gravel : 25%, Sand : 46%, Sill : 19%, Clay : 10% SS2 42 6 2-2-4-5 6 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -<		2 0.6	80.6		: 2% NATIVE :	/	\int												
4 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	C Kepo	3			SM-GRAVELLY SA	AND, some silt, trace loose to compact	X	SS2	42	6	2-2-4-5	6	┥						
5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 -1.5 <t< td=""><td>ND.GLE</td><td>4</td><td></td><td></td><td>Clay : 10%</td><td>a : 46%, Silt : 19%,</td><td>\square</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	ND.GLE	4			Clay : 10%	a : 46%, Silt : 19%,	\square												
5 - 1.5 6 - 1.8 7 - 2.0 7 - - 8 - 2.5 9 - - 10 - 3.5 10 - - 10 - - 10 - - 10 - - 10 - - 10 - - 9 - - 11 - - - - - 11 - - - - - 13 - 4.0 14 - - 15 - - 16 - 5.0 17 - - 18 - 5.5 19 - -	> E 2	+					N							$\mathbf{\lambda}$					
6 1.8 79.4 Borehole terminated due to spoon and auger refusal 7 - - - - 8 - 2.5 - - 9 - - - - 10 - 3.0 - - - 11 - 3.5 - - - 13 - 4.0 - - - 14 - - - - - 15 - - - - - 16 - - - - - 18 - 5.5 - - - - 19 - - - - - -		5 1.5					Ŵ	SS3	100	9	9-14-11-50/ 100mm	25		•				$\left \right $	
7 - 2.0 END OF BOREHOLE: NOTE: - - - 8 - 2.5 - - 9 - - - - 10 - 3.0 - - - 11 - - - - - 13 - 4.0 - - - 14 - - - - - 14 - - - - - 13 - 4.0 - - - 14 - - - - - 15 - - - - - 16 - 5.5 - - - - 18 - 5.5 - - - - - 19 - - - - - - - 18 - 5.5 - - - - - - <t< td=""><td>ה פער</td><td>6 - 1.8</td><td>79.4</td><td></td><td>Borehole terminate</td><td>ed due to spoon and</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	ה פער	6 - 1.8	79.4		Borehole terminate	ed due to spoon and													
8 - 2.5 .End of Borehole at 1.78 m bgs 9 - .End of Borehole at 1.78 m bgs 10 - 3.0 11 -	12021	2.0 7				F.												\square	
8 - 2.5 - End of Borehole at 1.78 m bgs 9 - - Dorehole was dry upon completion 10 - 3.0 11 - - - 3.5 - 12 - - - - - 13 - 4.0 14 - - 15 - - 16 - - - - - 18 - 5.5 19 - -	LIE:				NOTE :	<u></u>													
$\begin{array}{c} 9 & -1 \\ 10 & -3.0 \\ 11 & -4.5 \\ 13 & -4.0 \\ 14 & -1 \\ 15 & -4.5 \\ 16 & -5.0 \\ 17 & -4.5 \\ 18 & -5.5 \\ 19 & -4.5 \\ 19 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 & -4.5 \\ 10 &$	LIDrary	8 2.5			- End of Borehole - Borehole was dry	at 1.78 m bgs upon completion													
$ \begin{array}{c} 10 & - & 3.0 \\ 11 & - & 3.5 \\ 12 & - & & & \\ 13 & - & 4.0 \\ 14 & - & & & \\ 15 & - & 4.5 \\ 16 & - & 5.0 \\ 17 & - & & & \\ 18 & - & 5.5 \\ 19 & - & & & \\ 19 & - & & & \\ 19 & - & & & \\ 19 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 11 & - & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ 10 & - & & & \\ $	- 657	9 —			- bgs donates 'belo	ow ground surface'													
$ \begin{array}{c} 11 \\ - \\ - \\ 3.5 \\ 12 \\ - \\ - \\ 13 \\ - \\ 4.5 \\ - \\ 14 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$	AKEA	10 3.0																+	
$ \begin{array}{c} 11 \\ - \\ 3.5 \\ 12 \\ - \\ - \\ 13 \\ - \\ 4.0 \\ - \\ 14 \\ - \\ - \\ 15 \\ - \\ - \\ - \\ 5.0 \\ 17 \\ - \\ 18 \\ - \\ 5.5 \\ 19 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$	- 1D4C	+																+	
$ \begin{array}{c} 12 \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ - \\ -$	3/2GUZ	- 3.5																\square	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	SASE/1	12 —																	
$ \begin{array}{c} $	5 DA IAE	13 - 4.0																	
$ \begin{array}{c} $		-+ - 14																+	
$ \begin{array}{c} 10 \\\\ 16 \\\\\\\\\\\\ 17 \\\\\\ 18 \\\\\\\\\\\\\\\\\\\\ -$	19379/1E												$\left \right $					+	
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		- 5.5											\vdash	+				+	
		19											$\left \right $					+	

REFERENCE N	o.: <u>11205379</u>								ENCLOSURE No.: 16
		BOREHOLE No.:			BH1	6		B	OREHOLE REPORT
	GHD	ELEVATION:		81	.0 m				Page: <u>1</u> of <u>1</u>
CLIENT: Infra	astructure Ontario (I.O.)	PROJECT: P	relir	minary (Geote	chnica	al Investigat	ion	<u>LEGEND</u>
LOCATION:	401 Smyth Road, Ottaw	a, Ontario							SS - SPLIT SPOON
DRILLING RIG:	Track Drill Rig	DRILLING MET	HOI	D: <u>203</u>	mm C	D Ho	llow Stem A	lugers	ST - SHELBY TUBE
DESCRIBED B	/: D. Ash	CHECKED BY:		A. Kha	ndeka	ar 📃			
DATE (START):	12 July 2022	DATE (FINISH):		17 Dec	embe	er 202	2		
NORTHING:	5027602.7 m	EASTING:		448967	7.8 m				Shear test (Cu) A Field
Depth Elevation	Stratig Stratig SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Sensitivity (S) \Box Lab O Water content (%) $W_p W_l$ Atterberg limits (%) • "N" Value (blows / 12 in30 cm)
Feet Metres 81.0	GROUN	D SURFACE				%			10 20 30 40 50 60 70 80 90
	ASPHALT : 75 mr FILL : SW-SM-GRAVEL trace clay, brown, Gravel : 33%, Sar	n LY SAND, trace silt, moist, compact d : 56%, Silt : 8%, Clay		SS1	71	3	7-13-6-4	19	0 •
2 - 0.6 80.4 - 3 - 1.0	NATIVE : SM-SILTY SAND, clay, brown, moist	some gravel, trace , loose	$\left \right\rangle$	SS2	71	7	4-4-4-6	8	
$\begin{array}{c c} & - & \\ 4 & - & 1.2 \\ & - \\ & - \\ & - \\ 5 & - & 1.5 \end{array}$	SHALE-BEDROC brown	K, weathered, light	\mathbb{N}	SS3	100	6	39-42-50/ 100mm	92/ 254mn	0
	Borehole terminat	ed due to spoon and	Ť						
	END OF BOREHO	<u>LE :</u>							
	NOTE : - End of Borehole	at 1.62 m bgs							
8 - 2.5	- bgs donates 'bel	ow ground surface'							
9 -									
+ 3.5 12 -									
15 - 4.5									

	REFEREN	CE No.	:	11205379								ENCLOSU	RE No.:	1	7
					BOREHOLE N	lo.: _		MW	17		B	OREH	OLE F	REPO	RT
		Ĩ			ELEVATION:		80	.9 m			_	Page:	<u>1</u> c	f <u>1</u>	
	CLIENT:	Infrast	tructur	e Ontario (I.O.)	PROJECT:	Preli	minary	Geote	chnica	al Investigat	ion	LEGEN	<u>2</u>		
	LOCATION	1:	401	Smyth Road, Ottaw	a, Ontario							🖂 ss	- SPLI	SPOON	1
	DRILLING	RIG:	Trac	k Drill Rig	DRILLING M	IETHC	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	ST BC	- SHEL		Ξ
	DESCRIBE	D BY:	D. A	sh	CHECKED E	BY: _	A. Kha	ndeka	ar			⊥ KU I	- WATI	ER LEVE	L
77	DATE (STA	ART):	11 J	uly 2022	DATE (FINIS	SH): _	11 July	2022	2						
te: 1/9/	NORTHING	G:	502	7603.8 m	EASTING:		448944	1.2 m							
GKAPH+WELL Ua	Depth	Elevation (m)	Stratigraphy	DESCR SOIL ANI	IPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shear test Sensitivity (Water Atterbe W _p W ₁ M'' Valu (blows / 12	Cu) S) content (% erg limits (% ue in30 cm)	∆ Fiel □ Lab) 6)	d
HIN	Feet Metres	80.9		GROUN	D SURFACE				%			10 20 30	40 50 60	70 80 90	
P C C	° 0.1	80.8	\bigotimes	_ ASPHALT : 75 mm FILL :	1	-								0.2 m	
102878 20IL	1			SM-GRAVELLY S/ clay, brown, moist, Gravel : 22%, San	AND, some silt, trace , compact to loose d : 53%, Silt : 16%,		SS1	54	2	8-6-4-2	10		be	 ntonite 0.6 m—	-
eport: 112	2 0.6	80.3		Clay : 9% NATIVE : SM-SILTY SAND,	some gravel, trace	$\overline{\mathbf{A}}$	662	71	0	1_3_5_1	8				
JD.GLB R	4 1.0			clay, brown, moist,	loose	Δ	002		5	1-0-0-4	0				
	1.3 5 1.5	79.6		SHALE-BEDROCH	K, weathered, brown	Ř	SS3A SS3B	100	 8	 5-50/ 75mm	 50+			screen	
J GHU_GE	6 - 1.8	79.1		Borehole terminate	ed due to spoon and									1.8 m=	
2053/	2.0			auger refusal	_										-
IIe: 11				END OF BOREHO	<u>LE :</u>										-
GPJ LIDRARY F	8 2.5 9			 NOTE : End of Borehole : Borehole was dry Monitoring well ir bgs donates 'below 	at 1.78 m bgs / upon completion istalled at 1.78 m bgs ow ground surface'	5									-
4C AREA.				Groundwater leve Date Dep	l measurements oth (m) Elev (m)										-
UI - 875G				07/22/2022 1.0 07/28/2022 1.0	64 79.27 64 79.27										-
SASE/112															
OG DATA	13 - 4.0														-
9/IECH/L	14 —														
2/112023/	15 - 4.5														-
09\SIC	16 —														
JUPROJE	17 - 5.0														-
ORONIC	18 5.5														
9: N:\CA\I	19 —														
Ĩ	-														

1	REFERENCE	E No.:	11205379								ENCLOSURE No.: 18
				BOREHOLE No .:			MW	18		B	OREHOLE REPORT
			2	ELEVATION:		81	.0 m				Page: <u>1</u> of <u>1</u>
	CLIENT: Ir	nfrastruc	cture Ontario (I.O.)	PROJECT: Pr	elir	minary	Geote	chnica	al Investigat	ion	LEGEND
	LOCATION:	4	01 Smyth Road, Ottaw	a, Ontario							SS - SPLIT SPOON
	DRILLING RI	IG: <u>T</u>	rack Drill Rig	DRILLING METH	ю	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	ST - SHELBY TUBE
	DESCRIBED) BY: _ <u></u>). Ash	CHECKED BY:		A. Kha	ndeka	ır			▼ - WATER LEVEL
7716	DATE (STAR	RT): <u>1</u>	6 July 2022	DATE (FINISH):		16 July	2022				
3/I: :)/S	NORTHING:	5	027616.5 m	EASTING:		448962	2.0 m			1	
GKAPPH+WELL US	Depth	Elevation (m)	Aude DESCR SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) \blacksquare_{W_p} M, Atterberg limits (%) \blacksquare "N" Value (blows / 12 in30 cm)
	Feet Metres 8	81.0	GROUN	D SURFACE				%			10 20 30 40 50 60 70 80 90
11203379 SUIL LUG	1 0.5 2 0.6 8	80.9	ASPHALT : 75 mr FILL : GW-GM-SAND ar trace clay, brown, Gravel : 49%, San	n nd GRAVEL, trace silt, moist, compact d : 44%, Silt : 5%, Clay	M	SS1	79	3	5-9-8-8	17	0.2 m 0 •bentonite 0.6 m
VUD.GLB REPORT		80.2	MATIVE : SM-SILTY SAND, clay, brown, moist SM-GRAVELLY S clay, brown, moist very dense	some gravel, trace , compact AND, trace silt, trace to wet, compact to	X	SS2	71	13	3-10-10-6	20	
	5 1.5		Gravel : 35%, San Clay : 4%	d : 50%, Silt : 11%,	X	SS3	62	9	6-4-7-4	11	screen
112023/9 GH	6 2.0 7 2.1 7	78.9	Rorobolo terminat	ad due to speep and		SS4	100		50/ 0mm	50/ 0mm	2.1 m-
FII6:			auger refusal	ed due to spool and							
Library	8 2.5		END OF BOREHO	<u>LE :</u>							
ID4C AREA.GPJ	9 <u>-</u> 10 <u>-</u> 3.0		NOTE : - End of Borehole - Borehole was dr - Monitoring well ii - bgs donates 'bel	at 2.13 m bgs / upon completion hstalled at 2.13 m bgs ow ground surface'							
- 6/50	11 —		Groundwater leve	el measurements							
EVIIZU	- 3.5 12 -		07/22/2022 1.	52 79.45							
IABAS											
DG DA	¹³ — 4.0										
ECHL	14 —										
1/8/500211/2											
15/002	16 —										
RUJEC	17 - 5.0										
-NI CF											
ANI UKC	18 5.5										
	19 —										
E											

REFERENCE No.:	11205379								ENCLOSURE No.: <u>19</u>
		BOREHOLE No.:			BH1	9		B	OREHOLE REPORT
G		ELEVATION:		80	.3 m			_	Page: <u>1</u> of <u>1</u>
CLIENT: Infrastructu	ure Ontario (I.O.)	PROJECT: _P	relir	ninary (Geote	chnica	al Investigat	ion	LEGEND
LOCATION: 40	1 Smyth Road, Ottaw	a, Ontario							SS - SPLIT SPOON
DRILLING RIG: Tra	ack Drill Rig	DRILLING MET	HOI	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	ST - SHELBY TUBE
DESCRIBED BY: D.	Ash	CHECKED BY:		A. Kha	ndeka	ır			▼ - WATER LEVEL
DATE (START): <u>14</u>	July 2022	DATE (FINISH)	: <u> </u>	14 July	2022				
NORTHING: 502	27647.2 m	EASTING:		448901	.1 m				
Depth Elevation (m) Stratigraphy	DESCR SOIL ANI	IPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) $\biguplus_{p} W_{i}$ Atterberg limits (%) \bigcirc "N" Value (blows / 12 in30 cm)
Feet Metres 80.3	GROUN	D SURFACE				%			10 20 30 40 50 60 70 80 90
	FILL : SM-GRAVELLY S/ clay, grey, moist, c Gravel : 39%, San : 5%	AND, trace silt, trace ompact d : 47%, Silt : 9%, Clay	$\left \right\rangle$	SS1	42		23-7-3-2	10	
3 3 - 1.0	NATIVE : SM-SAND and GR clay, grey/brown, n Gravel : 37%, San Clay : 10%	AVEL, some silt, trace noist, compact d : 40%, Silt : 13%,	\mathbb{N}	SS2	100		3-4-9-8	13	 ▲ ■ ■
	Borehole terminate auger refusal	ed due to spoon and							
6	NOTE : - End of Borehole - Borehole was dry - bgs donates 'belo	at 1.37 m bgs y upon completion w ground surface'							
- 45									

REFERENCE No.: 1120	5379		ENCLOSURE No.: 20
	BOREHOLE No.:	BH20	BOREHOLE REPORT
GHD	ELEVATION:	81.2 m	Page: <u>1</u> of <u>1</u>
CLIENT: Infrastructure Ontario	(I.O.) PROJECT: Pr	reliminary Geotechnical Investi	igation LEGEND
LOCATION: 401 Smyth R	oad, Ottawa, Ontario		SS - SPLIT SPOON
DRILLING RIG: Track Drill Ri	DRILLING METH	HOD: 203mm OD Hollow Ster	MAUGERS
DESCRIBED BY: D. Ash	CHECKED BY:	A. Khandekar	▼ - WATER LEVEL
DATE (START): <u>14 July 2022</u>	DATE (FINISH):	14 July 2022	
NORTHING: 5027660.3 m	EASTING:	448923.8 m	
Depth Elevation (m) Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State Type and Number Recovery/ Moisture Content	per → → A Field N/ → A B Lab N/ → → A H N/ → → A H N/ → → A H N/ → → → A N/ → → A H N/ → → → A N/ → → → → N/ → → → N/ → → </td
Feet Metres 81.2	GROUND SURFACE	%	10 20 30 40 50 60 70 80 90
0 - 0.1 81.1 TOPSC 1 - FILL : 5 2 - 0.6 80.6 Gravel	IL/SOD : 100 mm TY SAND, some gravel, some pwn, moist, compact 15%, Sand : 55%, Clay : 11%,	SS1 50 5 2-7-8-	6 15 0 •
31.0 31.0 gravel,	% CLAYEY SILTY SAND, trace brown, moist, loose to very dense	SS2 83 5 2-3-3-	3 6
Gravel 5	6%, Sand : 42%, Silt : 31%, Clay	SS3 79 3-6-7-	8 13
7 – 2.0 7 – 2.2 79.0 SHALE	BEDROCK, weathered	SS4 100 6-27-5 125mr	0/ 77/ m 125mm
9 - 2.6 78.6 Boreho auger r	e terminated due to spoon and efusal		
10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 <	Borehole at 2.59 m bgs ble was dry upon completion bnates 'below ground surface'		

_	REFEREN	ICE No.	:	11205379								ENCLOSURE No.: 21
					BOREHOLE No.	:		BH2	21		B	OREHOLE REPORT
		ſ			ELEVATION:		81	.0 m				Page: <u>1</u> of <u>2</u>
Γ	CLIENT:	Infrast	ructur	e Ontario (I.O.)	PROJECT: _F	Preli	minary	Geote	chnica	al Investigat	ion	LEGEND
	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							SS - SPLIT SPOON
	DRILLING	RIG:	Trac	k Drill Rig	DRILLING MET	ΉО	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	ST - SHELBY TUBE
	DESCRIB	ED BY:	<u>S.</u> V	Vallis	CHECKED BY:		A. Kha	ndeka	ar			▼ - WATER LEVEL
771	DATE (ST	ART):	6 Ju	ly 2022	DATE (FINISH)	: _	6 July	2022				
3/I	NORTHIN	G:	502	7675.7 m	EASTING:		448916	6.2 m			1	
GRAPH+WELL US	Depth	Elevation (m)	Stratigraphy	DESCR SOIL ANI	IPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) $\blacksquare_{p,W_{i}}$ Atterberg limits (%) \blacksquare "N" Value (blows / 12 in30 cm)
	Feet Metres	81.0		GROUN	D SURFACE				%			10 20 30 40 50 60 70 80 90
SUL LUG		80 /		SOD : 50 mm FILL : SW-SM-SAND and	d GRAVEL, trace silt,		SS1	37	8	5-5-8-7	13	
R/SCUZIT	3 <u>-</u> 1.0	00.4		\grey/brown, moist, NATIVE : SM-SILTY SAND, grey/black_moist	trace gravel, brown to	ĺ	SS2	67	3	4-3-6-6	9	
LB Report:				grey/black, moist,	ouse to compact	X	SS3	50	6	4-8-10-5	18	
9.00 H	7 2.0					X	SS4	75	13	3-5-6-10	11	
	8	78.4			(abottored limestone		SS5	100		30	30	
	9 – 10 – 3.0			shale partings, ver with calcites, mode	tical fractures infilled erately to highly		RC1	100		0		
1200211 :	11 — <u> </u>			moderately fractures strong	ed, grey, very weak to							
IDLARY FIIG	13 <u>4</u> 4.0						RC2	100		9		
1.GPJ L												
D4C AKE	16 <u></u> 5.0 17 <u>-</u>											
L - 6/2002	18 — 19 —						RC3	100		43		
BASEVII	20 - 6.0											
DO DA IA	21 —		1111									
	23 <u>-</u> 7.0 24 <u>-</u>		իկկկկ				RC4	64		71		
VCCOZII	25											
170010	²⁶ – 8.0											
COLEC	21						RC5	95		77		
2420	29 —											
NOKO	30 - 9.0											
:/CA/I	31 —											
	32 —											

_	RE	FEREN	CE No.:		11205379								ENC	LOS	URE	E No.:		21	
						BOREHOLE No.:	_		BH2	21		B	OF	SEł	-10		REF	ORT	
			9	i HL		ELEVATION:		81	.0 m					Page	e: _	2 0	of _2		
	CL	IENT:	Infrast	ructur	e Ontario (I.O.)	PROJECT: _P	reli	minary	Geote	chnica	al Investigat	ion	L	EGE	ND				
	LO	CATION	N:	401	Smyth Road, Ottaw	a, Ontario							\triangleright	ss	3	- SPLI	T SPC	ON	
	DR	ILLING	RIG: _	Trac	k Drill Rig	DRILLING MET	но	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers] ST] R(-	- SHEI		JBE	
	DE	SCRIBE	ED BY:	<u>S.</u> W	/allis	CHECKED BY:		A. Kha	ndeka	ar			ļ	Ļ	-	- WAT	ER LE	VEL	
77	DA	TE (ST	ART): _	6 Ju	ly 2022	DATE (FINISH)	:	6 July	2022										
e: 1/9/	NC	RTHIN	G:	5027	7675.7 m	EASTING:		448916	6.2 m										
GKAPH+WELL Ua	4+C	nebru	Elevation (m)	Stratigraphy	DESCR SOIL AN	IPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shi Sei O w _p w (bli	ear te nsitivi Wa Atte "N" ows /	st (C ty (S) ter co rberg Value 12 in	u)) ontent (% g limits (' 30 cm)	△ □ %)	Field Lab	
H N	Feet	Metres	81.0		GROUN	D SURFACE				%			10	20 3	0 40	50 60	70 80	90	
POG.	34 -							RC6	100		88				$\left \right $		++	+	
a sol	35 —			1111			I											\square	
120021	- 36 —	-11:8	70.1				μ												
:::0	37 —				END OF BOREHO	<u>LE :</u>													
n Kep	38 —				NOTE :	at 10.95 m bas												+	
09.GL	39 —				- Borehole was dry	upon completion													
> E I I I I	40 —				- bgs donates 'belo	ow ground surface'													
EC H	41																	+	
	42 -	-13.0																	
93/9 (43																		
112(45 —																	+	
가면	46 —	-14.0																\square	
LIDIA	47 —																		
GPJ.	48 —																	+	
AKEA	49 —	-15.0																\square	
1D4C	50 —																		
- 6/20	51 -																		
E/1120	52 — -	-16.0																	
ABASI	53 — 54 —																		
G DAI	55 —																		
UH/LO	- 56 —	-17.0																	
/9/IE(- 57 —																		
12053	58 —																		
1/2001	59 —	-18.0												_				+	
	60 —																	\square	
UPRO'	61 —																		
CNIC	62 —	-19.0																\square	
A/I UK	63 —																		
N:C	64 -													+	\vdash	+		+	
File:	65 —	F																11	

