TECHNICAL MEMORANDUM

DATE April 10, 2018 **Project No.** 1524337-3000

TO Brad Smith
Greystone Village Inc.

FROM Susan Trickey, P.Eng. **EMAIL Susan_Trickey@Golder.com**

SUPPLEMENTAL GEOTECHNICAL INVESTIGATION
PROPOSED BUILDING - THE GROVE
GREYSTONE VILLAGE DEVELOPMENT
175 MAIN STREET
OTTAWA, ONTARIO

This letter presents the results of a supplemental geotechnical investigation carried out for the proposed building "The Grove" to be located within Phase 3 of the Greystone Village development at 175 Main Street in Ottawa, Ontario. The purpose of the supplemental geotechnical investigation was to provide additional foundation design recommendations for the building.

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

DESCRIPTION OF PROJECT AND SITE

Plans are being prepared to construct a new building called "The Grove" within the Greystone Village development in Ottawa, Ontario. The approximate location of the development and site are shown on the Site Plan, Figure 1. The Grove is to be located on Deschatelets Avenue, south of the Deschatelets Building.

It is understood that the proposed building will consist of a four-storey wood frame structure with one underground parking level, measuring about 40 metres by 34 metres in plan area.

Golder Associates completed a previous geotechnical investigation on the property for Phases 2 and 3 of the development. The results of that investigation were provided in a report titled "*Geotechnical Investigation, Proposed Development, Greystone Village – Phases 2 and 3, 175 Main Street, Ottawa, Ontario*" dated May 2017 (Report No. 14-1122-0005-5100-3). That investigation included one borehole within the footprint of the proposed building addressed by this letter.

Based on the existing subsurface information, the subsurface conditions at the site consist of surficial fill overlying a thick deposit of sensitive silty clay. The silty clay is underlain by a layer of silty sand and sandy silt, which is in turn underlain by a deposit of glacial till at depth. The bedrock surface is expected to be at about 25 to 30 metres depth below the ground surface and to consist of Billings Formation shale.

PROCEDURES

The field work for this investigation was carried out from November 10 to 14, 2016. During that time, three boreholes (numbered 16-211, 16-212, and 16-213) were advanced at the approximate locations shown on the Site Plan, Figure 1. The boreholes were advanced using a track mounted hollow-stem auger drill rig supplied and operated by CCC Geotechnical and Environmental Drilling of Ottawa, Ontario and were advanced to depths ranging from about 13.6 to 14.3 metres below the existing ground surface.

Standard penetration tests (SPTs) were carried out in the boreholes at regular intervals of depth and samples of the soils encountered were recovered using split spoon sampling equipment. In situ vane testing was carried out where possible in the cohesive deposits to determine the undrained shear strength of these soils. In addition, four relatively undisturbed 73 millimetre diameter thin walled Shelby tube samples of the silty clay were obtained from selected boreholes using a fixed piston sampler.

The field work was supervised by personnel from our engineering staff who located the boreholes, directed the drilling operations, logged the samples, and took custody of the soil samples retrieved.

Upon completion of the drilling operations, samples of the soil were transported to our laboratory for further examination by the project engineer and for laboratory testing. The laboratory testing included natural water content determinations, Atterberg limit tests, grain size distribution tests, and oedometer consolidation testing.

A soil sample from borehole 16-212 was submitted to Eurofins Environmental Testing for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried ferrous elements.

The borehole locations were selected, picketed, and surveyed in the field by Golder Associates Ltd. The borehole locations and elevations were surveyed using a Trimble R8 Global Positioning System (GPS) unit. The elevations are referenced to Geodetic datum.

SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes from the current and previous investigation are shown on the attached Record of Borehole sheets. The results of oedometer consolidation testing are provided on Figure 2. The results of grain size distribution testing are shown on Figures 3 and 4. The results of the basic chemical analysis are also attached. In general, the subsurface conditions consist of surficial fill overlying a thick deposit of sensitive silty clay, underlain by layered silt, sandy silt and silty sand underlain by glacial till.

Boreholes 14-209, 16-211 and 16-213 were advanced through the pavement structure of the existing parking area adjacent to the Deschatelets Building. The pavement structure consists of up to about 100 millimetres of asphaltic concrete over about 200 to 600 millimetres of gravelly sand/sandy gravel base layer. A subbase layer consisting of sandy gravel was encountered in borehole 16-213 with a thickness of about 360 millimetres.