	REFER	INCE N	0.:	11205379								ENCLOSU	JRE No	.:	22
					BOREHOLE No.:	:		BH2	22		B	OREH	OLE		ORT
			Gil		ELEVATION:		80	.4 m				Page:	_1_	of <u>1</u>	_
	CLIENT	Infra	structu	re Ontario (I.O.)	PROJECT: _P	reli	minary	Geote	chnica	al Investigat	ion	LEGEN	ID		
	LOCATI	ON:	401	Smyth Road, Ottaw	a, Ontario							🖂 ss	- SP	LIT SPC	ON
	DRILLIN	G RIG:	Tra	ck Drill Rig	DRILLING MET	ΉО	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	⊠ ST ∏ RC	- SH - RC	IELBY TI OCK COF	JBE RE
	DESCR	BED B)	′: <u>D.</u>	Ash	CHECKED BY:		A. Kha	ndeka	ar			Ţ	- W/	ATER LE	VEL
7716	DATE (S	START):	14 、	July 2022	DATE (FINISH)	:	14 July	/ 2022	2						
ate: 1/8	NORTH	NG:	502	27664.6 m	EASTING:		448897	7.9 m		I			(2.)		
GRAPH+WELL US	Depth	Elevation (m)	Stratigraphy	DESCF SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shear test Sensitivity O Wate M, Attert W, W, O "N" Va (blows / 12	: (Cu) r (S) r content perg limit alue 2 in30 c	△ □ : (%) s (%) :rm)	Field Lab
	Feet Metr	es 80.4		GROUN	D SURFACE				%			10 20 30	40 50 6	50 70 80	90
L LOG	0.	1 80.3		SW-SM-SAND an	d GRAVEL, trace silt,	\mathbb{A}									
19 501	1 —			NATIVE :	, loose	X	SS1	50	12	6-2-3-4	5	•ρ			
PGNZLL	- 0.	5		SM-SILTY SAND, grey/brown, moist	trace gravel, , loose	\mathbb{N}									
:Lode	2 —														
2 LB	3 _					\mathbb{N}									
	1. -	0				IX	SS2	79	12	5-4-5-6	9	•			
	4 —														
ביפו	- 1.	4 79.0		Borehole terminat	ed due to spoon and										
3/9 6	5 1.	5													
GUZTT	6 -				<u>LC .</u>										
Y FIIE:	- 2.	o		- End of Borehole	at 1.37 m bgs										
LIDIA	7 –			- bgs donates 'bel	ow ground surface'										
7.GFJ															
	8 - 2.	5													
- 1D4(9 -														
ZU33/	+														
ASE/11	10 - 3.	0													
DALAB	+														
1/206	- 3	5													
	12 -														
120021	÷														
1/200/0	13 - 4.	D													\square
しててい															
NON	15 - 4.	5													
SICAN C	ł														
LIIE: N	16 —														

r	REFEREN	CE No.	:	11205379								ENCLO	JSUF		D.: _		23	
					BOREHOLE No.	: _		MW2	23		В	ORE	ЕНС	DLE	ΞF	REF	POF	RT
					ELEVATION:		82	2.9 m			_	Pa	age:	_1	of	2	_	
	CLIENT:	Infrast	ructur	e Ontario (I.O.)	PROJECT:	Preli	minary	Geote	chnica	al Investigati	on	LEG	SEND	<u>)</u>				
	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							\boxtimes	SS	- SI	PLIT	SPO	ON	
	DRILLING	RIG:	Trac	ck Drill Rig	DRILLING ME	гно	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	, ⊠ :	ST BC	- SI	HELI		JBE	
	DESCRIBE	ED BY:	D. A	sh	CHECKED BY		A. Kha	ndeka	ır			Ţ		- W		RLE	VEL	
22	DATE (STA	ART):	13 J	luly 2022	DATE (FINISH): _	13 July	/ 2022										
e: 1/9/.	NORTHING	G:	502	7676.3 m	EASTING:		44895	5.6 m										
GRAPH+WELL Dat	Depth	Elevation (m)	Stratigraphy	DESCR SOIL AN	IPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	Shear Sensit O V M _p W ₁ A • "h (blows	test (tivity (Vater o tterbe V" Valu s / 12 i	Cu) S) conter rg limi ie in30	nt (%) its (% cm)		Field Lab	
HIM	Feet Metres	82.9		GROUN	D SURFACE				%			10 20	30 4	0 50	60 7	0 80 9	90	
9 SOIL LOG	$\begin{array}{c} & - & 0.1 \\ 1 & - & - \\ 2 & - & - \\ 2 & - & - \end{array}$	82.8		ASPHALT : 75 mn FILL : SM-GRAVELLY S clay, brown, moist	AND, some silt, trace	\mathbb{Z}	SS1	67	3	10-18-18-14	36	0	•		().2 m		KA KX
rt: 1120537	3 1.0 4						SS2	100	5	10-20-26-15	46	0)				
GLB Repo	$5 - \frac{1}{4}$ $6 - \frac{1}{4}$ $- \frac{1}{4}$ 2 0			Gravel : 34%, San Clay : 5%	d : 48%, Silt : 13%,		SS3	75	6	15-26-15-28	41	0						
DIECH_V05	7 2.0						SS4	83	6	17-40-30-37	70	0			_ber	ntonite		
HD_GE(9 <u>-</u> 10 <u>-</u> 3.0					X	SS5	79	7	15-28-28-22	56	0		9				
205379 G	10 - 3.2 11 - 3.5	79.7 79.4	Ě	NATIVE : GM-SANDY GRAV	/EL, some silt, trace	Ŕ	SS6	100		6-50/ 125mm	+50							
ry File: 11	12 — 13 — 4.0			Gravel : 49%, San Clay : 6%	d : 32%, Silt : 13%,		SS7	100		50/ 0mm	+50			•				
sPJ Libra	14 — - 15 — -			SHALE-BEDROCI	<, weathered, grey		SS8	100		50/ 0mm	+50			•				
1D4C AREA.G	$\begin{array}{c} 16 & \\ & 5.0 \\ 17 & & 5.0 \\ & 5.0 \\ 18 & \end{array}$	77.9		auger/spoon refus SHALE-BEDROCI infilled with clay in	al K, occasional fractures fills, highly to slightly	\mathbf{T}										4.9 m		¥
11205379 -	19 - 19 - 19 - 19 - 10 - 10 - 10 - 10 -		կ դ դ դ դ դ	weathered, highly fractured, grey, ve strong	to moderately ry weak to medium		RC1	80		6								
ATABASE			144444	occasional clay an	d silt seams													
CH/LOG D	23 - 7.0						DC2	100		40								
205379/1E	24 — 25 — 						R62	100		48					s	creer		
IS\662\11;	26 <u>-</u> 8.0 27 <u>-</u>																	
ROJEC	28						DOG	100		45								
HOIN N	29 - 9.0						RC3	100		45		$ + ^{-1}$	+	-			\mathbb{H}	
10HOI	30 <u>+</u> 31															∍.∠ if san¢		
N:/CA/	32 —					╢										9.8 n		
File:	3310.0																	

,	REFEREN	CE No.	:	11205379								EN	CLOS	SURE	E No.:		23	}
					BOREHOLE No.:	_		MW2	23		B	OF	REI	HO	LE	RE	EPO	RT
					ELEVATION:		82	.9 m				•.	Pag	e: _	2	of	2	
	CLIENT:	Infrast	ructur	e Ontario (I.O.)	PROJECT: P	reli	minary	Geote	chnica	al Investigat	ion	L	EGE	ND				
	LOCATION	N:	401	Smyth Road, Ottaw	a, Ontario							\triangleright	s 🛛	5	- SPI	LIT S	POON	
	DRILLING	RIG: _	Trac	k Drill Rig	DRILLING MET	но	D: <u>203</u>	mm C	D Ho	llow Stem A	ugers	E	ן מ ח R	Г Э	- SHI - RO	ELBY CK C	' TUBE ORF	<u>:</u>
	DESCRIBE	ED BY:	D. A	sh	CHECKED BY:	_	A. Kha	ndeka	ır			2	<u>r</u>	0	- WA	TER	LEVE	L
122	DATE (ST	ART):	13 J	uly 2022	DATE (FINISH)	-	13 July	2022	2									
te: 1/9	NORTHIN	G:	502	7676.3 m	EASTING:		44895	5.6 m		I								
GRAPH+WELL Da	Depth	Elevation (m)	Stratigraphy	DESCR SOIL AN	RIPTION OF D BEDROCK	State	Type and Number	Recovery/ TCR(%)	Moisture Content	Blows per 15cm/ RQD(%)	'N' Value/ SCR(%)	ഗ്ഗ്റ⊥്റം കെ	ear te nsitiv Wa Atte "N" ows /	est (C ity (S ter co erbero Value 12 in	u)) ontent (g limits 30 cr	(%) (%) n)	△ Field □ Lab	1
WITH	Feet Metres	82.9		GROUN	D SURFACE				%			10	20 3	30 40	50 60	0 70	80 90	
L LOG	34					I	RC4	100		52					bento	nite :	seal	
79 SO	35 - 11 0					I												
112053	37 – 11.1 37 –	71.8			. –	┦										_11.1 	1 m	-
sport:	38 –				<u>LE :</u>													-
SLB R	³⁹ – 12.0			- End of Borehole	at 11.13 m bgs													-
_V05.0	40			- Monitoring well in	nstalled at 9.15 m bgs													-
DTECH	41			Groundwater leve														-
ID_GE(43 - 13.0			Date Dep 07/25/2022 5.1	oth (m) Elev (m) 29 77.61													-
379 GF	44 —			08/03/2022 5.	18 77.72													-
11205	45																	-
y File:	46																	-
Librar	48 -																	+
.GPJ	49																	-
S AREA	50 —																	-
- 1D4C	51																	-
205379	52 - 16.0																	
\SE\11	54 —												_					-
ATABA	55 -																	-
LOG D	5617.0																	-
VTECH	57																	-
205379	50 <u>–</u> 59 ––18.0																	+
362\112	60 -																	-
ECTS/	61 🕂															_		
PROJ	⁶² – 19.0											\square						-
RONTC														\square				ļ
CANTOF																		+
e: N:/C	66 - 20.0													\square				-
É	-																	



Clie	ent:			nfras	stru	ucture	e Ont	ario	(IO)									Lab	No.:				G22	256						
Pro	oject, S	Site:	Ge Ea	otec sterr	hni 1 O	ical lı ntari	nvest o, Ot	igati tawa	on , O	- C N	hilo	drer	ns H	losp	ital	of			Proje	ect	No.	:		112	053	79					
	Boreh	ole No.:						Ν	۸M	1									Samp	ole N	lo.:			SS3	+ S	S4					
	Depth	1:					1.5m-	2.1m	1/2	.3m	1 - 2	2.9m	ı				_		Enclo	sure	e:										
	¹⁰⁰ T																								7					0	
	90 -																							- 10							
	80 —																							20							
	70 -																								- 30						
sing	60 —																										40	ained			
ent Pas																											ent Reta				
Perce	50 —																										- 50	Perce			
	40 —																$\left \right $												60		
	30 —														/													++++	70		
	20 —								/																	80					
								~																							
	10 —	•	-	•																										- 90	
	0 L 0.00	1			0	0.01					(D.1	Diam	eter	(mm))		1						10					1	L 100 00	D
	Γ			Sil	tv C	lav										Sa	nd								Gra	vel					
				•	., .	,		P	artic	le-S	Size	F e Lin	Fine nits	as p	er U	scs	Mee (AS	diur TM	n D-2487	Co ')	arse	•	F	ine			Coar	se			
	ſ			s	oil	Desc	riptic	on							Gra	vel	(%)		s	Sand	I (%)			Cla	ay &	Silt	(%)			
	F	:	Silty S	Sand	wit	h Gra	ivel, 1	race	e Cla	ay						26				5	8					1	6				
	Ŀ																														
Re	marks	Silt-s	0.01 0.1 Diamet								size	part	ticles	s (<0	0.00)2 mm)): 5%	6		_											
		Gra	0.01 0.1 0.01 0.1 Diameter (m) Silty Clay Fine Particle-Size Limits as per Soil Description G Silty Sand with Gravel, Trace Clay Silt-size particles (0.074 to 0.002 mm): 11%, Clay-size p Gravel 26%, Sand 58%, Silt 11%, Clay 5% by:																												
Pei	forme	ed by:						Rid	dhe	e F	Par	ncha	al						-	Dat	e:			De	ecer	mbe	er 16	6, 20)19		
Vei	ified I	by:						Raj	Ka	dia	, C	.E.T	Γ.						-	Dat	e:			De	ecer	mbe	er 27	, 20)19		



Clie	ent:		Infrast	ructure C	Ontario ((IO)					Lab No.:	G2256				
Pro	ject, S	lite:	Geotech Eastern	nical Inve Ontario,	estigatio Ottawa,	on - Cł ON	hildrens	Hospita	al of		Project No.:	112053	79			
	Boreho	ole No.:			М	IW2					Sample No.:	SS3 + S	S4			
	Depth:			1.5	m-2.1m	/ 2.3m	- 2.9m				Enclosure:					
	100														0 10 20	
cent Passing	60														- 40	cent Retained
Per	40														- 60 - 70	Per
	20					-									- 80	
	0.001	•		0.01			0.1 Dia	meter (m		1		10			100)
									San	d		Gra	vel			
			Silty	Clay			Fin	e		Mediu	m Coarse	Fine	Coar	se		
					Pa	rticle-S	Size Limits	s as per	USCS	(ASTM	D-2487)					
			So	il Descrip	otion			G	ravel (%)	Sand (%)	Cla	y & Silt	(%)		
		:	Silty Sand v	vith Grave	I, Trace	Clay			32		48		20			
Re	narks:	<u>Silt-</u> Gra	size particle vel 32%, S	es (0.074 t Sand 48%	o 0.002 5, Silt 13	mm): 1 3%, CI	3%, Clay ay 7%	/-size pa	articles	(<0.0	02 mm): 7%					
Pei	forme	d by:			Ridd	lhee P	anchal				Date:	Decer	nber 16	6, 2019		
Vei	ified b	y:			Raj I	Kadia,	C.E.T.				Date:	Decer	nber 27	7, 2019		



Clie	ent:	Infrastructure Ontario (IO)		Lab No.:	G2256	
Pro	ject, Site:	Geotechnical Investigation - Ch Eastern Ontario, Ottawa, ON	ildrens Hospital of	Project No.:	11205379	
	Borehole No.:	MW3		Sample No.:	SS2	
	Depth:	0.8m - 1.4m		Enclosure:		
	90					0
	80					20
Passing	60					Retained 06
Percent	50					50 50 Bercent 60
	30					70
	10					90
	0.001	0.01	0.1 1 Diameter (mm)		10	100 100
		Silty Clay	Sand		Gravel	
		Particle-Si	Fine Mediu ze Limits as per USCS (ASTM	m Coarse D-2487)	Fine Coarse	
		Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)	
		Sand with Gravel and Silt	43	52	5	
Rei	marks:	avel 43%, Sand 52%, Silt 5%				
Per	formed by:	Riddhee Pa	anchal	Date:	December 16, 2019	9
Ver	ified by:	Raj Kadia, (C.E.T.	Date:	December 31, 2019	9



Clien	t:	Infrastructure Ontario (IO)		Lab No.:	G2256		_
Proje	ect, Site:	Geotechnical Investigation - Childre Eastern Ontario, Ottawa, ON	ns Hospital of	Project No.:	11205379		_
E	orehole No.:	MW3		Sample No.:	SS4		
0	epth:	2.3m - 2.9m		Enclosure:			
Percent Passing							0 10 20 30 50 50 50 50 50 50 50 50 50 5
	10						30 90
	0.001	0.01 0.1	Diameter (mm)		10		100
			Sand		Gravel		
		Silty Clay	Fine Mediu	m Coarse	Fine C	Coarse	
		Particle-Size Li	mits as per USCS (ASTM	D-2487)			
		Soil Description	Gravel (%)	Sand (%)	Clay &	Silt (%)	
		Silty Sand with Gravel, Trace Clay	16	59	2	5	
Rem	arks: <u>Silt-</u> Gra	size particles (0.074 to 0.002 mm): 17%, vel 16%, Sand 59%, Silt 17%, Clay 8	Clay-size particles (<0.00	02 mm): 8%			-
Perfo	ormed by:	Riddhee Panch	al	Date:	Decembe	r 16, 2019	_
Verif	ied by:	Raj Kadia, C.E	Т.	Date:	December	r 27, 2019	_



Clie	nt:	Infrastructure Ontario (IO)		Lab No.:	G2256		_
Pro	ject, Site:	Geotechnical Investigation - Childrens Eastern Ontario, Ottawa, ON	Hospital of	Project No.:	11205379		_
	Borehole No.:	MW4		Sample No.:	SS2		_
	Depth:	0.8m-1.4m		Enclosure:			_
	90						0 10
	80						20
61	70						30 8
Percent Passi	50						Percent Retair
	40						60
	30						70
	20						80
	10						90
	0.001	0.01 0.1 D	ameter (mm)		10	100	100
			Sand		Gravel		
		Fi Particle-Size Limi	ne Mediur ts as per USCS (ASTM	n Coarse D-2487)	Fine (Coarse	
		Soil Description	Gravel (%)	Sand (%)	Clay &	Silt (%)]
	Ş	Silty Sand, Some Gravel, Trace Clay	11	59	3	0	
Ren	narks: <u>Silt</u> Gra	-size particles (0.074 to 0.002 mm): 20%, Cla avel 11%, Sand 59%, Silt 20%, Clay 10%	ay-size particles (<0.00	02 mm): 10%			-
Per	formed by:	Riddhee Panchal		Date:	Decembe	r 16, 2019	_
Ver	fied by:	Raj Kadia, C.E.T.		Date:	Decembe	r 27, 2019	_



Clie	ent:	Infrastructure Ontario (IO)		Lab No.:	G2256		_
Pro	ject, Site:	Geotechnical Investigation - Childr Eastern Ontario, Ottawa, ON	ns Hospital of	Project No.:	11205379		-
	Borehole N	No.: MW5-19		Sample No.:	SS2 + SS3		_
	Depth:	0.9m-1.2m / 1.5m-1.7	1	Enclosure:			_
	100						
	90						0
	80					2	:0
	70					3	0
Passing	60					4	o Retained
ercent	50						ercent
ď.	40						е. ю
	20						0
	30						0
	20					8	0
	10					9	0
	0 L 0.001	0.01 0.1	Diameter (mm)		10	1 100	00
		Silty Clay	Sand		Gravel		
		Particle-Size L	Fine Mediu mits as per USCS (ASTM	m Coarse	Fine C	Coarse	
		Soil Description	Gravel (%)	Sand (%)	Clay &	Silt (%)]
		Silty Sand, Trace Gravel, Trace Clay	8	62	3	0	
							3
Rei	marks:	Silt-size particles (0.074 to 0.002 mm): 20%,	Clay-size particles (<0.0	02 mm): 10%			-
		Gravel 8%, Sand 62%, Silt 20%, Clay 10	%				-
Per	formed by	Riddhee Panc	al	Date:	Decembe	r 16, 2019	-
Ver	ified by:	Raj Kadia, C.E	Т.	Date:	Decembe	r 27, 2019	-


Clie	ent:	Infrastructure Ontario (IO)		Lab No.:	G2256	
Pro	ject, Site:	Geotechnical Investigation - Childrens Eastern Ontario, Ottawa, ON	Hospital of	Project No.:	11205379	
	Borehole No	.: MW7		Sample No.:	SS2	
	Depth:	0.8m - 1.4m		Enclosure:		
Percent Passing	100 90 80 70 60 50 40 30					0 10 20 30 40 50 60 70 80
	10					90
	0.001	0.01 0.1 Dia	meter (mm)		10	100 <u>100</u>
			Sand		Gravel	
		Silty Clay Fin	e Mediur	n Coarse	Fine Coarse	_
				D-2407)		
		Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
		Silty Sand, Some Clay , Trace Gravel	3	54	43	
Rer	narks: <u>s</u>	ilt-size particles (0.074 to 0.002 mm): 30%, Clay Gravel 3%, Sand 54%, Silt 30%, Clay 13%	-size particles (<0.00	02 mm): 13%		
Per	formed by:	Riddhee Panchal		Date:	December 16, 2	019
Ver	ified by:	Raj Kadia, C.E.T.		Date:	December 27, 2	019



Clie	nt:	Infrastructure Ontario (IO)		Lab No.:	G2256		_
Proj	ect, Site:	Geotechnical Investigation - Childrens Eastern Ontario, Ottawa, ON	s Hospital of	Project No.:	11205379		-
I	Borehole No.:	BH8		Sample No.:	SS2		_
	Depth:	0.8m - 1.4m		Enclosure:			_
ercent Passing	00					0 1 2 3 	ercent Retained 0 0
	40						• • • •
	0.001	0.01 0.1 D	iameter (mm)		10	100	
		Silty Clay	Sand		Gravel		
		Fi Particle-Size Limi	ne Mediun ts as per USCS (ASTM	n Coarse D-2487)	Fine Co	barse	
		Soil Description	Gravel (%)	Sand (%)	Clay & S	Silt (%)	
	S	ilty Sand, Some Clay , Trace Gravel	8	59	33]
Rem	arks: <u>Silt-</u> Gra	size particles (0.074 to 0.002 mm): 22%, Cla vel 8%, Sand 59%, Silt 22%, Clay 11%	ay-size particles (<0.00	2 mm): 11%			
Perf	ormed by:	Riddhee Panchal		Date:	December	16, 2019	_
Veri	ied by:	Raj Kadia, C.E.T.		Date:	December	27, 2019	-



Clie	Client: Project, Site: Borehole No.: Depth:	Infrastructure Ontario (IO)		Lab No.:	G2256		-
Pro	ject, Site:	Geotechnical Investigation - Childrens Eastern Ontario, Ottawa, ON	Hospital of	Project No.:	11205379		-
	Borehole No.	MW9		Sample No.:	SS2 + SS3		_
	Depth:	0.8m-1.4m / 1.5m-2.0m		Enclosure:			_
	100						0
	00						0
	80					2	0
	70					3	0 9
Passing	60						0 Retaine
Percent	50						Percent
	40						0
	30					7	0
	20					8	0
	10					9	0
	0.001	0.01 0.1 Dia	1 meter (mm)		10	100 III	00
			Sand		Gravel		
		Silty Clay Fir	e Mediur	n Coarse	Fine C	oarse	
		Particle-Size Limit	s as per USCS (ASTM	D-2487)			-
		Soil Description	Gravel (%)	Sand (%)	Clay &	Silt (%)	
		Silty Sand, Some Gravel, Some Clay	14	53	3	3	
							•
Rei	marks: _{Si} G	t-size particles (0.074 to 0.002 mm): 20%, Cla ravel 14%, Sand 53%, Silt 20%, Clay 13%	y-size particles (<0.00	02 mm): 13%			-
Per	formed by:	Riddhee Panchal		Date:	December	16, 2019	_
Ver	ified by:	Raj Kadia, C.E.T.		Date:	December	27, 2019	-



Client:		Infrastructure Ontario (IO)			Lab No.:	G2253		_
Projec	t, Site:	Geotechnical Investigation - C Eastern Ontario, Ottawa, ON	Childrens H	Hospital of	Project No.:	11205379		_
Во	rehole No.:	MW10			Sample No.:	SS2		_
De	pth:	0.8m-1.4n	n		Enclosure:			_
100 90								0
80 70								20 30
rcent Passing								ercent Retained
ස් 40 30								8 50 70
20 10								30 90
0 C	0.001	0.01	0.1 Dian	neter (mm)		10	100	100
				Sand		Gravel		
		Particle	Fine Size Limits	as per USCS (ASTM	n Coarse D-2487)	Fine	Coarse	
		Soil Description		Gravel (%)	Sand (%)	Clay &	a Silt (%)]
		Silty Sand with Gravel, Trace Clay		26	47		27	
Pomor	ke:							
Nemd	Silt	size particles (0.074 to 0.002 mm): vel 26%, Sand 47%, Silt 18%, C	18%, Clay- Clay 9%	-size particles (<0.00	2 mm): 9%			-
Perfor	med by:	Riddhee	Panchal		Date:	Decembe	er 16, 2019	_
Verifie	d by:	Raj Kadia	a, C.E.T.		Date:	Decembe	er 27, 2019	_



Clie	nt:	Infrastructure Ontario (IO)		Lab No.:	G2253		
Pro	ject, Site:	Geotechnical Investigation - Children Eastern Ontario, Ottawa, ON	s Hospital of	Project No.:	11205379		
	Borehole No.:	BH12		Sample No.:	SS2 + SS3		
	Depth:	0.8m-1.4m / 1.5m-2.1m		Enclosure:			
Percent Passing	100 90 80 70 60 50 40 30					• 0 10 20 30 30 40 50 60 70	Percent Retained
	20					90	
	0.001	0.01 0.1	liameter (mm)		10	100	0
		Silty Clay	Sand		Gravel		
		Particle-Size Lim	ine Mediur	n Coarse	Fine Coa	se	
				,	1		
		Soil Description	Gravel (%)	Sand (%)	Clay & Silt	: (%)	
		Silty Sand with Gravel, Some Clay	18	52	30		
Ren	narks: <u>Silt-</u> Gra	size particles (0.074 to 0.002 mm): 19%, Cl avel 18%, Sand 52%, Silt 19%, Clay 11%	ay-size particles (<0.00 %	02 mm): 11%			
Per	ormed by:	Riddhee Pancha		Date:	December 16	6, 2019	
Ver	fied by:	Raj Kadia, C.E.T		Date:	December 27	7, 2019	



Client						Inf	rasti	ructu	ıre	On	taric)					Lab	No.	:				G	-22-(03			_
Projec	t, Site:					(Chilo	dren	Hc	ospi	tal						Proj	ject	No.				112	2053	379			_
Bo	rehole No.:						B	3H-18	5								Sam	iple N	lo.:				;	SS-1				_
De	pth:						0,08	- 0,6	61 n	n					_		Encl	osure	e:					-				-
100																							1	••			Ш,)
90									+	-																+		10
80																												20
70																												30
5																												per
16 Passi																												t Retair
Bercer Percer	50 50 50 50 50 50 50 50 50 50 50 50 50 5												+													+	+ 	Percer 05
40	40																											60
30						_				\parallel			+												$\left \right $	+	;	70
20									_																	30		
		•		-+	-	-																						
(0.001			0.	01					0.1	Dian	neter	(mm)		1						10					100	100
			Cla	v &	Silt									Sa	nd							G	ravel					
							Par	ticle	Siz	e Li	Fir mits	ne as p	oer U	ISCS	M (AS	ediu STM	um I D-248	Co 87)	arse		Fi	ne		Coa	rse	_		
																												7
			S	ioil	Desc	riptio	n						Gra	avel	(%)			Sanc	1 (%))			Clay	& Sil	lt (%	6)		
	s	and an	d Gra	ave	l, Trac	ces of	Silt	and (Cla	у				43				4	7					10				
	Silt-size particles (%) : Clay-size particles (%) (<0.002 mr								nm):										8								
	Clay-size particles (%) (<0.002 mm):									-																		
Remai	More information is available upon request.																											-
Perfor	formed by: J. Lalonde															_	Dat	e:			A	ugu	st 3,	202	22		_	
Verifie	d by:		($\left<\right.$	\sim	k	Z	2	Y)								Dat	e:			A	ugu	st 3,	202	22		



Client:	Infrastructure Ontario		Lab No.:	G-22-03	
Project, Site:	Children Hospital		Project No.:	11205379	
Borehole No.:	BH-15		Sample No.:	SS-2	
Depth:	0,61 - 1,22 m		Enclosure:		
100				····	, 10
90					10
80					20
70					30
					Setained
					50 50
<u>م</u> 40					60 6
30					70
20					80
10					90
0.001 0.01	0.1 Diam	eter (mm)		10	⊥⊥ ₁₀₀ 100
		Sand		Gravel	
Clay & Silt	Fin	e Mediu	m Coarse	Fine Coarse	
	Farticle-Size Limits		D-2407)] I	
Soil Des	cription	Gravel (%)	Sand (%)	Clay & Silt (%)	
Gravely Sand, with Sor	me Silt and Some Clay	25	46	29	
Silt-size par	rticles (%) :		19		
	es (%) (<0.002 mm).		10		
Remarks: More information is av	vailable upon request.				
Performed by:	J. Lalonde		Date:	August 3, 2022	
Verified by:	bgel		Date:	August 3, 2022	



Client:						Infr	astr	uctu	Ire	Ont	ario						Lab	No.	:				G-	-22-(03			_
Project	, Site:					C	Child	ren	Ho	spit	al						Proj	ject	No.	:			112	2053	879			-
Bor	ehole No.:						В	H-16	6								Sam	ple N	lo.:				ę	SS-1				-
Dep	oth:					(),08	- 0,6	1 m	<u>1</u>							Encl	osure	e:					-				-
100																							/					
90																						1				+	1	0
80																										++-	2	0
70																				1				+		+	3	0
Passing																			\mathbb{A}	+						+	4	o Retainec
ercent 50	50																			+				_		+	5	ercent I
م 40	40																									\parallel	6	م 0
30	30																										7	0
																												0
20											_															T	8	0
10				-	-	-																					9	0
0 0.	001			0.0	1		<u> </u>			0.1	Diam	eter ((mm)		_	1					1	0					100 L	00
			Clay		2114									Sa	nd							G	ravel					
			Cia	, a .	,		Part	ticle-	Size	e Lir	Fin nits	e as p	er U	scs	Me (AS	ediu STM	IM D-248	Co 37)	arse	•	Fi	ne		Coa	rse	\neg		
																	r	-										1
			S	oil [Descr	iptior	ו 						Gra	vel	(%)			Sand	d (%)		C	lay	& Sil	lt (%	,)		
	Gravely Sand, with Traces of Silt and Clay									у				33				5	6					11				
	Silt-size particles (%) : Clay-size particles (%) (<0.002 mm):									:										8								_
	Clay-size particles (%) (<0.002 mm):																											
Remark	ks: <u>Mo</u>	re infor	mati	on i	s avai	lable	upor	n req	ues	st.																		-
Perform	formed by: J. Lalonde																_	Dat	e:			A	ugus	st 3,	202	22		_
Verified	l by:	(\leq	<		20	2	Ż									-	Dat	e:			A	ugus	st 3,	202	22		-



Client:	Infrastructure Or	tario	Lab No.:	G-22-03	
Project, Site:	Children Hosp	tal	Project No.:	11205379	
Borehole No.:	MW-17		Sample No.:	SS-2	
Depth:	0,08 - 0,61 m		Enclosure:	-	
100 90 80 70 60 90 80 70 60 40 40 30 20 10					- 10 - 20 - 30 - 40 elega - 50 believe - 50 believe - 60 - 70 - 80 - 90
0.001	0.01 0.1	Diameter (mm)		10 10	100 00
		Sand		Gravel	
	Clay & Silt	Fine Medi	um Coarse	Fine Coarse	
	Particle-Size L	mits as per USCS (ASTM	1 D-2487)		
	Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)	
Grave	ly Sand, with Some Silt and Traces of Cla	y 22	53	25	
	Silt-size particles (%) :		16		
	Clay-size particles (%) (<0.002 mm):		9		
Remarks: <u>Mo</u>	re information is available upon request.				
Performed by:	J. Lalonde		Date:	August 3, 2022	
Verified by:	<u>Soch</u>		Date:	August 24, 2022	



Client:	Infrastructure Ontario)	Lab No.:	G-22-03	
Project, Site:	Children Hospital		Project No.:	11205379	
Borehole No.: Depth:	MW-18 0,08 - 0,61 m		Sample No.: Enclosure:	SS-1 -	
100 90 80 70 60 70 60 70 40 30 20 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 <	Image: Clay & Silt Soil Description Image: Clay & Silt Soil Description Image: Clay & Silt Image: Clay	neter (mm)	Im Coarse D-2487) Sand (%) 44	Image: Coarse Image: Coarse <td< th=""><th>0 10 20 30 40 50 50 60 70 80 90 0 100 0 100 0 100 0 100 0 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 10</th></td<>	0 10 20 30 40 50 50 60 70 80 90 0 100 0 100 0 100 0 100 0 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 10
Performed by: Verified by:	J. Lalonde		Date:	August 11, 2022 August 24, 2022	



Client:	ent: Infrastructure Oni							Onta	rio						Lab	No	:					G-	22-(03						
Projec	t, Site:						Chil	drer	n H	los	pita	I						Proj	ject	No	.:	_			112	2053	379			_
Bo	rehole No.:						1.00	ЛW-	18	~								Sam	ple I	No.:					S	SS-3	}			_
De	ptn:						1,22	2 - 1,	,83	m								Encl	osur	e:		_				-				_
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			Cla	IV &	Silt										Sa	nd					T			Gr	avel					
				_			Pa	articl	e-S	ize	Limi	Fine its a	e ns pe	er US	scs	Me (AS	ediu STM	um D-248	C 87)	oars	e		Fine	•		Coa	irse			
			s	Soil	Desc	riptic	on						(Grav	vel ((%)			San	d (%	6)			с	lay 8	& Si	lt (%	•)		
	Sand and Gravel, with Some Silt and Traces of								s of	Clay	y			35				5	50						15					
	Silt-size particles (%) : Clav-size particles (%) (<0.002 mm):								<u>س</u> ۱.											11										
	Ciay-size particles (%) (<0.002 mm):																			4								_		
Remar	Remarks: More information is available upon request.												_																	
Perfor	erformed by:J_alonde										e							_	Da	te:				Au	ugus	st 9,	202	22	. <u> </u>	_
Verifie	rified by:																	-	Da	te:				Au	gust	t 24	, 202	22		_



Client:	Infrastructure C	ntario	Lab No.:	G-22-03	_
Project, Site:	Children Hos	vital	Project No.:	11205379	_
Borehole No.: Depth:	BH19 0,15 - 0,76 m		Sample No.: Enclosure:	SS-1	-
100 90 80 70 60 50 40 30 20 10 0.001	Clay & Silt Clay &	Image: state of the state	um Coarse 1D-2487) Sand (%) 47	Gravel Fine Coarse Clay & Silt (%)	00 02 02 03 04 04 04 05 05 05 05 05 05 05 05 05 05
	Silt-size particles (%) : Clay-size particles (%) (<0.002 mm):		9 5		
Remarks: <u>Mor</u>	re information is available upon reques				_
Performed by:	J. Lalond		Date:	August 3, 2022	_
Verified by:	<u> </u>		Date:	August 24, 2022	_



Clier	it:	Inf	rastructure Ontario		Lab No.:	G-22-03			
Proje	ect, Site:	(Children Hospital		Project No.:	11205379			
E	Borehole N Depth:	lo.: 	BH19 0,76 - 1,37 m		Sample No.: Enclosure:	SS-2	_		
Percent Passing	00 90 80 70 60 50 40 30 20 10 0.001	0.01	0.1 Diar	eter (mm)		10 10	- 0 - 10 - 20 - 30 - 40 - 30 - 50 - 50 - 50 - 50 - 50 - 60 - 70 - 80 - 90 - 100 - 00		
		Clay & Silt	Fin	Sand e Mediu	ım Coarse	Gravel Fine Coarse			
			Particle-Size Limits	as per USCS (ASTM	D-2487)				
		Soil Description	n	Gravel (%)	Sand (%)	Clay & Silt (%)			
		Sand and Gravel, with Some	Silt and Clay	37 40 23					
		Silt-size particles ((%) : (~0 002 mm):		13		$\overline{-}$		
Dom			((),))))		10				
Rem	arks:	More information is available	upon request.						
Perfo	ormed by		J. Lalonde		Date:	August 3, 2022			
Verif	ied by:	$\underline{}$	<u>xel</u>		Date:	August 24, 2022			



Client:						In	frastr	uctu	ure	Or	ntario)					Lat	o No	o.:						G-2	2-0	3			_
Projec	t, Site:						Chilc	Iren	Ho	osp	ital						_Pro	jec	t N	o.:				1	120)537	79			-
Во	rehole No.:						В	H-2(0								San	nple	No	.:					S	S-1				_
De	pth:						0,10	- 0,6	61 r	m						•	Enc	losu	ure:							-				-
100 90 80 70 60 50 40 30 20 10 0 0	.001		Cla	0.0	01		Par	rticle		0.1	Diau	mete			and S (A		ium			rse		Image: constraint of the second se					0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			
			s	oil	Desc	riptic	on						Gra	ave	I (%)		Sai	nd ((%)				Cla	ıy &	Silt	(%))		
	Sand, with Some Silt, Gravel and Clay 15 55								3	30																				
		Clav	Silt-	size par	e parti	icles	(%): (<0.0	02 r	nm):)											19									
Remar	ks:							-																						1
	- <u>M</u>	ore info	ormat	ion	is ava	aiiadie	e upo	n reo	que	est.																				-
Perfor	med by:	-1		_	7		J	-Lal	lon	de							_	Da	ate	August 9, 2022				_						
Verifie	d by:	_	\geq		k	20	2	5									_	Da	ate	:	August 24, 2022									



Clie	ent:						In	fras	truc	tur	e C	Onta	ario						Lal	b N	o.:		G-22-03									
Pro	oject, S	Site:						Chil	dre	n F	los	spita	al						_Pro	ojeo	ct N	o.:				1	1120	<u>)53</u>	79		 	
	Boreh Depth	ole No.: :						1,22	BH- 2 - 1	20 ,83	i m								Sar Enc	mple	e No ure:).:					S	S-3 -			 	
Percent Passing				Clay	0.0	1 5ilt							Diam	eter ((mm)						Cozz			Fi		Gra					0 10 20 30 40 50 60 70 80 90 100	Percent Retained
								Pa	artic	le-S	Size	Lim	its :	as p	er U	SC	S (A	STN	/I D-24	487)												
		Soil Description											Gra	vel	(%)		Sa	nd	(%)				Cla	ay &	Sil	t (%	5)				
		Silty and Clayey Sand, with Traces of Grave							el				6					42						į	52							
		Silt-size particles (%) : Clay-size particles (%) (<0.002 mm):							:											31 21												
Rei	emarks: More information is available upon request.									t.																			 			
Per	forme	d by:		_			\		J. L	ala	nd	е								D	ate	:				Auę	gust	t 9, 1	202	22	 	
Verified by: Date: August 23								23,	20	22	 																					



Clie	nt:				Infrastructure Ontario Lab No.: G-22-03																																				
Pro	ject,	, Sit	e:									Cł	nild	rer	۱ H	los	spi	tal								Pro	jec	t N	lo.:		_			1	12	053	879				
	Bore	ehole	e No	o.:									M١	N-2	23									_		Sam	nple	N	o.:						S	S-3					
	Dep	oth:										1,	37 ·	- 1,	98	m								_		Encl	losı	ure:			-					-					
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	[_												Т																			_			
							S	oil	De	scr	ipti	on									Gra	ave	el (9	%)			Sa	nd	(%))				Cla	ay 8	Si	lt (%	6)			
	Gravely Sand, With some Silt and Traces of Cla							iy				34	4					48								18															
		Silt-size particles (%) : Clay-size particles (%) (<0.002 mm):								-											13 5																				
Bon	aark	(e)			-			-				-							_																						
Rei		(5.	N	Nore	e inf	orm	nati	ion	is i	avai	ilab	le u	por	n re	equ	ies	st.																								
Per	form	ned	by:		-	Ć	~	-					J.		lo	nd	e									_	D	ate	:		_			Aug	gus	t 9,	202	22			
Ver	ified	l by	:			(~	$\langle \rangle$		C	X	X	2	3												_	D	ate	:		_		Α	ug	ust	23	, 20	22			



Client:		Infrastructure Ontario Lab No.: G-22-03							_																							
Project	, Site:						Cł	nildr	en	Ho	sp	ital							Proj	ect	No	. :				1	120)537	79			_
Bor	ehole No	o.:						M١	N23	3									Sam	ple	No.	:					S	S-6				_
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			CI	ay	& Silt							Fi	ine		Т	5a	M	edi	um	С	oar	se		Fi	ne	Gra	vei (Coar	se	-		
								Parti	icle	-Siz	e L	imits.	s as	s pei	rUS	SCS	(AS	STN	/I D-248	37)												
		Soil Description										G	irav	vel (%))		San	d ('	%)				Cla	ıy &	Silt	(%)					
	Sandy Gravel, with Some Silt and Traces of Cla							ay			2	49				;	32						1	19								
		Silt-size particles (%) : Clay-size particles (%) (<0.002 mm):																	1	3												
		Clay-size particles (%) (<0.002 mm):																			b											
Remarks: More information is available upon request.																					-											
Perform	ned by:					\frown	~	J.	Lal	ono	de	\								Da	te:					Aug	gust	9, 2	2022	2		_
Verified	d by:	_			\geq	\leq	J	X	2	2	X)						Date: August 9, 2022 Date: August 23, 2022														



Client:		Infr	astructure Ontar	rio (IO)		Lab no.:	G2256
Project/Site:	Preliminary	Geotechnical Or	Investigation – (ntario, Ottawa, C	Childrens Hos Intario	pital of Eastern	Project no.:	11205379
Borehole no.:	MW3		Sample no.:		SS4	Depth:	2.3m- 2.9 m
Soil description:		Low Plasti	city Inorganic Clay	/ (CL)		Date sampled:	28-Nov-19
Apparatus:	Hand	Crank	Balance no.:		1	Porcelain bowl no .:	3
Liquid limit device no.:	2	2	Oven no.:		2	Spatula no.:	1
	Liquid Limit (Oldoo pieto no	Sail Broparati	· · · · · · · · · · · · · · · · · · ·		
		LLJ:	Tact No. 3		Cohosive <425 um	, D	Deveration
Number of blows	1051 NO. 1 35	1051 NU. 2	16		Cohesive >425 um		Wet preparation
	Water Conte		10		Non-cohesive		Wetpreparation
Tare no.	A27	A13	A11			Doculto	
Wet soil+tare, q	19.30	22.77	20.44	32.5			
Drv soil+tare, g	17.99	20.60	18.71	32.0			
Mass of water, g	1.31	2.17	1.73	- 			
Tare, g	13.54	13.55	13.33	د. اد (ه			
Mass of soil, g	4.45	7.05	5.38	- ^{TE} 31.0 O			
Water content %	29.4%	30.8%	32.2%	05 Sate			
Plastic Limit (Pl	L) - Water Conte	ent:		30.0			
Tare no.	A26	A52		29.5			
Wet soil+tare, g	19.60	19.51		29.0			
Dry soil+tare, g	18.52	18.47			15 17 19 2	21 23 25 27 Nb Blows	29 31 33 35
Mass of water, g	1.08	1.04			Soil	Plasticity Chart	
Tare, g	13.49	13.47		70		LL 50	
Mass of soil, g	5.03	5.00		60 -	Low plasticity	High plastic Inorganic c	ay
Water content %	21.5%	20.8%		H 50		C	
Average water content %	21.	.1%		ية بغ 40 –			
Natural Wate	r Content (W ⁿ)):		전 <u>cit</u> 30	CL		
Tare no.	W21			20 -	Low compressibility		(MH) and (CH)
Wet soil+tare, g	25.7					- High inor - Inprg	ganic silt ganic day
Dry soil+tare, g	23.3			·		- Medium co norganic si ML and OL - Organic cla	mpressibility It
Mass of water, g	2.40			0 +	10 20 3	0 40 50 60	70 80 90 100
Tare, g	1.30				T	Liquid Limit LL	T
Mass of soil, g	22.00			Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %	10.9%			31	21	10	11
Remarks:							
Performed by:		Sharif	Hossain		Date:		12/27/2019
Verified by:		Raj Kao	Jia, C.E.T.		Date:		12/31/2019



Client:	_	Infr	astructure Onta	rio (IO)		Lab no.:	G2256
Project/Site:	Preliminary	Geotechnical Or	Investigation – (ntario, Ottawa, O	Childrens Hos Intario	pital of Eastern	Project no.:	11205379
Borehole no.:	MW4		Sample no.:		SS2	Depth:	0.8m- 1.4m
Soil description:		Low Plasti	city Inorganic Clay	/ (CL)		Date sampled:	28-Nov-19
Apparatus:	Hand	Crank	Balance no.:		1	Porcelain bowl no .:	1
Liquid limit device no.:	2	2	Oven no.:		2	Spatula no.:	1
Sieve no.:	4()	Glass plate no.:		1		
	Liquid Limit (I	LL):		Soil Preparati	on:		
	Test No. 1	Test No. 2	Test No. 3	 Image: A start of the start of	Cohesive <425 µm	ı √	Dry preparation
Number of blows	30	29	16		Cohesive >425 µm		Wet preparation
	Water Conte	nt:			Non-cohesive		
Tare no.	A23	A52	A13			Results	
Wet soil+tare, g	23.42	25.76	25.88	30.5			
Dry soil+tare, g	21.39	23.04	23.00	30.0			
Mass of water, g	2.03	2.72	2.88				
Tare, g	13.86	13.47	13.54	29.0			
Mass of soil, g	7.53	9.57	9.46	Ö 28.5			
Water content %	27.0%	28.4%	30.4%	ອັ ≥ 28.0			
Plastic Limit (P	L) - Water Conte	ent:		27.5			
Tare no.	A71	A22		27.0			
Wet soil+tare, g	19.51	19.57		26.5			
Dry soil+tare, g	18.49	18.54			15 17 19	21 23 2 Nb Blows	25 27 29 31
Mass of water, g	1.02	1.03			Soil	Plasticity Chart	
Tare, g	13.34	13.44		70		LL 50	
Mass of soil, g	5.15	5.10		60 -	Low plasticity	High plasti Inorganic d	city clay
Water content %	19.8%	20.2%		H- 50 -	morganic clay		
Average water content %	20.0	0%		ă 40 —			
Natural Wate	er Content (W ⁿ)	:		20 Aii 30	CL		
Tare no.	A18			Dasti	Low compressibility		(MH) and (CH)
Wet soil+tare, g	51.9			20		- High inor - Inor	n compressibility ganic silt ganic day
Dry soil+tare, g	45.2			10		- Medium co norganic s	ilt
Mass of water, g	6.70			0	10 20 3	0 40 50 60	70 80 90 100
Tare, g	1.30					Liquid Limit LL	
Mass of soil, g	43.90			Liquid Limit	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %	15.3%			29	20	9	15
Remarks:	<u> </u>			-			
Performed by:		0			Date:		10/07/0010
r enormed by.		Sharif	Hossain		Dale.		12/27/2019
Verified by:		Raj Kao	dia, C.E.T.		Date:		12/31/2019



Client:		Infr	astructure Onta	rio (IO)		Lab no.:	G2253
Project/Site:	Preliminary	Geotechnical Or	Investigation – (ntario, Ottawa, C	Childrens Hospit Intario	tal of Eastern	Project no.:	11205379
Borehole no.:	MW5		Sample no .:	SS2-	+SS3	Depth:	0.9m- 1.7m
Soil description:		Low Plasti	city Inorganic Clay	y (CL)		Date sampled:	28-Nov-19
Apparatus:	Hand (Crank	Balance no.:		1	Porcelain bowl no .:	2
Liquid limit device no.:	2	<u>.</u>	Oven no.:		2	Spatula no.:	1
Sieve no.:	4()	Glass plate no.:	,	1		
	Liquid Limit (L	_L):		Soil Preparatior	n:		
	Test No. 1	Test No. 2	Test No. 3	√ C	Cohesive <425 μm		Dry preparation
Number of blows	35	30	25		Cohesive >425 μm		Wet preparation
	Water Conter	nt:			lon-cohesive		
Tare no.	A2	A20	A10			Results	
Wet soil+tare, g	23.83	23.44	25.84	29.5 -			
Dry soil+tare, g	21.66	21.24	23.07	29.0			
Mass of water, g	2.17	2.20	2.77	8 28.5			
Tare, g	13.40	13.23	13.61	uniter 10, 28.0 -			
Mass of soil, g	8.26	8.01	9.46	Ŭ - ¹ - ¹ - ² - ² - ²			
Water content %	26.3%	27.5%	29.3%	× 21.0			
Plastic Limit (Pl	L) - Water Conte	ent:	I	27.0 -			
Tare no.	A23	A24	I	26.5 -			
Wet soil+tare, g	19.62	20.27	I	26.0	4 26	28 30	
Dry soil+tare, g	18.75	19.26	I	-	4 20	Nb Blows	32 04 00
Mass of water, g	0.87	1.01	I	70	Soil I	Plasticity Chart	
Tare, g	13.59	13.33	I			LL 50	
Mass of soil, g	5.16	5.93	I		ow plasticity	High plastic Inorganic cl	ity ay
Water content %	16.9%	17.0%	I	- - - - - - - - - - - - - - - - - - -		CH	
Average water content %	16.9	3%	I	^교 40			
Natural Wate	r Content (W ⁿ):	:	I	<u>ون</u> غني 30	CL		
Tare no.	W1		I		ow compressibility	-	(MH) and (CH)
Wet soil+tare, g	24.2		I	10		- riigii inorg - Inorg	compressionity janic silt anic day
Dry soil+tare, g	22.4		I			- Medium cor norganic sil	npressibility It
Mass of water, g	1.80		I	0 +	10 20 30) 40 50 60	70 80 90 100
Tare, g	1.30		I	ļ		Liquid Limit LL	
Mass of soil, g	21.10		I	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %	8.5%			29	17	12	9
Remarks:							
Performed by:		Riddhe	e Panchal		Date:		12/24/2019
Verified by:		Rai Kar			Date:		12/31/2019
vermed by.		raj rac	ла, С.Е.Т.		Date.		12/31/2019



Client:		Infr	astructure Onta	rio (IO)		Lab no.:	G2256
Project/Site:	Preliminary	Geotechnical Or	Investigation – (ntario, Ottawa, O	Childrens Hos Intario	pital of Eastern	Project no.:	11205379
Borehole no.:	BH7		Sample no.:		SS2	Depth:	0.8m- 1.4m
Soil description:		Low Plasti	city Inorganic Clay	(CL)		Date sampled:	28-Nov-19
Apparatus:	Hand	Crank	Balance no.:		1	Porcelain bowl no .:	1
Liquid limit device no.:	2	<u>.</u>	Oven no.: Glass plate no :		2	Spatula no.:	1
Sieve no	4		Glass plate no			-	
-	Liquid Limit (LL):		Soil Preparati	on:	_	
	Test No. 1	Test No. 2	Test No. 3		Cohesive <425 µm		Dry preparation
Number of blows	35 Water Canto	20	19		Conesive >425 µm		Wet preparation
-	water Conte	nt:			Non-conesive		
lare no.	A9	A16	A23	21.0		Results	
Wet soil+tare, g	19.65	20.31	25.45	- 31.0			
Dry soil+tare, g	18.23	18.73	22.73	30.5			
Mass of water, g	1.42	1.58	2.72	it (%)			
Tare, g	13.33	13.42	13.83	0.00 outen			
Mass of soil, g	4.90	5.31	8.90	ater C			
Water content %	29.0%	29.8%	30.6%	≥ 29.5			
Plastic Limit (P	L) - Water Conte	ent:		29.0			
Tare no.	A71	A4					
Wet soil+tare, g	17.55	17.65		28.5			
Dry soil+tare, g	16.75	16.94			10 20 22	Nb Blows	30 32 34 36
Mass of water, g	0.80	0.71		70	Soil	Plasticity Chart	
Tare, g	13.34	13.62		⁷⁰ T		LL 50	
Mass of soil, g	3.41	3.32		60 +	Low plasticity	High plasti Inorganic d	city slay
Water content %	23.5%	21.4%		4 ۲ 50 –		(°	н
Average water content %	22.4	4%		لم م 40 -			
Natural Wate	r Content (W ⁿ)	:		2 4 30	CL		
Tare no.	W89			Dasti	Low compressibility		(MH) and (CH)
Wet soil+tare, g	30.5			20 -		- High infor - Infor	n compressibility ganic silt ganic day
Dry soil+tare, g	28.6			10		- Medium co norganic s	ilt
Mass of water, g	1.90			0	10 20 3	^{M_}) _{and} OL - <mark>P</mark> rganic pla 0 40 50 60	^{ay} 70 80 90 100
Tare, g	1.30					Liquid Limit LL	
Mass of soil, g	27.30			Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %	7.0%			30	22	8	7
Remarks:							•
Performed by:					Date:		
renomed by:		Sharif	Hossain		Date:		12/27/2019
Verified by:		Raj Kao	lia, C.E.T.		Date:		12/31/2019



Client:		Infr	astructure Ontar	rio (IO)		Lab no.:	G2256
Project/Site:	Preliminary	[,] Geotechnical Or	Investigation – 0 Itario, Ottawa, C	Childrens Hosp Intario	bital of Eastern	Project no.:	11205379
Borehole no.:	BH8		Sample no.:		SS2	Depth:	0.8m- 1.4m
Soil description:		Low Compress	sibiity Inorganic Sil	lt (CL-ML)		Date sampled:	28-Nov-19
Apparatus: Liquid limit device no.:	Hand	Crank 2	Balance no.: Oven no.:		1 2	Porcelain bowl no.: Spatula no.:	<u>1</u> <u>1</u>
Sieve no.:	4	10	Glass plate no.:		1		
	Liquid Limit ((LL):		Soil Preparation	on:		
	Test No. 1	Test No. 2	Test No. 3	I	Cohesive <425 µm	n 🗸	Dry preparation
Number of blows	28	27	18		Cohesive >425 µm	n 🗌	Wet preparation
	Water Conte	ənt:			Non-cohesive		
Tare no.	A11	A9	A16			Results	
Wet soil+tare, g	25.69	27.66	29.73	25.0			
Dry soil+tare, g	23.34	24.96	26.50	24.8			
Mass of water, g	2.35	2.70	3.23	24.0 [®] 24.4			
Tare, g	13.35	13.34	13.43	tent 24.2			
Mass of soil, g	9.99	11.62	13.07	ບັບ ບັບ 24.0			
Water content %	23.5%	23.2%	24.7%	23.8 M			
Plastic Limit (Pl	L) - Water Cont	ent:		23.6			
Tare no.	A20	A10		23.4 23.2			
Wet soil+tare, g	21.21	20.11		23.0			
Dry soil+tare, g	19.94	19.07			17 19	21 23 Nb Blows	25 27 29
Mass of water, g	1.27	1.04			Soil	Plasticity Chart	
Tare, g	13.23	13.63		70		LL 50	
Mass of soil, g	6.71	5.44		60	Low plasticity	High plastic Inorgani¢ cl	ity lay
Water content %	18.9%	19.1%		50		CF	
Average water content %	19.	.0%		لط چ 40			
Natural Wate	r Content (W ⁿ):		й 30	CL		
Tare no.	C97			D2 Blast	Low compressibility	-	(MH) and (CH)
Wet soil+tare, g	31.8					- High inorg - Inprg	compressibility ganic silt janic day
Dry soil+tare, g	29.1			10 +		- Medium con norganic si Organic cla	npressibility It
Mass of water, g	2.70			0 + 0	10 20 30	0 40 50 60	70 80 90 100
Tare, g	1.30					Liquid Limit LL	
Mass of soil, g	27.80	Í		Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %	9.7%			24	19	5	10
Remarks:							
Performed by:		Sharif	Haccoin		Date:		10/07/2010
· •···································		Slidin	HUSSam				12/27/2019
Verified by:		Raj Kac	lia, C.E.T.		Date:		12/31/2019



Client:		Infra	astructure Ontai	rio (IO)	Lab no	:	G2256
Project/Site:	Preliminary Ge	eotechnical li Ont	nvestigation – (ario, Ottawa, O	Childrens Hospital of Ea ntario	stern Project	no.:	11205379
Borehole no.:	MW9	S	Sample no.:	SS2+SS3	Depth:		0.8m- 2.0m
Soil description:	Lo	w Compressil	biity Inorganic Sil	t (CL-ML)	Date sar	npled:	28-Nov-19
Apparatus:	Hand Cra	ank B	Balance no.:	1	Porcelai	n bowl no.:	1
Liquid limit device no.:	2	C	Oven no.:	2	Spatula	no.:	1
Sieve no.:	40	0	Jass plate no.:	1			
	Liquid Limit (LL)):		Soil Preparation:			
	Test No. 1 T	Fest No. 2	Test No. 3	Cohesive	<425 µm	\checkmark	Dry preparation
Number of blows	25	22	16	Cohesive :	>425 µm		Wet preparation
	Water Content:			Non-cohes	sive		
Tare no.	A14	A12	A28		Resu	lts	
Wet soil+tare, g	23.85	26.05	31.69	28.5			
Dry soil+tare, g	21.68	23.42	27.71	28.0			
Mass of water, g	2.17	2.63	3.98	t (%)			
Tare, g	13.47	13.77	13.53	27.5		\leftarrow	
Mass of soil, g	8.21	9.65	14.18	ter CC		\Rightarrow	
Water content %	26.4%	27.3%	28.1%	× 27.0			
Plastic Limit (Pl	L) - Water Content:	:		26.5			
Tare no.	A71	A22					
Wet soil+tare, g	19.51	19.57		26.0	17 10		
Dry soil+tare, g	18.49	18.54		15	17 Nb	Blows	23 25
Mass of water, g	1.02	1.03			Soil Plasticit	y Chart	
Tare, g	13.34	13.44		70		LL 50	
Mass of soil, g	5.15	5.10		60 Low plasticity		High plastic Inorganic cl	sity lay
Water content %	19.8%	20.2%				CF	
Average water content %	20.0%)		لم بي 40			
Natural Wate	r Content (W ⁿ):			30			
Tare no.	W29				ssibilty		(MH) and (CH)
Wet soil+tare, g	23.6			20		- High inorg - Inorg	compressibility ganic silt tanic day
Dry soil+tare, g	21.7					- Medium coi norganic si	mpressibility
Mass of water, g	1.90			0 10	20 30 40	50 60	y
Tare, g	1.30				Liq	uid Limit LL	
Mass of soil, g	20.40			Liquid Limit (LL) Plastic Lin	mit (PL) Plastic	ty Index (PI)	Natural Water Content W ⁿ
Water content %	9.3%			27 20	,	7	9
Remarks:					• 		
Performed by:				Dat	۵.		10/07/0010
r enormed by.		Sharif F	Hossain				12/27/2019
Verified by:		Raj Kadi	a, C.E.T.	Dat	e:		12/31/2019



Client:		Infr	astructure Onta	rio (IO)		Lab no.:	G2253
Project/Site:	Preliminary	Geotechnical Or	Investigation – (ntario, Ottawa, C	Childrens Hos Intario	pital of Eastern	Project no.:	11205379
Borehole no.:	MW10		Sample no .:		SS2	Depth:	0.8m- 1.4m
Soil description:		Inc	organic Silt (ML)			Date sampled:	28-Nov-19
Apparatus:	Hand	Crank	Balance no.:		1	Porcelain bowl no.:	3
Liquid limit device no.:	2	2	Oven no.:		2	Spatula no.:	1
Sieve no.:	4	0	Glass plate no.:		1		
·	Liquid Limit (LL):		Soil Preparati	on:		
	Test No. 1	Test No. 2	Test No. 3		Cohesive <425 µm	۱ ا	Dry preparation
Number of blows	28	21	16		Cohesive >425 µm	۱ ا	Wet preparation
	Water Conte	/nt:			Non-cohesive		
Tare no.	A4	A26	A24	-		Results	
Wet soil+tare, g	19.22	33.10	27.75	30.5			
Dry soil+tare, g	18.24	28.82	24.41	28.5			
Mass of water, g	0.98	4.28	3.34	8 27.5			
Tare, g	13.56	13.50	13.34	tuation 26.5			
Mass of soil, g	4.68	15.32	11.07	୦୦ 25.5 ଜୁ			
Water content %	20.9%	27.9%	30.2%	§ 24.5			
Plastic Limit (Pl	L) - Water Cont	ent:	i	23.5			
Tare no.	A27	A23	i	21.5			
Wet soil+tare, g	19.22	22.51	i	20.5			
Dry soil+tare, g	18.24	20.90	i		15 17	19 21 23 Nb Blows	25 27 29
Mass of water, g	0.98	1.61	I	70	Soil	Plasticity Chart	
Tare, g	13.56	13.57	I	70		LL 50	
Mass of soil, g	4.68	7.33	i	60 +	Low plasticity	High plasti Inorganic d	city clay
Water content %	20.9%	22.0%	I	H 50 +			н
Average water content %	21.	.5%	I	لم م 40 -			
Natural Wate	r Content (W ⁿ):	I	2 city 10 -	(CL		
Tare no.	E10		i		Low compressibility		(MH) and (CH)
Wet soil+tare, g	21.7		i	20		- High inor - Inpr	i compressibility ganic silt ganic dav
Dry soil+tare, g	20.1		I	10 +		- Medium co norganic s	ilt in the second secon
Mass of water, g	1.60		I	0 +	10 20 3	0 40 50 60	^{1y}
Tare, g	1.30		i			Liquid Limit LL	
Mass of soil, g	18.80		I	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %	8.5%		I	24	21	3	9
Remarks:				• 			·
Performed by:					Data		
Ferrornieu by.		Sharit	Hossain				12/27/2019
Verified by:		Raj Kac	lia, C.E.T.		Date:		12/31/2019



Client:		Infrastructure Ontai	rio (IO)	Lab no.:	G2253
Project/Site:	Preliminary Geote	echnical Investigation – (Ontario, Ottawa, O	Childrens Hospital of Eastern	Project no.:	11205379
Borehole no.:	BH12	Sample no.:	SS2+SS3	Depth:	0.8m- 2.1m
Soil description:	Low C	ompressibility Inorganic Sil	lt (CL-ML)	Date sampled:	28-Nov-19
Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	3
Liquid limit device no.: Sieve no.:	<u> </u>	Oven no.: Glass plate no.:	2	_Spatula no.:	1
0.0101.0	Liquid Limit (LL):		Sail Propagation	_	
		No.2 Test No.3		~ 7	Dry proportion
Number of blows	24	NO. 2 TESTINO. 3			
	Water Content:	20 17			
Tare no.	A7 A	A17 A21		Doculte	
Wet soil+tare, g	26.98 27	7 17 25.65	27.0		· · · · · · · · · ·
Drv soil+tare, q	24 30 24	130 23.10			
Mass of water, g	2.68 2.	87 2.55			
Tare, g	13.32 13	3.35 13.50	26.0 te		
Mass of soil, g	10.98 10).95 9.60	25.5		
Water content %	24.4% 26	.2% 26.6%	Matei		
Plastic Limit (P	L) - Water Content:		25.0		
Tare no.	A18 A	.25	24.5		
Wet soil+tare, g	21.35 20	0.11	24.0		
Dry soil+tare, g	20.07 18	3.99	16 18 20	22 24 26 2 Nb Blows	28 30 32 34
Mass of water, g	1.28 1.	.12	Soil	Plasticity Chart	
Tare, g	13.64 13	3.42	70	LL 50	
Mass of soil, g	6.43 5.	.57	60 Low plasticity	High plasti Inorganic d	city clav
Water content %	19.9% 20.	.1%			н)
Average water content %	20.0%				
Natural Wate	r Content (W ⁿ):				
Tare no.	E6		Low compressibility		(MH) and (CH)
Wet soil+tare, g	32.5			- Higr inor - Inpr	n compressibility ganic silt ganic day
Dry soil+tare, g	31.2			ML and OL - Organic s	ilt
Mass of water, g	1.30		0 10 20	30 40 50 60	70 80 90 100
Tare, g	1.30			Liquid Limit LL	1
Mass of soil, g	29.90		Liquid Limit (LL) Plastic Limit (PL) Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %	4.3%		26 20	6	4
Remarks:					
Performed by:		Sharif Hossain	Date:		12/27/2019
Verified by:		Rai Kadia, C.F.T.	Date		12/31/2019
vermed by:			Date.		12/31/2013



Client:			Infrastructure On	tario		Lab no.:	G-22-03	
Project/Site:			Children Hospi	tal		Project no.:	11205379	
Borehole no.:	BH-15		Sample no.:		SS-2 Depth:		0,61 - 1,22 m	
Soil Description:						Date sampled:		
Apparatus:	Hand	Crank	Balance no.:	8033	3031049	Porcelain bowl no.:	1	
Liquid limit device no.:		1	Oven no.:	B23	3-04645	Spatula no.:	1	
Sieve no.:	015	5690	Glass plate no.:		1	-		
	Liquid Limit	(LL):	-	Soil Preparat	on:			
	Test No. 1	Test No. 2	Test No. 3	¥.	Cohesive <425 µr	n 🗵	Dry preparation	
Number of blows					Cohesive >425 µr	m ⊏	Wet preparation	
	Water Conte	ent:			Non-cohesive			
Tare no.						Results		
Wet soil+tare, g				2.0				
Dry soil+tare, g								
Mass of water, g				(%)				
Tare, g				ntent (
Mass of soil, g				er Col				
Water content %				Wat				
Plastic Limit (Pl	L) - Water Cont	ent:		1				
Tare no.								
Wet soil+tare, g				0.0				
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27	
Mass of water, g			-		Soil	Plasticity Chart ASTI	M D2487	
Tare, g				70		LL 50		
Mass of soil, g				60 —	Lean clay (C)	Eat clay		
Water content %				립		Fat clay		
Average water content %				≝ ₩ 40 —		Organic cla	ay OH)	
Natural Wate	r Content (W ⁿ):		면 	Orga	nnic clay OL		
Tare no.				is blasti	Ity clay (CL (ML)-	E	astic silt (MH)	
Wet soil+tare, g				20 -		Org	anic silt OH	
Dry soil+tare, g				10		Organic silt		
Mass of water, g					10 20 3		70 80 90 100	
Tare, g				-		Liquid Limit LL		
Mass of soil, g			1	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ	
Water content %								
Remarks:	Non-Plastic S	Sample		-				
Performed by	\frown		alonde		Date:	Sent	ember 13, 2022	
Yestfeele	$\langle \rangle$		V		Def		and an 40, 2022	
verified by:			3		Date:	Septe	ember 13, 2022	
Laboratory Location:	179 Col	onnade Rd. S	uite 400, Ottawa	, Ontario				



Client:			Infrastructure On	tario		Lab no.:	G-22-03	
Project/Site:			Children Hospi	tal		Project no.:	11205379	
Borehole no.:	BH-16 Sample no.:			SS-2		Depth:	0,61 - 1,22 m	
Soil Description:						Date sampled:		
Apparatus:	Hand	Crank	Balance no.:	8033	3031049	Porcelain bowl no.:	1	
Liquid limit device no.:		1	Oven no.:	B23	3-04645	Spatula no.:	1	
Sieve no.:	015	5690	Glass plate no.:		1	-		
	Liquid Limit	(LL):	-	Soil Preparat	on:			
	Test No. 1	Test No. 2	Test No. 3	Ξ.	Cohesive <425 µ	m 🗵	Dry preparation	
Number of blows					Cohesive >425 µ	^m ⊏	Wet preparation	
	Water Conte	ent:			Non-cohesive			
Tare no.						Results		
Wet soil+tare, g				2.0				
Dry soil+tare, g								
Mass of water, g				(%)				
Tare, g				ntent				
Mass of soil, g				er Col				
Water content %				Wat				
Plastic Limit (P	L) - Water Cont	ent:						
Tare no.								
Wet soil+tare, g				0.0				
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27	
Mass of water, g					Soil	Plasticity Chart ASTI	M D2487	
Tare, g				70		LL 50		
Mass of soil, g				60 —	Lean clay (c)	Eat clay (
Water content %				H- 1 50 -				
Average water content %				≝ ă 40 —		Organic cla	ау ОН	
Natural Wate	r Content (W ⁿ):		2 2 30	Orga	anic clay OL		
Tare no.				is blasti	Ity clay (CL (ML)-	EI	astic silt (MH)	
Wet soil+tare, g				20 -		Org	anic silt OH	
Dry soil+tare, g				10		Organic silt		
Mass of water, g				0	10 20 3	0 40 50 60	70 80 90 100	
Tare, g						Liquid Limit LL		
Mass of soil, g				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ	
Water content %								
Remarks:	Non-Plastic S	Sample						
Performed by:	/	\frown	alonde 🗢		Date:	Senta	ember 13, 2022	
			\sim					
verified by:	(~ 0	9		Date:	Septe	ember 13, 2022	
Laboratory Location:	179 Col	onnade Rd. S	uite 400, Ottawa	, Ontario				



Client:			Infrastructure On	tario		Lab no.:	G-22-03
Project/Site:			Children Hospi	ital		Project no.:	11205379
Borehole no.:	BH-19		Sample no.:	:	SS-2 Depth: 0		0,76 - 1,37 m
Soil Description:						Date sampled:	
Apparatus:	Hand	Crank	Balance no.:	803	3031049	Porcelain bowl no.:	1
Liquid limit device no.:		1	Oven no.:	B23	3-04645	Spatula no.:	1
Sieve no.:	015	5690	Glass plate no.:		1	-	
	Liquid Limit ((LL):	•	Soil Preparati	on:		
	Test No. 1	Test No. 2	Test No. 3	∠	Cohesive <425 µr	n 🗷	Dry preparation
Number of blows					Cohesive >425 µr	^m ⊏	Wet preparation
	Water Conte	ent:			Non-cohesive		
Tare no.						Results	
Wet soil+tare, g				2.0			
Dry soil+tare, g							
Mass of water, g				(%)			
Tare, g				ntent			
Mass of soil, g				er Col			
Water content %				Wat			
Plastic Limit (Pl	L) - Water Cont	ent:		-			
Tare no.							
Wet soil+tare, g				0.0			
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27
Mass of water, g					Soil	Plasticity Chart ASTI	M D2487
Tare, g				70		LL 50	
Mass of soil, g				60 —	Lean clay (c)	Eat clay	
Water content %				14 			
Average water content %				ä 40 –		Organic cla	ay OH)
Natural Wate	r Content (W ⁿ):		면 값 30	Orga	anic clay OL	
Tare no.				is Plastic	Ity clay (CL (ML)	T EI	astic silt MH
Wet soil+tare, g				20 -		Org	anic silt OH
Dry soil+tare, g				10		Organic silt	
Mass of water, g				0	10 20 3		70 80 90 100
Tare, g						Liquid Limit LL	
Mass of soil, g				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %					. ,		
Remarks:	Non-Plastic S	Sample		-			
Performed by:		<u> </u>	alonda		Date:	Sont	amber 13, 2022
. chomed by						<u>Gepte</u>	
Verified by:	$-\tilde{c}$		4		Date:	Septe	ember 13, 2022
Laboratory Location:	179 Col	onnade Rd. S	uite 400, Ottawa	i, Ontario			



Client:			Infrastructure On	tario		Lab no.:	G-22-03	
Project/Site:			Children Hospi	tal		Project no.:	11205379	
Borehole no.:	BH-20 Sample no.:				SS-3 Depth:		1,22 - 1,83 m	
Soil Description:						Date sampled:		
Apparatus:	Hand	Crank	Balance no.:	8033	3031049	Porcelain bowl no.:	1	
Liquid limit device no.:		1	Oven no.:	B23	3-04645	Spatula no.:	1	
Sieve no.:	015	5690	Glass plate no.:		1	-		
	Liquid Limit	(LL):	-	Soil Preparat	on:			
	Test No. 1	Test No. 2	Test No. 3	¥.	Cohesive <425 µ	m 🗵	Dry preparation	
Number of blows					Cohesive >425 µ	m ⊏	Wet preparation	
	Water Conte	ent:			Non-cohesive			
Tare no.						Results		
Wet soil+tare, g				2.0				
Dry soil+tare, g								
Mass of water, g				(%)				
Tare, g				ntent (
Mass of soil, g				er Col				
Water content %				Wat				
Plastic Limit (Pl	L) - Water Cont	tent:		1				
Tare no.								
Wet soil+tare, g				0.0				
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27	
Mass of water, g			-		Soil	Plasticity Chart ASTI	M D2487	
Tare, g				70		LL 50		
Mass of soil, g				60 —		Ent alov		
Water content %				님 50 —		Pat clay		
Average water content %		I		["] ⊟ 40 −		Organic cla	ау он	
Natural Wate	r Content (W ⁿ):		면 	Orga			
Tare no.				is blasti	Ity clay (CL (ML)-	E	astic silt MH	
Wet soil+tare, g				20 -		Org	anic silt OH	
Dry soil+tare, g				10		Organic silt		
Mass of water, g					10 20 3		70 80 90 100	
Tare, g				-		Liquid Limit LL		
Mass of soil, g				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ	
Water content %								
Remarks:	Non-Plastic S	Sample		-		· · · · · · · · · · · · · · · · · · ·		
Performed by:		J. L	alonde		Date:	Septe	ember 13, 2022	
Verified by:	\sim	600	X		Date:	Septe	ember 13, 2022	
-	179 Col	onnade Rd S	Juite 400. Ottawa	. Ontario				
_action y Eboution.				,				



Client:			Infrastructure On	tario		Lab no.:	G-22-03
Project/Site:			Children Hospi	ital		Project no.:	11205379
Borehole no.:	BH-21		Sample no.:		SS-2 Depth: 0,61 - 1,22 m		0,61 - 1,22 m
Soil Description:						Date sampled:	
Apparatus:	Hand	Crank	Balance no.:	8033	3031049	Porcelain bowl no.:	1
Liquid limit device no.:		1	Oven no.:	B23	3-04645	Spatula no.:	1
Sieve no.:	015	5690	Glass plate no.:		1	-	
	Liquid Limit	(LL):	•	Soil Preparati	on:		
	Test No. 1	Test No. 2	Test No. 3	Σ	Cohesive <425 µr	n 🗵	Dry preparation
Number of blows					Cohesive >425 µr	^m ⊏	Wet preparation
	Water Conte	ent:			Non-cohesive		
Tare no.						Results	
Wet soil+tare, g				2.0			
Dry soil+tare, g							
Mass of water, g				(%)			
Tare, g				ntent			
Mass of soil, g				er Col			
Water content %				Wat			
Plastic Limit (Pl	L) - Water Cont	ent:		-			
Tare no.							
Wet soil+tare, g				0.0			
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27
Mass of water, g					Soil	Plasticity Chart AST	M D2487
Tare, g				70		LL 50	
Mass of soil, g				60 -	Lean clay CL	Eat clay (
Water content %				H- 1 50 -			
Average water content %				اللہ اللہ اللہ اللہ اللہ اللہ اللہ اللہ		Organic cla	ay OH
Natural Wate	r Content (W ⁿ):		2 2 30	Orga	Inic clay OL	
Tare no.				Si Dlasti	ity clay (CL (ML)-	7 Ela	astic silt MH
Wet soil+tare, g				20 -		Org:	anic silt OH
Dry soil+tare, g				10		Organic silt	
Mass of water, g					10 20 3		70 80 90 100
Tare, g				-		Liquid Limit LL	
Mass of soil, g			1	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %							
Remarks:	Non-Plastic S	Sample		-		· · · · · · · · · · · · · · · · · · ·	
Performed by		<u> </u>	alorde		Date:	Sente	ember 13, 2022
Vorified by:			2 2		Data	Cont	amber 13, 2022
vermed by:	-C	100	5		Date:	5epte	5111JEI 13, 2U22
Laboratory Location:	179 Col	onnade Rd. S	uite 400, Ottawa	, Ontario			



Client:			Infrastructure On	itario		Lab no.:	G-22-03	
Project/Site:			Children Hospi	ital		Project no.:	11205379	
Borehole no.:	MW-14		Sample no.:		SS-2	Depth:	0,61 - 1,22 m	
Soil Description:						Date sampled:		
Apparatus:	Hand	Crank	Balance no.:	803	3031049	Porcelain bowl no.:	1	
Liquid limit device no.:		1	Oven no.:	B23	3-04645	Spatula no.:	1	
Sieve no.:	015	5690	Glass plate no.:		1	-		
	Liquid Limit	(LL):	-	Soil Preparat	on:			
	Test No. 1	Test No. 2	Test No. 3	¥	Cohesive <425 µ	m 🗵	Dry preparation	
Number of blows					Cohesive >425 µ	m ⊏	Wet preparation	
	Water Conte	ent:			Non-cohesive			
Tare no.						Results		
Wet soil+tare, g				2.0				
Dry soil+tare, g								
Mass of water, g				(%)				
Tare, g				ntent (
Mass of soil, g				er Col				
Water content %				Wat				
Plastic Limit (Pl	L) - Water Cont	ent:		-				
Tare no.								
Wet soil+tare, g				0.0				
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27	
Mass of water, g			-		Soil	Plasticity Chart ASTI	M D2487	
Tare, g				70		LL 50		
Mass of soil, g				60 —		Ent alov		
Water content %				립 - 50 -		Pat clay		
Average water content %				["] ⊟ 40 −		Organic cla	ау он	
Natural Wate	r Content (W ⁿ):		면 값 30	Orga			
Tare no.				ia Plasti	Ity clay (CL (ML)-	E	astic silt MH	
Wet soil+tare, g				20		Org	anic silt OH	
Dry soil+tare, g				10		Organic silt		
Mass of water, g				0	10 20 3		70 80 90 100	
Tare, g				-		Liquid Limit LL		
Mass of soil, g				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ	
Water content %								
Remarks:	Non-Plastic S	Sample				· · · · · · · · · · · · · · · · · · ·		
Performed bv:		JL	alonde		Date:	Septe	ember 13, 2022	
Verified by:	$\langle \rangle$	m	5		Date:	Sente	ember 13. 2022	
	170.01			Ontorio	2410.			
Laboratory Location:	179 Col	onnade Rd. S	uite 400, Ottawa	i, Untario				



Client:			Infrastructure On	tario		Lab no.:	G-22-03	
Project/Site:			Children Hospi	ital		Project no.:	11205379	
Borehole no.:	MW-17		Sample no.:		SS-2 Depth:		0,08 - 0,61 m	
Soil Description:						Date sampled:		
Apparatus:	Hand	Crank	Balance no.:	8033	3031049	Porcelain bowl no.:	1	
Liquid limit device no.:		1	Oven no.:	B23	3-04645	Spatula no.:	1	
Sieve no.:	015	5690	Glass plate no.:		1	-		
	Liquid Limit	(LL):		Soil Preparati	on:			
	Test No. 1	Test No. 2	Test No. 3	4	Cohesive <425 µr	n 🗵	Dry preparation	
Number of blows					Cohesive >425 µr	^m ⊏	Wet preparation	
	Water Conte	ent:			Non-cohesive			
Tare no.						Results		
Wet soil+tare, g				2.0				
Dry soil+tare, g								
Mass of water, g				(%)				
Tare, g				ntent				
Mass of soil, g				er Co				
Water content %				Wat				
Plastic Limit (P	L) - Water Cont	ent:		-				
Tare no.								
Wet soil+tare, g				0.0				
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27	
Mass of water, g					Soil	Plasticity Chart AST	M D2487	
Tare, g				70		LL 50		
Mass of soil, g				60 -	Lean clay (c)	Eat clay		
Water content %				ы т 50 —				
Average water content %				ä 40 –		Organic cla	ay OH)	
Natural Wate	r Content (W ⁿ):			Orga	anic clay OL		
Tare no.				Si Si	Ity clay (CL (ML)-	E	astic silt (MH)	
Wet soil+tare, g				20		Org	anic silt OH	
Dry soil+tare, g				10		Organic silt		
Mass of water, g				0	10 20 3		70 80 90 100	
Tare, g						Liquid Limit LL		
Mass of soil, g				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ	
Water content %								
Remarks:	Non-Plastic S	Sample						
Performed by:		<u> </u>	alonde		Date:	Sent	ember 13, 2022	
			\sim		-			
verified by:			¥)		Date:	Septe	ember 13, 2022	
Laboratory Location:	179 Col	onnade Rd. S	uite 400, Ottawa	i, Ontario				



Client:			Infrastructure On	tario		Lab no.:	G-22-03
Project/Site:			Children Hospi	tal		Project no.:	11205379
Borehole no.:	MW-23		Sample no.:		SS-6 Depth: 3,20 - 3,		3,20 - 3,81 m
Soil Description:						Date sampled:	
Apparatus:	Hand	Crank	Balance no.:	8033	3031049	Porcelain bowl no.:	1
Liquid limit device no.:		1	Oven no.:	B23	-04645	Spatula no.:	1
Sieve no.:	015	5690	Glass plate no.:		1		
	Liquid Limit	(LL):		Soil Preparati	on:		
	Test No. 1	Test No. 2	Test No. 3	<i>.</i>	Cohesive <425 µr	n 🗵	Dry preparation
Number of blows					Cohesive >425 µr	n ⊏	Wet preparation
	Water Conte	ent:			Non-cohesive		
Tare no.						Results	
Wet soil+tare, g				2.0			
Dry soil+tare, g							
Mass of water, g				(%)			
Tare, g				ntent			
Mass of soil, g				er Co			
Water content %				Wat			
Plastic Limit (Pl	L) - Water Cont	ent:					
Tare no.							
Wet soil+tare, g				0.0			
Dry soil+tare, g					15 17	19 21 Nb Blows	23 25 27
Mass of water, g					Soil	Plasticity Chart AST	M D2487
Tare, g				70		LL 50	
Mass of soil, g				60	Lean clay (C)	Eat alou (
Water content %				Ы- 1- 50 —		T at Ciay	
Average water content %				ä 40 –		Organic cla	ау ОН
Natural Wate	r Content (W ⁿ):			Orga	nic clay OL	
Tare no.				Sil Sil	ty clay (CL (ML)	7 Ela	astic silt MH
Wet soil+tare, g				20		Org	anic silt OH
Dry soil+tare, g				10		Organic silt	
Mass of water, g				0	10 20 3		70 80 90 100
Tare, g						Liquid Limit LL	
Mass of soil, g			1	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W ⁿ
Water content %					× /		
Remarks:	Non-Plastic S	Sample		-			
Performed by		<u> </u>	alonde		Date:	Sente	ember 13, 2022
Varified by:			2		Data		ambor 12, 2022
vermed by:	$-\epsilon$	100	5		Date:	Septe	
Laboratory Location:	179 Col	onnade Rd. S	uite 400, Ottawa	, Ontario			



Moisture Content of Soils (ASTM D 2216)

Client:	Infrastru	ucture Ontar	io		Lab No.:		G-22-03	
Project/Site:	Childro	en's Hospita	I		Project No.	.:	1120	15379
Apparatus Used for Testing	Oven No.:	B23-0	04645	Scale No.:	80330	031049		
BH No.:	BH21	BH21	BH21	BH21	BH15-22	BH15-22	BH16-22	BH16-22
Sample No.:	SS1	SS2	SS3	SS4	SS1	SS2	SS1	SS2
Depth:	0,0-2,0	2,0-4,0	4,0-6,0	6,0-8,0	0,0-2,0	2,0-3,5	0.0-2,0	2,0-4,0
Container no.	21	14	13	2	18	9	13	23
Mass of container + wet soil (g)	53.50	53.80	61.80	65.50	61.00	62.70	78.90	58.40
Mass of container + dry soil (g)	50.79	52.57	59.01	59.51	59.50	60.20	77.00	55.40
Mass of container (g)	15.10	14.80	14.70	14.50	15.00	14.70	14.80	15.10
Mass of dry soil (g)	35.7	37.8	44.3	45.0	44.5	45.5	62.2	40.3
Mass of water (g)	2.7	1.2	2.8	6.0	1.5	2.5	1.9	3.0
Moisture content (%)	7.6	3.3	6.3	13.3	3.4	5.5	3.1	7.4
BH No.:								
Sample No.:								
Depth:								
Container no.								
Mass of container + wet soil (g)								
Mass of container + dry soil (g)								
Mass of container (g)								
Mass of dry soil (g)								
Mass of water (g)								
Moisture content (%)								
Remarks:								
Performed Bv:	🦳 JABa	aptiste		Date:		Julv 27	7, 2022	
Verified by :		2		Date:	August 3, 2022			



Moisture Content of Soils (ASTM D 2216)

Client:	Infrastr	ucture Ontar	io		Lab No.:		G-2	2-03	
Project/Site:	Childr	en's Hospita	I		Project No.:			11205379	
Apparatus Used for Testing	Oven No.:	B23-	04645	Scale No.:	80330	031049			
BH No.:	BH15	BH16	BH22	BH22					
Sample No.:	SS3	SS3	SS1	SS2					
Depth:	4,0-6,0	4,0-5,4	0,5-2,5	2,5-4,5					
Container no.	35	11	47	52					
Mass of container + wet soil (g)	45.20	48.30	42.80	49.20					
Mass of container + dry soil (g)	42.40	46.30	39.50	45.20					
Mass of container (g)	11.50	11.40	11.50	11.40					
Mass of dry soil (g)	30.9	34.9	28.0	33.8					
Mass of water (g)	2.8	2.0	3.3	4.0					
Moisture content (%)	9.1	5.7	11.8	11.8					
MW No.:	BH14	BH14	BH14	BH17	BH17	BH17	BH18	BH18	
Sample No.:	SS1	SS2	SS3A	SS1	SS2	SS3	SS1	SS2A	
Depth:	0,6-2,6	2,6-4,6	4,6-5,4	0,3-2	2,0-4,0	4,0-4,9	0,3-2	2,0-2,7	
Container no.	1	25	26	6	8	22	37	16	
Mass of container + wet soil (g)	37.30	38.60	46.50	67.70	61.40	39.00	50.00	45.00	
Mass of container + dry soil (g)	36.30	36.70	43.20	66.60	57.60	36.90	48.80	41.20	
Mass of container (g)	11.20	11.40	11.40	15.00	14.30	11.50	11.30	11.40	
Mass of dry soil (g)	25.1	25.3	31.8	51.6	43.3	25.4	37.5	29.8	
Mass of water (g)	1.0	1.9	3.3	1.1	3.8	2.1	1.2	3.8	
Moisture content (%)	4.0	7.5	10.4	2.1	8.8	8.3	3.2	12.8	
Remarks:									
Derformed Dir		ntioto		Data		h.h.o	7 2022		
Verified by :	JA BE			Date:		August	3, 2022		



Moisture Content of Soils (ASTM D 2216)

Client:	Infrastructu	ure Ontario		Lab No.:	G-22-03		
Project/Site:	IO Childrer	's Hospital		Project No.:	11205379		
Apparatus Used for Testing	Oven No.:	B23-04645	Scale No.:	8033031049			
MW No.:	BH18						
Sample No.:	SS3						
Depth:	4,0-6,0						
Container no.	4						
Mass of container + wet soil (g)	56.00						
Mass of container + dry soil (g)	52.30						
Mass of container (g)	11.30						
Mass of dry soil (g)	41.0						
Mass of water (g)	3.7						
Moisture content (%)	9.0						
BH No.:							
Sample No.:							
Depth:							
Container no.							
Mass of container + wet soil (g)							
Mass of container + dry soil (g)							
Mass of container (g)							
Mass of dry soil (g)							
Mass of water (g)							
Moisture content (%)							
Remarks:							
Performed By:	J A Baptis	ste	Date:	July	, 27, 2022		
Verified by :	= back)	Date:	August 3, 2022			


Moisture Content of Soils (ASTM D 2216)

Client:	Infrastr	ucture Ontar	io		_Lab No.: G-22-03			2-03
Project/Site:	Childr	en's Hospita	I	Project No.:			1120	5379
Apparatus Used for Testing	Oven No.:	B23-(04645	Scale No.:	803303	1049		
MW No.:	BH23	BH23	BH23	BH23	BH23			
Sample No.:	SS1	SS2	SS3	SS4	SS5			
Depth:	0,3-2,0	2,5-4,5	4,5-6,5	6,5-8,5	8,5-10			
Container no.	33	2	13	18	15			
Mass of container + wet soil (g)	70.60	73.50	61.70	62.40	55.50			
Mass of container + dry soil (g)	69.20	70.80	59.20	59.90	52.80			
Mass of container (g)	14.60	14.50	14.70	15.00	14.80			
Mass of dry soil (g)	54.6	56.3	44.5	44.9	38.0			
Mass of water (g)	1.4	2.7	2.5	2.5	2.7			
Moisture content (%)	2.6	4.8	5.6	5.6	7.1			
MW No.:	BH20-22	BH20-22						
Sample No.:	SS1	SS2						
Depth:	0,5-2,5	2,5-4,5						
Container no.	16	28						
Mass of container + wet soil (g)	48.50	58.60						
Mass of container + dry soil (g)	47.00	56.40						
Mass of container (g)	14.90	14.90						
Mass of dry soil (g)	32.1	41.5						
Mass of water (g)	1.5	2.2						
Moisture content (%)	4.7	5.3						
Remarks:								
Performed By:	J A Ba	aptiste		Date:		July 27	, 2022	
Verified by :	bae	<u>X</u>		Date:		August	3, 2022	



Client :	Infr	astructure Ontario	o (IO)	Lab No :	S19 ⁻	12
Project/Site :	Preliminary Geo Hospital	technical Investig of Eastern Ontari	ation – Children's o Campus	Project No :	11205	379
			1			
2090					Zero Air Voids	Line
2070						
ູ ²⁰⁵⁰ . ເມ						
ensity (k						
2010 ·						
1990 •						
1970 •						
1950 - 6.0		8.0	10.0 Water Content (%)	12.0	14.0
Prepared Sample	Dry	X Moist		As	sumed G _s :	2.80
ASTM D698 Test	Method: A	X B	C	- Iy	pe of Hammer:	Manual
Soil Type: Material: Proposed Use:		Augure	Fill d Material V/A			
Sample Identificat Sample Location:	ion:	M	IW1 N/A	Max. Dry Optimum	Density: Moisture:	2067 kg/m ³ 9.5 %
Aggregate Supplie	er / Pit Name:	N	N/A	% Retain	ed on 19.0 mm:	0.0 %
Sampled By:			S.H	Corrected	d Opt. Moist.:	9.5 %
Remarks :						
Performed by :		Sharif Hossain		Date :	December	19, 2019
Verified by :		Raj Kadia, C.E.T		Date :	December	31, 2019



Client :	Infra	structure Ontario (IC	D)	Lab No :	S1916
Project/Site :	Preliminary Geotechnical Investigation – Children's Hospital of Eastern Ontario Campus			Project No :	11205379
2150					
2130					Zero Air Voids Line
2110					
2090 .					
бу) 2070					
Density					
<u>ک</u> 2030					
2010					
1990 •					
1970 •					
1950 + 5.0		7.0	9 Water Content (%	.0 (6)	11.0
Prepared Sample:	Dry	X Moist		Assu	ımed G _s : 2.70
ASTM D698 Test	Method: A	ХВ	C	- Туре	e of Hammer: Manual
Soil Type: Material: Proposed Use:	-	Sandy Silt, Tra Augured Ma N/A	ce Gravel aterial		
Sample Identificat	ion:	MW3-1 N/A	9	Max. Dry Do Optimum M	ensity: <u>2062 kg/m³</u> loisture: <u>8.4 %</u>
Aggregate Supplie	er / Pit Name:	N/A	2010	% Retained	l on 19.0 mm: 0.0 %
Sampled By:	-	S.H	9, 2019	Corrected (Div Density. 2002 kg/m Opt. Moist.: 8.4 %
Remarks :					
Performed by :		Sharif Hossain		Date :	December 19, 2019
Verified by :	F	Raj Kadia, C.E.T.		Date :	December 31, 2019



Client :	Infrastructure Ontario (IO)	Lab No : S1914				
Project/Site :	Preliminary Geotechnical Investigation – Children's Hospital of Eastern Ontario Campus	Project No : 11205379				
2100		Zaro Air Voids Lina				
2050 -						
sity (kg/m³)						
1950 -						
1900						
1850 - 7.0	9.0 Water Conten	11.0 13.0 t (%)				
Prepared Sample: ASTM D698 Test	: Dry X Moist Method: A X B C	Assumed G _s : 2.80 - Type of Hammer: Manual				
Soil Type: Material: Proposed Use:	Fill Augured Sample N/A	-				
Sample Identificat Sample Location: Aggregate Supplie Sample Date: Sampled By:	tion: MW5 N/A er / Pit Name: N/A December 9, 2019 S.H	Max. Dry Density:2057 kg/m³Optimum Moisture:10.0 %% Retained on 19.0 mm:0.0 %Corrected Dry Density:2057 kg/m³Corrected Opt. Moist.:10.0 %				
Remarks :						
Performed by :	Basharat Ali	Date : December 17, 2019				
Verified by :	Raj Kadia, C.E.T.	December 20, 2019				



Client :	Infr	astructure Ontari	o (IO)	_ Lab N	Lab No : S1913			
Project/Site :	Preliminary Geo Hospital	technical Investion of Eastern Ontar	gation – Children's io Campus	Project N	lo : 112	205379		
2140				Zero A	ir Voids Line			
2120 •								
				¥				
و 2100 •								
(kg/n								
2080 •								
Dens								
2060 ·								
2040								
2020								
2000								
5.0		7.0	Water Conten	9.(t (%)	0	11.0		
				(,,,)				
Prepared Sample	: Dry	X Moist	-		Assumed G _s :	2.80		
ASTM D698 Test	Method: A	х в	C	-	Type of Hammer:	Manual		
								
Soil Type: Material:		Augure	Fill A Material	-				
Proposed Use:		, tugure	N/A	_				
Sample Identifica	tion:		BH6	Ma	ax. Dry Density:	2086 kg/m ³		
Aggregate Suppli	er / Pit Name:		N/A	0	ntimum Moisture: Retained on 19.0 mm	7.1 % n: 0.0 %		
Sample Date:		Decem	ber 9, 2019	Co	orrected Dry Density:	2086 kg/m ³		
Sampled By:			S.H	Co	prrected Opt. Moist.:	7.1 %		
Remarks :								
Performed by :		Sharif Hossain	1	_ Da	te: Decemb	er 17, 2019		
Verified by :		Raj Kadia, C.E. ⁻	T.	Da	te: Decemb	er 31, 2019		
,				_		·		



Client :	Infrastructure Ontario (IO)	Lab No : \$1917
Project/Site :	Preliminary Geotechnical Investigation – Children's Hospital of Eastern Ontario Campus	Project No : 11205379
2290		Zero Air Voids Line
2270		
໌ ເ		
9 2230 .		
2210 ·		
2190		
2170 •		
2150 • 5.0	7.0 Water Content (9.0 %)
Prepared Sample: ASTM D698 Test	Dry X Moist Method: A X B C	Assumed G _s : 2.80 - Type of Hammer: Manual
Soil Type: Material: Proposed Use:	Fill Augured Material N/A	
Sample Identificat Sample Location: Aggregate Supplie Sample Date: Sampled By:	ion: BH12 er / Pit Name: N/A December 9, 2019 S.H	Max. Dry Density:2250 kg/m³Optimum Moisture:6.8 %% Retained on 19.0 mm:0.7 %Corrected Dry Density:2250 kg/m³Corrected Opt Moist :6.8 %
Remarks :		
Performed by :	B.Ali	Date : December 14, 2019
Verified by :	Raj Kadia, C.E.T.	Date : December 31, 2019



Client :	Infr	astructure Ontaric	o (IO)	Lab No :	Lab No : \$1910			
Project/Site :	Preliminary Geo Hospital	technical Investig of Eastern Ontario	ation – Children's o Campus	Project No :	1120	5379		
2200					Zero Air Void	s Line		
2150 •								
(kg/m³) 100 •		/						
2050 -								
2000 -								
1950 4 .0		6.0	8.0 Water Conten	t (%)	10.0	12.0		
Prepared Sample ASTM D698 Test	: Dry Method: A	X Moist	C	· .	Assumed G _s : Type of Hammer:	2.80 Manual		
Soil Type: Material: Proposed Use:		F Augured	Fill d Material I∕A	-				
Sample Identificat Sample Location: Aggregate Suppli Sample Date: Sampled By:	tion: er / Pit Name:	Bł N Decembe Sir	H13 I/A Pr 12, 2019 mon	Max. Optim % Ret Corre Corre	Dry Density: num Moisture: ained on 19.0mm: cted Dry Density: cted Opt. Moist.:	2143 kg/m³ 8.7 % 0.0 % 2143 kg/m³ 8.7 %		
Remarks :								
Performed by :		Sharif Hossain		Date :	Decembe	r 17, 2019		
Verified by :		Raj Kadia, C.E.T		_ Date :	December	r 31, 2019		



Client :	Infra	astructure Ontario (IO)		Lab No : \$1919			
Project/Site :	Preliminary Geo Hospital	technical Investigation of Eastern Ontario Car	– Children's npus	Project No :	11205379		
2250				7	ero Air Voids Line		
2200							
2150 •							
sity (kg/m סיד 100 -							
ם ₂₀₅₀ .							
2000 -							
1950 •							
1900	5	.0 Wa	7.0 ater Content (%	9.0 9)	11.0		
Prepared Sample: ASTM D698 Test I	Dry Method: A	X Moist - X B -	c	- Type of	ed G _s : 2.80 Hammer: Manual		
Soil Type: Material: Proposed Use:		Fill Augured Mate N/A	ərial				
Sample Identificati Sample Location: Aggregate Supplie Sample Date: Sampled By:	on: r / Pit Name:	BH14 Depth 0' to N/A December 9, 2 S.H	2'	Max. Dry Dens Optimum Moi % Retained of Corrected Dry Corrected Op	sity: 2178 kg/m³ sture: 7.6 % n 19.0 mm: 0.0 % p Density: 2178 kg/m³ t. Moist.: 7.6 %		
Remarks :							
Performed by :		Sharif Hossain		Date :	December 12, 2019		
Verified by :		Raj Kadia, C.E.T.		Date :	December 31, 2019		



GHD



GHD

Client :		Infra	astructure C	Ontario		_ L	.ab No :		A-22	-02	
Project/Site :		С	hildren Hos	pital		Proj	Project No : 11205379				
2400											
2300 •								Zero A	lir Vojds	Line	
2200											
j/m ³)											
(kç											
Densi											
D											
2000 •											
1900 -											
1800 0.0	2	.0	4.0	6.	0	8.0	10	0.0	12.0)	14.0
				Wat	er Contei	nt (%)					
Prepared Sam	ole:	Dry	0 Mo	oist x			As	ssumed G	s.	2.	70
ASTM D698 Te	est Method:	A	0 E 75 mm	3 0 9.50 r	C	x 19.0 mm	Ту	ype of Har	nmer:	Mech	anical
Soil Type: Material:		_	Cr	ushed Stor	e						
Proposed Use: Sample Identifi	cation.			MW 17		— — 1	Max Dru	Density		2214	ka/m ³
Sample Locatio	Dh:			In Diass		_	Optimum	n Moisture	9:	7.2	%
Aggregate Sup Sample Date:	piler / Pit Name	e:		IN PIACE		_	% Retain Correcte	ed on 19 d Dry Dei	nsity:	1.0 2214	% kg/m ³
Sampled By:				D. Ash		_	Correcte	d Opt. Mo	oist.:	7.2	%
Remarks :											
Performed b	y:		J. Lalonde	9			Date :	Se	eptembe	r 7, 2022	
	($\langle \rangle$)				_			_



CLIENT:	Infrastructure On	tario	LAB No.:	, WLT 293-1		
PROJECT/ SITE:	Preliminary Geotechnical Investi Road, Ottawa, C	Preliminary Geotechnical Investigation: 401 Smyth Road, Ottawa, ON				
Borehole No.:	MW2	Sampled ID:	n/a			
Depth:	5.13 m	Date Sampled:	n/a			
Lithologic Descrip	tion: Shale					
	Initial Specim	en Parameters				
Diar	neter, cm		6.3			
Heig	ght, cm		12.8			
Heig	ght-to-Diameter Ratio		2.0			
Volu	ıme, cm ³	3	391.7			
Mas	s, g	1	042.0			
Bulk	c Density, kg/m ³	2	2661			
Mois	sture Condition	As F	Received			
Mois	sture Content, %		2.0			
Max	imum Applied Load, kN	1	10.3			
Con	npressive Strength, MPa		35.9			
	WW2D 5.13 m	MW	2D 5.13 m			
REMARKS:						
PERFORMED BY:	M. Mitchell	DATE:	December 3	, 2019		
VERIFIED BY:	Michael Braverman	DATE:	December 16	3, 2019		



CLIENT:	Infrastructure Ont	tario	LAB No.:	, WLT 293-2	
PROJECT/ SITE:	Preliminary Geotechnical Investig Road, Ottawa, O	gation: 401 Smyth N	PROJECT No.:	11205379	
Borehole No.:	MW2	Sampled ID:	-		
Depth:	7.67 m	Date Sampled:	n/a		
Lithologic Descrip	tion: Shale				
	Initial Specime	en Parameters			
Diar	neter, cm		6.2		
Heig	ght, cm		13.1		
Heię	ght-to-Diameter Ratio		2.1		
Volu	ıme, cm ³	2	402.4		
Mas	s, g	1	067.1		
Bulk	c Density, kg/m ³	:	2652		
Mois	sture Condition	As F	Received		
Moi	sture Content, %		2.3		
.	·····				
Max	imum Applied Load, KN		31 4		
Con			31.4		
	WW2D 7.67 m		W2D 7.67 m		
REMARKS:					
PERFORMED BY:	M. Mitchell	DATE:	December 3	3, 2019	
VERIFIED BY: Michael Braverman DATE:			December 1	6, 2019	



CLIENT:	Infrastructure Ont	ario	LAB No.:	WLT 293-3
PROJECT/ SITE:	Preliminary Geotechnical Investig Road, Ottawa	PROJECT No.:	11205379	
Borehole No.:	MW2	Sampled ID:	-	
Depth:	9.70 m	Date Sampled:	n/a	
Lithologic Descripti	i on: Shale			
	Initial Specime	en Parameters		
Diam	eter, cm		6.2	
Heigh	nt, cm		12.8	
Heigh	nt-to-Diameter Ratio		2.1	
Volun	ne, cm ³	3	393.6	
Mass	, g	1	052.9	
Bulk I	Density, kg/m ³	:	2675	
Moist	ure Condition	As F	Received	
Moist	ure Content, %		2.0	
		T		
Maxir	num Applied Load, kN		75.0	
Comp	pressive Strength, MPa			
	WW2D 9.70 m	MV	V2D 9.70 m	
REMARKS:				
PERFORMED BY:	M. Mitchell	DATE:	December 3	3, 2019
VERIFIED BY: Michael Braverman DATE:			December 1	6, 2019



CLIENT:	Infrastructure Ontario		LAB No.:	WLT 293-4
PROJECT/ SITE:	Preliminary Geotechnical Investig Road, Ottawa, Ot	pation: 401 Smyth N PROJECT No.:		11205379
Borehole No.: Depth: Lithologic Descrip	MW3 6.28 m tion: Shale	Sampled ID: Date Sampled:	- n/a	
	Initial Specime	n Parameters		
Dian	neter, cm		6.3	
Heig	ht, cm		13.1	
Heig	ht-to-Diameter Ratio		2.1	
Volu	me, cm ³	2	401.6	
Mas	s, g	1	067.4	
Bulk	Density, kg/m ³	:	2658	
Mois	sture Condition	As F	Received	
Mois	sture Content, %		2.1	
Max	Maximum Applied Load, kN		87.2	
	WW3D 6.28 m	M	W3D 6.28 m	
REMARKS:				
PERFORMED BY:	M. Mitchell	DATE:	December 3	3, 2019
VERIFIED BY:	Michael Braverman	DATE:	December 1	6, 2019



CLIENT:	Infrastructure Ontario		LAB No.:	WLT 293-5
PROJECT/ SITE:	Preliminary Geotechnical Investig Road, Ottawa. Ol	gation: 401 Smyth		11205379
Borehole No.:	MW3	Sampled ID:	-	
Depth:	7.83 m	Date Sampled:	n/a	
Lithologic Description	on: Shale			
	Initial Specime	n Parameters		
Diame	eter, cm		6.3	
Heigh	t, cm		12.8	
Heigh	t-to-Diameter Ratio		2.0	
Volum	ne, cm ³	3	394.0	
Mass	, g	1	041.1	
Bulk [Density, kg/m ³	:	2642	
Moist	ure Condition	As F	Received	
Moist	ure Content, %		2.2	
Maxin	num Applied Load kN		103.2	
Comp	pressive Strength, MPa		33.5	
	WW3D 7.83 m	MW	BD 7.83 m	
REMARKS:				
PERFORMED BY:	M. Mitchell	DATE:	December 3	3, 2017
VERIFIED BY:	Michael Braverman	DATE:	December 1	6, 2019



CLIENT:	Infrastructure Ontario		LAB No.:	WLT 293-6
PROJECT/ SITE:	Preliminary Geotechnical Investigation: 401 Smyth SITE: Road, Ottawa		PROJECT No.:	11205379
Borehole No.:	MW3	Sampled ID:	-	
Depth:	10.27 m	Date Sampled:	n/a	
Lithologic Descrip	tion: Shale			
	Initial Specime	en Parameters		
Dian	neter, cm		6.3	
Heig	ht, cm		12.4	
Heig	ht-to-Diameter Ratio		2.0	
Volu	me, cm ³	:	383.6	
Mas	s, g	1	036.8	
Bulk	Density, kg/m ³		2703	
Mois	sture Condition	As F	Received	
IVIOIS	sture Content, %		1.8	
Max	imum Applied Load kN		109.0	
Com	pressive Strength, MPa		35.4	
	WW3D 10.27 m	MW	3D 10.27 m	
REMARKS:				
	M Mitchell	ΠΔΤΕ·	December 1	3 2019
VERIFIED BY:	Michael Braverman	DATE:	December 1	6, 2019



CLIENT:	Infrastructure Ontario		LAB No.:	WLT 293-7
PROJECT/ SITE:	Preliminary Geotechnical Investig Road, Ottawa	gation: 401 Smyth	PROJECT No.:	11205379
Borehole No.:	MW4	Sampled ID:		
Depth:	3.26 m	Date Sampled:	n/a	
Lithologic Descrip	shale			
	Initial Specime	en Parameters		
Dia	meter, cm		6.2	
Hei	ght, cm		12.5	
Hei	ght-to-Diameter Ratio		2.0	
Volu	ume, cm ³	;	383.9	
Mas	ss, g	1	023.1	
Bull	k Density, kg/m ³		2665	
Moi	sture Condition	As F	Received	
Moi	sture Content, %		2.2	
Mo	vimum Applied Lood KN	1 .	128.0	
Cor	nnressive Strength MPa		41.8	
	WW4D 3.26M	MW4D 3.	26M	
REMARKS:				
PERFORMED BY:	M. Mitchell	DATE:	December	3, 2019
VERIFIED BY:	Michael Braverman	DATE:	December 1	6, 2019



CLIENT:	Infrastructure Ontario		LAB No.:	WLT 293-8
PROJECT/ SITE:	Preliminary Geotechnical Investigation: 401 Smy ROJECT/ SITE: Road, Ottawa		PROJECT No.:	11205379
Borehole No.:	MW4	Sampled ID:		
Depth:	6.38 m	Date Sampled:	n/a	
Lithologic Descrip	tion: Shale			
	Initial Specime	n Parameters		
Diar	neter, cm		6.3	
Hei	ght, cm		12.5	
Hei	ght-to-Diameter Ratio		2.0	
Volu	ıme, cm ³	:	384.0	
Mas	ss, g	1	020.3	
Bulk	c Density, kg/m ³		2657	
Moi	sture Condition	As i		
INIOIS	sture Coment, %		1.0	
Мах	imum Applied Load, kN		87.5	
Con	npressive Strength, MPa		28.5	
	<image/>	MW4	D 6.38M	
REMARKS:				
PERFORMED BY	M. Mitchell	DATE	December :	3. 2019
VERIFIED BY:	Michael Braverman	DATE:	December 1	6, 2019



CLIENT:	Infrastruct	Infrastructure Ontario		WLT 293-9	
PROJECT/ SITE	Preliminary Geotechnical Investigation: 401 Smyth OJECT/ SITE: Road, Ottawa		PROJECT No.:	11205379	
Borehole No.:	MW4	Sampled ID:	-		
Depth:	7.58 m	Date Sampled:	n/a		
Lithologic Descri	ption: Shale				
	Initial	Specimen Parameters			
Dia	ameter, cm		6.2		
Не	ight, cm		12.7		
Не	ight-to-Diameter Ratio		2.0		
Vo	lume, cm ³		390.5		
Ма	ss, g	1	036.8		
Bu	lk Density, kg/m ³		2655		
Mo		As F	Received		
IVIO	isture Content, %		2.3		
Ма	ximum Applied Load, kN		93.5		
Co	Compressive Strength, MPa		30.5		
	WHD 7.55M		WW4D 7.58M		
REMARKS:					
			December	2010	
			December	9, 2013	
VERIFIED BY:	Michael Brave	erman DATE:	December 1	6, 2019	

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

Client :	Infrastructure C	Ontario				Proje	ect N° :	11205379
Project :	Children Hospital				Sample N° : BH21-rc5			
	· · · ·					_	Depth :	8.13 - 8.24 m
						— Sampling	g Date :	
						_		
Testing Appara	atus Used :			Loadin	g device N°_	9130		Caliper N° _1
			Fechnical Data					View of Specimen
			1		Average	7		Before Test :
Diameter :		63.37	63.24	63.31	63.31	(mm)		
Length :		111.13	112.75	110.08	111.32	(mm)		
Straightness (0.5mm ma	aximum) (S1) :	0.3	0.3	0.2	0.3	(mm)		
Flatness (25µm maximu	ım) (FP2) :	Ok	Ok	Ok	Ok	(µm)		
Parallelism (0.25 ° maxi	imum) (FP2) :	0.15	0.10	0.20	0.15	(°)		After Test :
Mass :	93	7.9	_(g) Volume:	35	0398	(mm ³)		
Density :			267	77	(kg/m ³)			
Moisture Conditions :			Dr	у				
Loading Rate (0.5 to	1.0 MPa / sec) :		0.9	0	(MPa/sec)			
Type of Fracture :			Along Fo	oliation	_			
Test Duration (2-15 N	/linutes) :		78	3	(seconds)			
Maximum Applied Lo	ad :		220.	.86	_(kN)			
Compressive Stre	ngth :		70.	2	(MPa)			
Remarks :								
Analysed by :	J. Lalonde	\cap				_	Date :	8/12/2022
Verified by :	\rightarrow	<u>pæf</u>				_	Date :	9/13/2022



FINAL REPORT

Results of Free Swell Tests on Shale of Georgian Bay Formation and Blue Mountain/Billings Formations

Children's Hospital of Eastern Ontario Campus – Preliminary Geotechnical Investigation Ottawa, ON

Project No. 11205379

Prepared for:

GHD 111 Brunel Road Suite 200 Mississauga, ON

K. Y. Lo Inc.

July 22, 2020

TABLE OF CONTENT

1.	Introduction	3
2.	Methods of testing	3
2.1	Free swell tests	3
2.2	Calcite content, water content and salinity tests	3
3.	Results of laboratory testing	4
4.	References	5

<u>Appendix</u>

7

1. Introduction

K.Y. Lo Inc. was retained by GHD to test the swelling characteristics of shale cores of the Georgian Bay Formation and Blue Mountain/Billings Formations for the Children's Hospital of Eastern Ontario Campus – Preliminary Geotechnical Investigation project in Ottawa. Rock cores from boreholes MW2D, MW3D and MW4D were provided for testing. Four (4) free swell tests were requested by GHD to be performed on these rock cores; one from MW2D, one from MW3D and two from MW4D.

This report presents factual laboratory results of four (4) free swell tests completed on the received rock samples. The results of calcite content test, pore water salinity tests and water content tests done on the same rock samples are also included.

2. Methodology of Testing

2.1 Free Swell Test

Free swell test (FST) was performed using the method developed by Lo et al. (1978). In free swell tests, freshly trimmed rock specimen is permitted to deform unrestrictedly in all directions. A typical specimen for a free swell test is shown on Figure 1. The diameter-ratio of the cylindrical sample should be approximately one to one. However, sometimes it is controlled by availability of the rock core.

Three orthogonal dimensional changes of the specimen preserved under constant temperature and 100% relative humidity with direct access to fresh (tap) water, are measured with time. The "UWO deformation gauge" shown on Figure 1 is used to measure the dimensions of the two horizontal (X and Y) and vertical (axial/Z) directions for 100 days. Test data were plotted as strain vs. the logarithm (to the base of 10) of elapsed time.

2.2 Water Content, Salinity and Calcite Content Tests

The gravimetric method was used to measure water content of the rock sample. In this method the measurement of water content is direct, being simply the mass of water lost on drying in a convection oven at a temperature of 105°C until the mass remains constant.

It was experimentally established that shales need 4 days of drying to reach constant dry mass.

The salinity of rock pore fluid was determined by adding distilled water to the powdered rock sample and then centrifuging the mixture. The electrical conductivity of the supernatant of the centrifuged solution was measured using a conductivity meter (WTW TetraCon 325), and then converted to the salinity (salt concentration) expressed in grams per litre of pore water, NaCl equivalent.

Water content and salinity of each swell test specimen were measured before and after the test (after 100 days of swelling). Before a swell test, water content and salinity were measured on rock pieces adjacent to the swell test specimen. After swell test, water content and salinity tests were performed on the actual swell test specimen. The gasometric method using the Chittick apparatus (Dreimanis, 1962) was used to estimate the amount of calcite in the rock samples after swell test.

3. Results of Laboratory Testing

The results of free swell tests are presented on the attached graphs. The results of calcite content, water content and salinity tests performed before and after free swell tests are presented on the insert in each graph.

K.Y. Lo Inc.



Kwan Yee Lo, Ph.D., P.Eng., FEIC

4. References

Dreimans, A. 1962. Quantitative Gasometric Determination of Calcite and Dolomite Using Chittick Apparatus. Journal of Sedimentary Petrology, Vol. 32, pp. 520-529.

Lo, K.Y., Wai, R.S.C., Palmer, J.H.L. and Quigley, R.M. 1978. Time-dependent Deformation of Shaly Rocks in Southern Ontario. Canadian Geotechnical Journal, Vol. 15, pp. 537-547.



Figure 1. Typical set-up for free swell tests

Appendix A – Results of Free Swell Tests

Free Swell Test Children's Hospital of Eastern Ontario Campus -Preliminary Geotechnical Investigation, Ottawa **FST-MW2D-1 BH**: MW2D; **Depth**: 4.38m - 4.44m







Free Swell Test Children's Hospital of Eastern Ontario Campus -

o inc.



Children's Hospital of Eastern Ontario Campus -

Free Swell Test

o inc.

Free Swell Test Children's Hospital of Eastern Ontario Campus -Preliminary Geotechnical Investigation, Ottawa FST-MW4D-2









MASW Investigation Seismic Site Classification

Portion of Children's Hospital of Eastern Ontario 401 and 407 Smyth Road Ottawa, Ontario

Infrastructure Ontario



Y



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3.	Fieldwork	. 2
4.	Data Interpretation	. 3
5.	Closure	. 3

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Figure 1	Site Location Map
Figure 2	MASW Survey Investigation Lines Layout
Figure 3	Shearwave velocity vs depth

Table Index

Table 1 Summary of Shear wave velocity measurementsTable 2 Site Classification for Seismic Site Response – Table 4.1.8.4 OBC 2012

Appendix Index

Appendix A Seismic Hazard Values



1. Introduction

GHD was retained by Ontario Infrastructure and Lands Corporation (Client) to conduct a Multichannel Analysis of Surface Waves (MASW) investigation for the proposed 1Door4Care building which will be part of the Children's Hospital of Eastern Ontario (CHEO) Campus in Ottawa, Ontario (Site). The proposed development would be located at the southwestern portion of the CHEO's Campus, which is currently developed with parking lot and landscape areas. A site location map is provided on **Figure 1**.

The purpose of the MASW survey was to assist with the seismic site class determination by measuring the average shear wave velocity approximately within the upper 30 m of the soil/rock profile below the founding elevation of the proposed building at the site. The shear wave velocity measurements were carried out along two MASW survey lines assumed to be representative of the Site. The investigation line locations are shown in the attached **Figure 2**.

Based on the available geotechnical information (GHD Report 3 – Preliminary Geotechnical Investigation, Jan 2020), the Site in general consists of fill materials consisting of sitly sand to sand. The fill is underlain by sandy silty clay deposit which is underlain by bedrock. The thickness of the overburden (fill and native) layer range from 1.0 to 3.81 m. The boreholes were terminated in the bedrock.

The SPT 'N' values within the native layer ranged from 6 to over 50 blows per 0.3 m of penetration. The low 'N' values (less than 15) in some boreholes were obtained at the interface of fill and native layer. The SPT 'N' values (above 15) indicate the stiff to hard consistency of the native deposit.

2. MASW Procedure

To carry out the MASW test, 24 transducers (geophones) are deployed along a line at certain distances from a seismic source. The length of the geophone array determines the deepest investigation depth that can be obtained from the measurements. The source should produce enough seismic energy over the desired test frequency range to allow for detection of Rayleigh waves above background noise (Park et al 1999¹). A common seismic source is either a sledgehammer or a drop weight hitting a metallic or rubber base plate set at ground surface. The existing traffic noise or the noise generated by heavy machinery travelling close to the survey line can also be utilized as a source for investigating deep soil layers. For this site, only active seismic source is used. Figure 2.1 shows a typical MASW setup.

¹ Park, C.B., Miller, R.D., and Xia, J., 1999, Multichannel analysis of surface waves: Geophysics, v. 64, n. 3, pp. 800-808.





Figure 2.1: Schematic Layout of MASW Test Setup (Park et al 1999 and Xia et al 1999²)

3. Fieldwork

The fieldwork for this MASW investigation program was carried out on December 17, 2019 by GHD professionals. The field data was collected using a 24 channel seismograph (Geometrics Geode 24 consol #3389), twenty-four 4.5 Hz geophones, and one 24 take-out cable with 5 m spacing. A Panasonic Toughbook© laptop was used in the field to record and collect the seismic data utilizing Geometrics single geode OS controller version 9.14.0.0.

The survey was carried out along two survey lines along the north-south and east-west directions in the vicinity of boreholes and monitoring wells MW-9, BH-6, BH-7, BH-8, MW-4S, and MW-2S as shown on **Figure 2**. For all line locations, the geophones were installed 75 mm into the ground by manually pushing them into position.

A multi geometry approach was utilized for data collection along both lines. The active data sets were collected using a 4.5 kg sledge hammer hitting the ground surface at three different offset distances (distance between the source and first geophone) along each survey line. The following table summarizes the geometry for each investigation line.

Line No. De	esignation	Geophone Spacing (m)	Array Length (m)	Offset Distances (m)
Line 1 and Lo	ong	2.0	46.0	24.0, 16.0, 8.0
Line 2 Sł	hort	1.0	23.0	12.0, 8.0, 4.0

MASW Line Geometry

² Xia, J., Miller, R.D., and Park, C.B., 1999, Estimation of near-surface shear-wave velocity by inversion of Rayleigh waves: Geophysics, v. 64, n. 3, p. 691-700.


Three sets of data files (active) were collected for each array location/set up. For the active survey measurements, the ground vibrations were recorded for four seconds with one sample per 0.25 ms.

4. Data Interpretation

Data analysis including generation of dispersion curves, inversion of the obtained dispersion curves and development of the 1D shear wave velocity profiles at the Site were carried out using SurfSeis© version 6.0. The dispersion curves were calculated at the middle stations along each line. At each investigation line, the dispersion images obtained from active data at different offsets were stacked to obtain a combined dispersion curve. The data inversion was carried out using a 10-layer soil velocity numerical model to obtain 1D shear wave velocity profiles at the location of each mid station. The calculated 1D velocity profile along the investigation lines are shown on the attached Shear Wave Velocity Profile. **Figure 3** shows the obtained results at the proposed location for the construction of the building.

In accordance with the requirements of Ontario Building Code (OBC 2012) and National Building Code of Canada 2015 (NBC 2015), the variation of the measured shear wave velocity versus depth up to 30 m below the proposed founding level of the building (assumed to be 1.5 m bgs) was obtained along each line and is shown on Tables 1-A and 1-B. The average shear wave velocity within the upper 30 m of the soil/rock profile (Vs₃₀) immediately below the founding level of the building (at 3.0 m bgs) were obtained utilizing the averaging scheme introduced in Sentence 4.1.8.4 (2) of Commentary J of NBC (2010) User's Guide.

Based on the calculations presented in the attached Tables, the lowest average shear wave velocity (from 3.0 m bgs to 33.0 m bgs) along the investigation line is **1302 m/s** (along **Line 1**). Therefore, in accordance Table 4.1.8.4.A of OBC 2012 (Table 2) and based on the measured average shear wave velocity, for seismic load calculations the Site can be classified as Class 'B'.

As per the Geotechnical report (GHD, 2019), the foundation of the structure will be supported on native sandy silt, the Site can be classified as **Class 'C'. As per OBC 2012, Site Class A and B are only applicable if footings are founded on bedrock.**

The seismic site classification provided in this report is based solely on the shear wave velocity values derived from the MASW method and that it can be superseded by other geotechnical information as per requirement from NBC (2010).

The seismic hazards for the site as obtained from Natural Resources Canada (NRC) website are provided as **Appendix A** to this correspondence.

5. Closure

It is important to emphasize that the results and conclusions of the MASW analysis are based on the available geotechnical information and the survey conducted along two investigation lines. Should any conditions at the Site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.



All of Which is Respectfully Submitted,

GHD

tte

Hassan Ali, Ph.D. P. Eng.



Ali Ghassemi, Ph.D.

Farsheed Bagheri, P. Eng.

Figures



Source: MNRF NRVIS, 2018. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2020



PARKING LOT AND ACCESS ROADS PORTION OF CHILDREN'S HOSPITAL OF EASTERN ONTARIO 401 AND 407 SMYTH ROAD, OTTAWA, ONTARIO 11205379 Jan 14, 2020

SITE LOCATION MAP

FIGURE 1



Source: Microsoft Product Screen Shot(s) Reprinted with permission from Microsoft Corporation, Accessed: 2019





Infrastructure Ontario Proposed 1Door4Care Development Part of Childrens Hospital of Eastern Ontario Campus 401 and 407 Smyth Road, Ottawa Ontario SHEAR WAVE VELOCITY VS DEPTH PROJECT NO. 11205379 DATE 13-Jan-19

FIGURE NO. 3

Tables

GHD | MASW Investigation - 11205379 (2)



Table 1 Summary of Shear Wave Velocity Measurements Seismic Site Class Determination Proposed 1Door4Care Development Part of Childrens Hospital of Eastern Ontario Campus 401 and 407 Smyth Road, Ottawa Ontario

Table 1-A: Average Shear Wave Velocity (VS ₃₀)										
(As	sumed foun	daiton at 3.	0 m below e	existing grou	ind surface)					
	Line 1									
Laver No	aver No. Depth (m bgs) Thickness V _s d/V _{ci}									
Layer No.	From	То	m	m/s						
1	3.0	3.1	0.1	1130	0.0001					
2	3.1	4.9	1.8	1143	0.0016					
3	4.9	7.1	2.2	1045	0.0021					
4	7.1	9.9	2.8	805	0.0035					
5	9.9	13.5	3.5	893	0.0039					
6	13.5	17.8	4.4	1438	0.0030					
7	17.8	33.0	15.2	1729	0.0088					
	Total 30.0 0.0230									
Avera	Average Shear Wave Velocity Along the Line (m/s) 1302									

(As	Table 1-B: Average Shear Wave Velocity (VS ₃₀) (Assumed foundaiton at 3.0 m below existing ground surface)							
			Line 2					
Laver No	Depth ((m bgs)	Thickness	Vs	d./V.			
Layer No.	From	То	m	m/s				
1	3.0	3.7	0.7	1256	0.0006			
2	3.7	5.8	2.1	1284	0.0017			
3	5.8	8.5	2.7	1115	0.0024			
4	8.5	11.9	3.4	637	0.0053			
5	11.9	16.1	4.2	990	0.0042			
6	16.1	21.3	5.2	2000	0.0026			
7	21.3	33.0	11.7	2370	0.0049			
	Total		30.0		0.0217			
Avera	Average Shear Wave Velocity Along the Line (m/s) 1384							

Average VS₃₀ = **Recommended Site Class:** 1343 m/s Subjected to Code requirements

Notes:

1 - The Seismic Site class is recommended in accordance to Table 4.1.8.4.A of the National Building code of Canada 2010 and based on the lowest measured average shear wave velocity measured along the investigated lines.

В

2 - VS30 is calculated based on the average shear wave velocity below the proposed founding elevation.

3 - Site Classes A and B are only applicable if footings are founded on bedrock or there is no more than 3.0 m of soil between founding elevation and bedrock.

4 - The recommended site class is only applicable if site conditions for Site Class F (liquefiable soil/soft soil layers more than 3.0 m thick) are not applicable.





Infrastructure Ontario Proposed 1Door4Care Development Part of Childrens Hospital of Eastern Ontario Campus 401 and 407 Smyth Road, Ottawa Ontario SHEAR WAVE VELOCITY VS DEPTH PROJECT NO. 11205379 DATE 13-Jan-19

FIGURE NO. 3



Table 2Site Classification for Seismic Site ResponseForming Part of Sentences 4.1.8.4. (1) to (3)

		Ave	erage Properties in Top 30 m							
	Name	Average Shear Wave Velocity, \overline{V} s (m/s)	Average Standard Penetration Resistance, \overline{N}_{60}	Soil Undrained Shear Strength, _{Su}						
А	Hard rock	Ī⁄s > 1500	N/A	N/A						
В	Rock	$760 < \overline{V}_{s} \le 1500$	N/A	N/A						
С	Very dense soil and soft rock	$360 < \bar{V}_{\rm s} < 760$	$\overline{N}_{60} > 50$	s _u > 100 kPa						
D	Stiff soil	$180 < \overline{V}_{s} < 360$	$15 \leq \overline{N}_{60} \leq 50$	50 kPa < s _u ≤ 100 kPa						
		\overline{V}_{s} < 180	$\overline{N}_{60} \leq 15$	s _u < 50 kPa						
E	Soft soil	Any profile with more than 3m of soil with the following characteristics: plasticity index: PI > 20 moisture content w \ge 40%, and undrained shear strength: s _u < 25 kPa								
F	Other soils	Site-specific evaluation required								
- <i>(</i>										

Reference: 2012 Ontario Building Code Compendium, Division B – Part 4, Section 4.1.8.4.



Appendix A Seismic Hazard Values



about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

Farsheed Bagheri

Farsheed.Bagheri@ghd.com 289.374.3816

www.ghd.com



CLIENT NAME: GHD LIMITED 455 Phillip St WATERLOO, ON N2V1C2 (519) 884-0510

ATTENTION TO: Jennifer Balkwill

PROJECT: 11205379-30 (PO#73518459)

AGAT WORK ORDER: 19T553493

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Supervisor

DATE REPORTED: Jan 08, 2020

PAGES (INCLUDING COVER): 6

VERSION*: 2

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

<u>*NOTES</u> VERSION 2:Revised report issued January 08, 2020.

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories (V2)

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA) AGAT La Western Enviro-Agricultural Laboratory Association (WEALA) scope of Environmental Services Association of Alberta (ESAA) Associat

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Page 1 of 6

Results relate only to the items tested. Results apply to samples as received. All reportable information as specified by ISO 17025:2017 is available from AGAT Laboratories upon request



AGAT WORK ORDER: 19T553493 PROJECT: 11205379-30 (PO#73518459) 5835 COOPERS AVENUE MISSISSAUGA, ONTARIO CANADA L4Z 1Y2 TEL (905)712-5100 FAX (905)712-5122 http://www.aqatlabs.com

CLIENT NAME: GHD LIMITED

SAMPLING SITE:

ATTENTION TO: Jennifer Balkwill

SAMPLED BY:

				-	eee en igina						
DATE RECEIVED: 2019-12-09									DATE REPORT	ED: 2020-01-08	
				SAMPL	E DESCRIPTION: SAMPLE TYPE:	MW1 Soil	BH6 Soil	MW5 Soil	MW2 Soil	MW3 Soil	BH12 Soil
					DATE SAMPLED:	2019-12-07	2019-12-07	2019-12-07	2019-12-07	2019-12-07	2019-12-07
Parameter	Unit	G/S	RDL	Date Prepared	Date Analyzed	783860	783884	783885	783886	783887	783888
Loss on Ignition	%		0.01	2020-01-06	2020-01-07	1.09	2.04	2.52	2.97	1.22	3.30
				SAMPL	E DESCRIPTION:	BH13	BH14				
					SAMPLE TYPE:	Soil	Soil				
					DATE SAMPLED:	2019-12-07	2019-12-07				
Parameter	Unit	G/S	RDL	Date Prepared	Date Analyzed	783889	783890				
Loss on Ignition	%		0.01	2020-01-06	2020-01-07	2.28	2.46				

Loss on Ignition (Soil)

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

783860-783890 Loss on Ignition is not an accredited analysis. Analysis was performed at 475°C.

Analysis performed at AGAT Toronto (unless marked by *)



Certified By:



Quality Assurance

CLIENT NAME: GHD LIMITED

PROJECT: 11205379-30 (PO#73518459)

SAMPLING SITE:

AGAT WORK ORDER: 19T553493

ATTENTION TO: Jennifer Balkwill

SAMPLED BY:

Soil Analysis															
RPT Date: Jan 08, 2020		DUPLICATE				REFERE	NCE MATERIAL		METHOD	BLANK	SPIKE	MAT	RIX SPII	KE	
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured	Acce Lir	ptable nits	Recovery	Acce Lir	ptable nits	Recovery	Accep Lin	otable 1its
		Ia					value	Lower	Upper		Lower	Upper	-	Lower	Upper
Loss on Igniton LOI	783887		11.0	11.0	0.0%	< 0.5									
Loss on Ignition (Soil) Loss on Ignition	783860	783860	1.09	1.06	2.8%	< 0.01									

Certified By:



AGAT QUALITY ASSURANCE REPORT (V2)

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Page 4 of 6



Method Summary

CLIENT NAME: GHD LIMITED

PROJECT: 11205379-30 (PO#73518459)

AGAT WORK ORDER: 19T553493

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE: SAMPLED BY: PARAMETER AGAT S.O.P LITERATURE REFERENCE ANALYTICAL TECHNIQUE Soil Analysis Inore 13139 FURNACE Lol INOR-181-6030 ASTM D2974-07a GRAVIMETRIC

Chain of Custody Reco	ord If this is a		abora	atori	ies	Ph: 90	Mis 5.712 vater o	5. sissau .5100 wei	835 Coop ga, Ontari Fax: 905 bearth.aga d by human	ers Avo o L4Z 712.5 atlabs	enue 1Y2 5 122 com		La Wor Coc Arri	bor a k Ord bler Q val Te	ator ler #: uanti impe	ty:	ie O	nly TS	53L	19	3
Report Information: Company:	ltd	, and a state	, sumple, p	Re (Plea	egulatory Requirements: ase check all applicable boxes)		lo Re	egula	tory Rec	uire	ment		Cus Not	tody es:	Seal IC	intact:		□Yes		No	Der A
Contact: Address: Phone: Reports to be sent to: 1. Email: 2. Email:	- Somme nel Ra unga R 3 3527-ax 	agh.	d. lon	Soit	Regulation 153/04 Sewe Table Ind/Com Ind/Com Stor Agriculture Stor It Texture (Check One) Region Coarse Indice Fine MISA	er Use hitary rm ate One	_		Regulation CCME Prov. Water Objectives Other	558 Quali (PWQ)	ty))		Tur Reg Rus	naro cular h TA D 0	DUN TAT T (Rus Busi ays R Da	d Tin • • • • • • • • • • • • • • • • • •	ne (E arges A	TAT) 5 tr Apply) 2 E Day	Required 7 Business Business ys 1 Surcharges	I: Days Days Da Da May Ap	ext Business iy ply):
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Please note: If quotation num Please note: If quotation num Company: Contact: Address: Email: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Company: Compan	Ltd Somme LRons Sanone	III be billed full price Bill To Same: C, MM C, JMM	Ior analysis Yes No Mang	B GW O P SD SD SW	ample Matrix Legend Biota V Ground Water Oil Paint Soil O Sediment V Surface Water	Field Filtered - Metals, Hg, CrVI	and Inorganics	als	JB-HWS CICICION JEC CIFOC CIHE SAR	als Scan	on/Custom Metals	JNO, DNO, +NO,	: OVOC DBTEX DTHM	L- F4		I Total Daroclors	chlorine Pesticides	M&I □ VOCs □ ABNs □ B(a)P □P	gare contrate gare contrate 3723 5tandonty	10.000	y Hazardous or High Concentration (Y
Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Metals	All Met		Full Met	Regulat	on D	Volatile	PHCs F	ABNS	PCBs:	Organo	TCLP: []	Sewer L		Potential
MWI	Die 07	10:00 00	1	SOIL																	
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15117		U		V				_				_			-						
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Document ID: DIV 78-1511 016									Pink (Copy -	Client	Yel	low C	opy -	AGAT	I Wh	ite Co	opy- A	GAT Date	U D	4 Ardy28, 2019



CLIENT NAME: GHD LIMITED 455 Phillip St WATERLOO, ON N2V1C2 (519) 884-0510

ATTENTION TO: Jennifer Balkwill

PROJECT: 11205379 (PO#73518459)

AGAT WORK ORDER: 19T555371

MISCELLANEOUS ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

SOIL ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

DATE REPORTED: Dec 31, 2019

PAGES (INCLUDING COVER): 8

VERSION*: 1

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

*NOT	TES		

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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 Benvironmental Services Association of Alberta (ESAA)
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AGAT WORK ORDER: 19T555371 PROJECT: 11205379 (PO#73518459) 5835 COOPERS AVENUE MISSISSAUGA, ONTARIO CANADA L4Z 1Y2 TEL (905)712-5100 FAX (905)712-5122 http://www.aqatlabs.com

CLIENT NAME: GHD LIMITED

SAMPLING SITE:

ATTENTION TO: Jennifer Balkwill

SAMPLED BY:

				Sulphi	de					
DATE RECEIVED: 2019-12-12							[DATE REPORT	ED: 2019-12-31	
					11205379-MW1	11205379-MW1	11205379-MW2-	11205379-MW3-	11205379-MW4	11205379-MW5-
				SAMPLE DESCRIPTION:	(SS2+SS3)	(SS6)	SS4	SS4	(SS2+SS3)	SS4
				SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil	Soil
				DATE SAMPLED:	2019-12-11	2019-12-11	2019-12-11	2019-12-11	2019-12-11	2019-12-11
Parameter	Unit	G/S	RDL	Date Prepared Date Analyzed	796593	796645	796646	796647	796648	796649
Sulfide (S2-)	%		0.05		0.18	0.94	0.36	0.31	0.14	0.75
					11205379-BH6	11205379-BH7	11205379-BH8	11205379-BH9	11205379-BH12	
				SAMPLE DESCRIPTION:	(SS2+SS3)	(SS3)	(SS3)	(SS3+SS4)	(SS3+SS4)	
				SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil	
				DATE SAMPLED:	2019-12-11	2019-12-11	2019-12-11	2019-12-11	2019-12-11	
Parameter	Unit	G/S	RDL	Date Prepared Date Analyzed	796650	796651	796652	796653	796654	
Sulfide (S2-)	%		0.05		0.60	0.86	0.30	0.09	0.06	
1										

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

796593-796654 Analysis performed at AGAT 5623 McAdam.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Inis Verastegui



AGAT WORK ORDER: 19T555371 PROJECT: 11205379 (PO#73518459) 5835 COOPERS AVENUE MISSISSAUGA, ONTARIO CANADA L4Z 1Y2 TEL (905)712-5100 FAX (905)712-5122 http://www.aqatlabs.com

CLIENT NAME: GHD LIMITED

SAMPLING SITE:

ATTENTION TO: Jennifer Balkwill

SAMPLED BY:

					concentry i	uonugo					
DATE RECEIVED: 2019-12-12								DA	TE REPOR	TED: 2019-12-31	
						11205379-MW1		11205379-MW1		11205379-MW2-	
				SAMPL	E DESCRIPTION:	(SS2+SS3)		(SS6)		SS4	
					SAMPLE TYPE:	Soil		Soil		Soil	
					DATE SAMPLED:	2019-12-11		2019-12-11		2019-12-11	
Parameter	Unit	G/S	RDL	Date Prepared	Date Analyzed	796593	RDL	796645	RDL	796646	
Chloride (2:1)	µg/g		2	2019-12-19	2019-12-19	60	4	185	2	145	
Sulphate (2:1)	µg/g		2	2019-12-19	2019-12-19	200	4	1000	2	130	
pH (2:1)	pH Units		NA	2019-12-20	2019-12-20	7.87	NA	7.78	NA	7.78	
Electrical Conductivity (2:1)	mS/cm		0.005	2019-12-19	2019-12-19	0.447	0.005	1.34	0.005	0.765	
Resistivity (2:1) (Calculated)	ohm.cm		1	2019-12-19	2019-12-19	2240	1	746	1	1310	
Redox Potential 1	mV		NA	2019-12-19	2019-12-19	269	NA	241	NA	223	
Redox Potential 2	mV		NA	2019-12-19	2019-12-19	268	NA	219	NA	214	
Redox Potential 3	mV		NA	2019-12-19	2019-12-19	271	NA	230	NA	219	
						11205379-MW3-		11205379-MW4		11205379-MW5-	11205379-BH6
				SAMPL	E DESCRIPTION:	SS4		(SS2+SS3)		SS4	(SS2+SS3)
					SAMPLE TYPE:	Soil		Soil		Soil	Soil
					DATE SAMPLED:	2019-12-11		2019-12-11		2019-12-11	2019-12-11
Parameter	Unit	G/S	RDL	Date Prepared	Date Analyzed	796647	RDL	796648	RDL	796649	796650
Chloride (2:1)	µg/g		4	2019-12-19	2019-12-19	736	2	44	4	531	403
Sulphate (2:1)	µg/g		4	2019-12-19	2019-12-19	286	2	96	4	337	272
pH (2:1)	pH Units		NA	2019-12-20	2019-12-20	7.88	NA	8.29	NA	9.21	8.54
Electrical Conductivity (2:1)	mS/cm		0.005	2019-12-19	2019-12-19	1.60	0.005	0.460	0.005	1.54	1.17
Resistivity (2:1) (Calculated)	ohm.cm		1	2019-12-19	2019-12-19	625	1	2170	1	649	855
Redox Potential 1	mV		NA	2019-12-19	2019-12-19	234	NA	179	NA	173	180
Redox Potential 2	mV		NA	2019-12-19	2019-12-19	241	NA	186	NA	173	182
Redox Potential 3	mV		NA	2019-12-19	2019-12-19	246	NA	193	NA	179	186
1											

Corrosivity Package

Certified By:

Iris Verastegui



AGAT WORK ORDER: 19T555371 PROJECT: 11205379 (PO#73518459) 5835 COOPERS AVENUE MISSISSAUGA, ONTARIO CANADA L4Z 1Y2 TEL (905)712-5100 FAX (905)712-5122 http://www.aqatlabs.com

CLIENT NAME: GHD LIMITED

SAMPLING SITE:

ATTENTION TO: Jennifer Balkwill

SAMPLED BY:

				•	Somosivity	uonago					
DATE RECEIVED: 2019-12-12								DA	TE REPOR	TED: 2019-12-31	
						11205379-BH7		11205379-BH8		11205379-BH9	
				SAMPL	E DESCRIPTION:	(SS3)		(SS3)		(SS3+SS4)	
					SAMPLE TYPE:	Soil		Soil		Soil	
					DATE SAMPLED:	2019-12-11		2019-12-11		2019-12-11	
Parameter	Unit	G/S	RDL	Date Prepared	Date Analyzed	796651	RDL	796652	RDL	796653	
Chloride (2:1)	hð\ð		2	2019-12-19	2019-12-19	117	4	416	2	167	
Sulphate (2:1)	µg/g		2	2019-12-19	2019-12-19	365	4	225	2	124	
pH (2:1)	pH Units		NA	2019-12-20	2019-12-20	8.01	NA	8.62	NA	7.95	
Electrical Conductivity (2:1)	mS/cm		0.005	2019-12-19	2019-12-19	0.732	0.005	1.12	0.005	0.573	
Resistivity (2:1) (Calculated)	ohm.cm		1	2019-12-19	2019-12-19	1370	1	893	1	1750	
Redox Potential 1	mV		NA	2019-12-19	2019-12-19	203	NA	206	NA	205	
Redox Potential 2	mV		NA	2019-12-19	2019-12-19	206	NA	205	NA	205	
Redox Potential 3	mV		NA	2019-12-19	2019-12-19	205	NA	208	NA	208	
				0.0.00		11205379-BH12					
				SAMPL	E DESCRIPTION:	(553+554)					
					SAMPLE TYPE:	5011					
Parameter	Unit	G/S	RDI	Date Prepared	DATE SAMPLED:	2019-12-11					
Chloride (2:1)		0/0	4	2019-12-19	2019-12-19	665					
Sulphate (2:1)	µg/g		4	2019-12-19	2019-12-19	130					
nH (2:1)	pg/g		ΝA	2019-12-20	2019-12-20	8.81					
Electrical Conductivity (2:1)	mS/cm		0.005	2010-12-10	2019-12-19	1.41					
Posistivity (2:1) (Calculated)	obm cm		0.000	2019-12-19	2019-12-19	700					
Podox Potontial 1	m\/		NA	2019-12-19	2019-12-19	212					
Podox Potential 2	m\/		NA	2019-12-19	2019-12-19	212					
Redex Potential 2	m\/		NA	2019-12-19	2019-12-19	223					
	IIIV		INA	2019-12-19	2019-12-19	221					
1											

Corrosivity Package

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

796593-796654 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.

Elevated RDLs indicate the degree of sample dilutions prior to the analysis to keep analytes within the calibration range, reduce matrix interference and/or to avoid contaminating the instrument. Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Irus Verastegui



Quality Assurance

CLIENT NAME: GHD LIMITED

PROJECT: 11205379 (PO#73518459)

SAMPLING SITE:

AGAT WORK ORDER: 19T555371

ATTENTION TO: Jennifer Balkwill

SAMPLED BY:

			Mis	cella	neou	s An	alysi	S							
RPT Date: Dec 31, 2019			C	DUPLICAT	E		REFEREN	NCE MA	TERIAL	METHOD	BLAN	< SPIKE	MAT	RIX SPI	KE
PARAMETER	Batch	Sample	Dup #1	Dup #2	RPD	Method Blank	Measured	Measured Lin		Recovery	Acce	ptable mits	Recovery	Acce	ptable nits
		iù					value	Lower	Upper	-	Lower	Upper	-	Lower	Upper
Sulphide															
Sulfide (S2-)	796593	796593	0.18	0.17	5.7%	< 0.01	97%	80%	120%						

Certified By:

Inis Verastegui

AGAT QUALITY ASSURANCE REPORT (V1)

Page 5 of 8

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.



Quality Assurance

CLIENT NAME: GHD LIMITED

PROJECT: 11205379 (PO#73518459)

SAMPLING SITE:

AGAT WORK ORDER: 19T555371

ATTENTION TO: Jennifer Balkwill

SAMPLED BY:

Soil	Ana	lysis
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RPT Date: Dec 31, 2019			C	DUPLICAT	E		REFERE	NCE MA	TERIAL	METHOD	BLANK	SPIKE MATRIX			KE
PARAMETER	Batch	Sample	Dup #1	1 Dup #2 RPD Method Blank		Measured	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
		Ia					value	Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	796593	796593	60	60	0.0%	< 2	98%	80%	120%	106%	80%	120%	98%	70%	130%
Sulphate (2:1)	796593	796593	200	200	0.0%	< 2	104%	80%	120%	106%	80%	120%	101%	70%	130%
pH (2:1)	796593	796593	7.87	7.86	0.1%	NA	101%	90%	110%						
Electrical Conductivity (2:1)	796593	796593	0.447	0.448	0.2%	< 0.005	100%	90%	110%						
Redox Potential 1	1					NA	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.

Certified By:

Inis Verastegui

Page 6 of 8

AGAT QUALITY ASSURANCE REPORT (V1)

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Method Summary

CLIENT NAME: GHD LIMITED PROJECT: 11205379 (PO#73518459)

AGAT WORK ORDER: 19T555371

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:		SAMPLED BY:							
PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE						
Miscellaneous Analysis	·	·							
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC						
Soil Analysis									
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH						
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & 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	McKeague 4.12, 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	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE						
Redox Potential 2	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE						
Redox Potential 3	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE						

Chain of Custody Record If this is a Drinking Water sam	orato	Se Drinking Water Chain of Custody Form (F	Ph: 90	Mis 5.712 vater co	58 sissau .5100 web	335 Coop ga, Ontari Fax: 905 Jearth.ag	ers Av o L42 .7 12 .ª atlabs	enue 1Y2 5 122 .com	-	La Wor Coo Arri	bora k Orde eler Qu val Te	er #: uantity	/ Us) (nly T5	553 1 Blye	71	10	<u>e)</u>
Report Information:		Regulatory Requirements: (Please check all applicable boxes)		lo Re	egulat	ory Red	luire	men	Custody Seal Intact:					JN/A					
Contact: Address:	Regulation 153/04 Sewer Use Regulation 558 Table Indicate One Sanitary Ind/Com Sanitary CCME				Notes: Turnaround Time (TAT) Required: Regular TAT 5 to 7 Business Days														
Phone: Reports to be sent to: 1. Email: 2. Email: Ahmed. Sonotun@ghd.com		☐ Reg/Fain	m te One			rov. Water bjectives ther	Qual (PWQ)	ity O)		Rus	Rush TAT (Rush Surcharges Apply) 3 Business 2 Business Days Days OB Date Required (Ruch Surchardes May Apply):								
Project Information: Project: Infrastmetime Ontam'o Site Location:		Is this submission for a Record of Site Condition ?		Re Cert	port (ficat Yes	Guidelin The of An	e on alys No	ls D		F	*7/ or 'Sa	Pleas T is e me Da	se pro xclusi ay' an	ovide ive of alysis	prior n weeke	otification fo nds and sta se contact y	or rush tutory h	TAT Iolidays	5 M
Sampled By: AGAT Quote #: Please note: If quotation number is not provided, client will be billed full price for analy Please note: If quotation number is not provided, client will be billed full price for analy Rill To Some: Yos F	sis	Sample Matrix Legend B Biota	Hg, CrVI		rides) O. Reg	153				W					B(a)P DPCBs	ALLACE			ntration (Y/N)
Company: Contact: Address: LII-BRUNEL ROAD, by Shi Email: Address: LII-BRUNEL ROAD, by Shi Email: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact: Contact:	Stanger Otv	 O Oil P Paint S Soil SD Sediment SW Surface Water 	Field Filtered - Metals,	and Inorganics	tals 🗌 153 Metals (excl. Hyd) e Metals 🗌 153 Metals (Incl.	DB-HWS DCI- DCN DEC DFOC DHg ISAR	tals Scan	tion/Custom Metals		s: Ovoc Obtex Oth	1 - F4] Total Aroclors	chlorine Pesticides	M&I UOCS DABNS D	Les Rosourty			ily Hazardous or High Concei
Sample Identification Date Time Sampled Contra	of Sam iners Mati	ple Comments/ rix Special Instructions	Y/N	Metals	All Me	ORPs: DC ⁶⁺	Full Me	Regula		Volatile	PHCs F	PAHS	PCBs: [Organo	TCLP: []	Cok	au _r i		Potentia
11205379-MW1(352+553) Dec 11 11205379-MW1(556) 11 5.00pm 1 11205379-MW2-554 U U II 11205379-MW3-554 II 0 11205379-MW4(552+553) U II 11205379-MW5-584 V U 11205379-BH6(552+553) U II		Image: Constraint of the second sec														× × × × × × × × × × × × × ×			
11205379-1347(553) U 11205379-1348(553) U 11205379-1349(553+554) U 11205379-13412(553+554) U 11205379-13412(553+554) U	0 0 0					11	9									>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>			
Samples Relinquished By (Print Name and Sign): Date Date Date Date Date Date Date Date	Time Time Time	Samples Received By (Print Name and Sign): Samples Received By (Print Name and Sign): Samples Received By (Print Name and Sign):	aiq	14	M	Pink	2012	Date Date Date	² (-	12	Time		1.0	3 2/ N ⁴	∽ ۶: Т	Page	_ of	0	2019



CERTIFICATE OF ANALYSIS

Work Order	: WT2214174	Page	i 1 of 5
Client	: GHD Limited	Laboratory	: Waterloo - Environmental
Contact	: Rick Hawthorne	Account Manager	: Rick Hawthorne
Address	: 455 Phillip Street	Address	: 60 Northland Road, Unit 1
	Waterloo ON Canada N2L 3X2		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	: 15-Sep-2022
		Commenced	
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

for analysis.

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

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	QCLot
							Date	
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.CI	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	QCLot
							Date	
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.CI	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	QCLot
							Date	
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.CI	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	QCLot
							Date	
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 sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis	QCLot
							Date	
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.CI	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 Sail	
Sub-Iviality. Sull	

(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	QCLot
							Date	
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.CI	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	QCLot
							Date	
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 sampling date / time: 14-Sep-2022

Analyte	CAS Number	Result	LOR	Unit	Method	Prep Date	Analysis	QCLot
							Date	
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.CI	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	Address	: 60 Northland Road, Unit 1
	Waterloo ON Canada N2L 3X2		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 summarizes.

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

- <u>No</u> Method Blank value outliers occur.
- <u>No</u> 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.

RIGHT SOLUTIONS | RIGHT PARTNER

Page	: 3 of 11
Work Order	: WT2214174
Client	: GHD Limited
Project	11205379-100



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					Ev	aluation: × =	Holding time exce	edance ; 🔹	= Within	Holding Time
Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation	Holdin	g Times	Eval	Analysis Date	Holding	g Times	Eval
			Date	Rec	Actual			Rec	Actual	
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	3 days	1	16-Sep-2022	28 days	0 days	✓
				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	3 days	✓	16-Sep-2022	28 days	0 days	~
				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	3 days	✓	16-Sep-2022	28 days	0 days	~
				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	3 days	~	16-Sep-2022	28 days	0 days	~
				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	3 days	~	16-Sep-2022	28 days	0 days	~
				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	3 days	~	16-Sep-2022	28 days	0 days	✓
				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	3 days	✓	16-Sep-2022	28 days	0 days	✓
				days						

Page	: 4 of 11
Work Order	: WT2214174
Client	: GHD Limited
Project	11205379-100



Analyse Group Method Sampling Date Terms and the second of the secon	Matrix: Soil/Solid					Ev	aluation: × =	Holding time exce	edance ; •	= Within	Holding Time
Control Product Product <t< th=""><th>Analyte Group</th><th>Method</th><th>Sampling Date</th><th colspan="4">Extraction / Preparation</th><th></th><th></th></t<>	Analyte Group	Method	Sampling Date	Extraction / Preparation							
Includibly Address & Muthems : Water Extractable Sulfate by IC Description Res Address Address & Muthems : Water Extractable Sulfate by IC Laachable Address & Muthems : Water Extractable Sulfate by IC E236 CU 14-Sep-2022 16-Sep-2022 30 3 days If 19-Sep-2022 28 days 0 days 0 days 0 days Isseed 19-Sep-2022 28 days 0 days Isseed	Container / Client Sample ID(s)			Preparation	Holdin	g Times	Eval	Analysis Date	Holding	g Times	Eval
Lackhable Anlang & Nutrients : Water Extractable Chloride by IC E236. Cl 14.4 Sep-2022 16.5 Sep.2022 30, days 34 days 4** 16.5 Sep.2022 28 days 0 days 4** Lackhable Anlang & Nutrients : Water Extractable Sulfate by IC E236. SO4 14.4 Sep.2022 16.5 Sep.2022 30, days 3 days 4** 16.5 Sep.2022 28 days 0 days 4** Lackhable Anlang & Nutrients : Water Extractable Sulfate by IC E236. SO4 14.4 Sep.2022 16.5 Sep.2022 30, days 3 days 4** 16.5 Sep.2022 28 days 0 days 4** Clackhable Anlang & Nutrients : Water Extractable Sulfate by IC E236. SO4 14.4 Sep.2022 16.5 Sep.2022 30, days 3 days 4** 16.5 Sep.2022 28 days 0 days 4** Clackhable Anlang & Nutrients : Water Extractable Sulfate by IC E236. SO4 14.4 Sep.2022 16.5 Sep.2022 30, days 3 days 4** 16.5 Sep.2022 28 days 0 days 4** Clackhable Anlang & Nutrients : Water Extractable Sulfate by IC E236. SO4 14.4 Sep.2022 16.5 Sep.2012 30, days 3 days 4** 16.5 Sep.2022 28 days 0 days 4**				Date	Rec	Actual			Rec	Actual	
Bias coli jar/Telno lined cap 11203379 - MV18-SS3 E238.CR 14-Sep-202 Resp:222 Resp:222 <thresp:222< th=""> <thresp:223< th=""> Resp:223<</thresp:223<></thresp:222<>	Leachable Anions & Nutrients : Water Extractable Chloride by IC										
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Idea	11205379- BH16-22-SS2	E236.SO4	14-Sep-2022	16-Sep-2022	30	3 days	✓	16-Sep-2022	28 days	0 days	1
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Leachable Anions & Nutrients : Water Extractable Sulfate by IC Glass soil jar/Teflon lined cap 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 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 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 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 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 E236.SO4 14-Sep-2022 16-Sep-2022 30 days 3 days ✓ 16-Sep-2022 28 days 0 days ✓ Sizes soil jar/Tefion lined cap			·		days	-			-		
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Leachable Anions & Nutrients : Water Extractable Sulfate by ICE236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓Leachable Anions & Nutrients : Water Extractable Sulfate by ICE236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓Leachable Anions & Nutrients : Water Extractable Sulfate by ICE236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓	11205379- MW09-22	E236.SO4	14-Sep-2022	16-Sep-2022	30	3 days	1	16-Sep-2022	28 days	0 days	1
Leachable Anions & Nutrients : Water Extractable Sulfate by ICGlass soil jar/Tefion lined cap 11205379- MW17-SS1E236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓Leachable Anions & Nutrients : Water Extractable Sulfate by ICGlass soil jar/Tefion lined cap 11205379- MW18-SS3E236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓			·	•	days	,			,		
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 ✓ 16-Sep-2022 28 days 0 days ✓	Leachable Anions & Nutrients : Water Extractable Sulfate by IC				,					1	
E1320 SON juriferior integrationE236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓Leachable Anions & Nutrients : Water Extractable Sulfate by ICE236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓Glass soil jar/Tefion lined cap 11205379- MW18-SS3E236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days✓	Glass soil iar/Teflon lined can										
Leachable Anions & Nutrients : Water Extractable Sulfate by ICE236.SO414-Sep-202216-Sep-202230 days3 days✓16-Sep-202228 days0 days	11205379- MW17-SS1	E236.SO4	14-Sep-2022	16-Sep-2022	30	3 davs	1	16-Sep-2022	28 davs	0 davs	1
Leachable Anions & Nutrients : Water Extractable Sulfate by IC E236.SO4 14-Sep-2022 16-Sep-2022 30 days 3 days ✓ 16-Sep-2022 28 days 0 days ✓					davs	, -					
Class soil jar/Teflon lined cap E236.SO4 14-Sep-2022 16-Sep-2022 30 3 days ✓ 16-Sep-2022 28 days 0 days	Loophahla Aniana & Nutrianta i Watar Eutrophahla Sulfata hu IC				42,5						
11205379- MW18-SS3 E236.SO4 14-Sep-2022 16-Sep-2022 30 3 days ✓ 16-Sep-2022 28 days 0 days	Glass soil iar/Teflon lined can										
	11205379- MW18-SS3	E236.SO4	14-Sep-2022	16-Sep-2022	30	3 davs	1	16-Sep-2022	28 davs	0 davs	1
				· · · · · · ·	davs						
Page	: 5 of 11										
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Work Order	: WT2214174										
Client	: GHD Limited										
Project	11205379-100										



Matrix: Soil/Solid					Ev	aluation: × =	Holding time exce	edance ; 🔹	<pre>< = Within</pre>	Holding Time
Analyte Group	Method	Sampling Date	Extraction / Preparat		tion / Preparation		Analysis		is	
Container / Client Sample ID(s)			Preparation Date	Holding Rec	g Times Actual	Eval	Analysis Date	Holding Rec	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	4
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 11205379- BH11-22-SS2	E144	14-Sep-2022					15-Sep-2022			

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Work Order	: WT2214174
Client	: GHD Limited
Project	11205379-100



Matrix: Soil/Solid					Ev	aluation: × =	Holding time excee	edance ; •	= Within	Holding Time
Analyte Group	Method	Sampling Date	Extraction / Preparation			Analysis				
Container / Client Sample ID(s)			Preparation	Holdin	g Times	Eval	Analysis Date	Holding	g Times	Eval
			Date	Rec	Actual			Rec	Actual	
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					1					
Glass soil jar/Teflon lined cap										
11205379- MW09-22	E144	14-Sep-2022					15-Sep-2022			
Physical Tests : Moisture Content by Gravimetry					1					
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							1			
Glass soil jar/Teflon lined cap										
11205379- BH11-22-SS2	E125	14-Sep-2022	15-Sep-2022				15-Sep-2022	180	1 days	✓
		·	·					davs		
Physical Tasts : OPP by Electrode								,		
Glass soil jar/Teflon lined can										
11205379- BH16-22-SS2	E125	14-Sep-2022	15-Sep-2022				15-Sep-2022	180	1 days	1
		· ·					· ·	days		

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Client	: GHD Limited
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Matrix: Soil/Solid					Ev	aluation: × =	Holding time exce	edance ; 🔹	<pre>/ = Withir</pre>	Holding Time	
Analyte Group	Method	Sampling Date	Ext	raction / Pr	eparation			Analys	Analysis		
Container / Client Sample ID(s)			Preparation	Holding	, Times	Eval	Analysis Date	Holding	Times	Eval	
			Date	Rec	Actual			Rec	Actual		
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	1	
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	1	
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	1	
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	1	
Physical Tests : ORP by Electrode								1			
Glass soil jar/Teflon lined cap											
11205379- MW18-SS3	E125	14-Sep-2022	15-Sep-2022				15-Sep-2022	180 days	1 days	1	
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	1	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received								1			
Glass soil jar/Teflon lined cap											
11205379- BH16-22-SS2	E108A	14-Sep-2022	15-Sep-2022				15-Sep-2022	30 days	1 days	1	
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	-	

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Work Order	: WT2214174
Client	: GHD Limited
Project	11205379-100



Matrix: Soil/Solid					Ev	aluation: × = I	Holding time exce	edance ; 🗸	= Within	Holding Time
Analyte Group	Method	Sampling Date	Ext	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)			Preparation	Holding	g Times	Eval	Analysis Date	Holding	Times	Eval
			Date	Rec	Actual			Rec	Actual	
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	1
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.

x: Soil/Solid Evaluation: * = QC frequency outside specification; 								
Quality Control Sample Type		Co	ount					
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.CI	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.CI	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.CI	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 $20 \pm 5^{\circ}$ 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.

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Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil : 0.01CaCl2 - As Received for	EP108A	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M
pH				calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is
	Waterloo -			separated from the soil by centrifuging, settling or decanting and then analyzed using a
	Environmental			pH meter and electrode.
Preparation of ORP by Electrode	EP125	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP
				meter.
	Waterloo -			
	Environmental			
Anions Leach 1:10 Soil:Water (Dry)	EP236	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.
	Waterloo -			
	Environmental			
Distillation for Acid Volatile Sulfide in Soil	EP396-L	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
	Waterloo -			evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.
	Environmental			



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

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Client	: GHD Limited
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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: 6480)52)										
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: 6480	953)										
WT2214174-006	11205379- BH16-22-SS2	chloride, soluble ion content	16887-00-6	E236.CI	5.0	mg/kg	83.2	83.3	0.136%	30%		

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Work Order	: WT2214174
Client	: GHD Limited
Project	: 11205379-100



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 C	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 648051)						
conductivity (1:2 leachate)	E	E100-L	5	μS/cm	<5.00	
Physical Tests (QCLot: 648057)						
moisture	E	E144	0.25	%	<0.25	
Leachable Anions & Nutrients (QCLot: 648052)						
sulfate, soluble ion content	14808-79-8 E	E236.SO4	20	mg/kg	<20	
Leachable Anions & Nutrients (QCLot: 648053)						
chloride, soluble ion content	16887-00-6 E	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	3)										
chloride, soluble ion content	16887-00-6	E236.CI	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:						port			
					RM Target	Recovery (%)	Recovery L	.imits (%)	
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (Q	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	s & Nutrients (QCLot: 6	48052)							
	RM	sulfate, soluble ion content	14808-79-8	E236.SO4	217 mg/kg	98.5	60.0	140	
Leachable Anions	s & Nutrients (QCLot: 6	48053)							
	RM	chloride, soluble ion content	16887-00-6	E236.CI	673 mg/kg	94.1	70.0	130	





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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.