A layer of fill exists at the ground surface in borehole 16-212 and below the pavement structure in boreholes 14-209, 16-211 and 16-213. The fill consists of sand to silty sand to silty clay and extends to depths ranging from about 1.1 to 2.3 metres below the existing ground surface.

A deposit of native silty clay to clayey silt to clay (hereafter referred to as silty clay) exists below the fill. The upper portion of the deposit has been weathered to a grey brown crust that extends to depths ranging from about 3.6 to 4.6 metres below the existing ground surface. Standard penetration tests carried out within the weathered silty clay gave SPT ‘N’ values ranging from 1 to 10 blows per 0.3 metres of penetration, indicating a stiff to very stiff consistency.

Atterberg limit testing carried out on one sample of the weathered crust gave a liquid limit value of about 31 percent and a plasticity index value of about 17 percent, indicating a silty clay of intermediate plasticity. The measured natural water content of two samples of the weathered silty clay were about 25 and 29 percent.

The silty clay below the depth of weathering is grey in colour. The grey silty clay extends to depths ranging from about 11.4 to 13.4 metres below the existing ground surface. In situ vane testing carried out within the unweathered silty clay gave undrained shear strengths ranging from about 55 to greater than 96 kilopascals, indicating a stiff to very stiff consistency.

Atterberg limit testing carried out on one sample of the silty clay gave a liquid limit value of about 36 percent and a plasticity index value of about 19 percent, indicating a silty clay of intermediate plasticity. The measured natural water content of four samples of the silty clay ranges from about 29 to 49 percent.

Oedometer consolidation testing was carried out on one sample of silty clay from Boreholes 16-212. The results of that testing are provided on Figure 2, as well as summarized in the table below.

Borehole/ Sample Number	Sample Depth/ Elevation (m)	Unit Weight (kN/m^3)	σ_P' (kP)	σ_{VO}' (kP)	$\sigma_P' - \sigma_{vo}'$ (kPa)	Cc	Cr	e_o	OCR
16-212 / 6	5.9 / 58.8	18.1	330	75	255	0.60	0.011	1.08	4.4

Notes:

σ_P' - Apparent preconsolidation pressure
σ_{VO}' - Computed existing vertical effective stress
Cc - Compression index
Cr - Recompression index
e_o - Initial void ratio
OCR - Overconsolidation ratio

A layered deposit of silty sand, sandy silt and silt was encountered below the silty clay. The deposit was not fully penetrated in the boreholes but was proven/inferred to extend to depths ranging from 13.6 to 22.6 metres below the existing ground surface. Standard penetration tests carried out within the silty sand gave SPT 'N' values ranging from 'weight of hammer' to 21 blows per 0.3 metres of penetration, indicating a very loose to compact state of packing.

The results of grain size distribution testing carried out on the sandy silt and silt are shown on Figure 3. The results of grain size distribution testing on one sample of the silty sand are provided on Figure 4. The measured natural water content of one sample of the silty sand was about 29 percent.

A deposit of glacial till was inferred to exist below a depth of about 22.6 metres based on the dynamic cone penetration testing carried out in borehole 14-209. The glacial till deposit was inferred to a depth of about 29.5 metres. The glacial till at this site generally consists of gravel, cobbles, and boulders in a matrix of silty sand to sandy silt.

The groundwater levels in the monitoring devices sealed into the boreholes were measured at various times between April 2014 and September 2015, as summarized in the table below.

Borehole Number	Geologic Stratum	Ground Surface Elevation (m)	Groundwater Level Elevation / Depth (m)	
			Aug 26, 2014	Sept 9, 2014
14-209A (Deep)	Silty Sand	64.7	57.8 / 6.9	57.9 / 6.8
14-209B (Shallow)	Silty Clay	64.7	62.0 / 2.7	62.6 / 2.1

The above groundwater level data indicates a downward gradient from the silty clay to the silty sand deposit.

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

DISCUSSION

The following provides additional geotechnical engineering guidelines for the design of the foundations for the proposed building. However, these recommendations should be read in conjunction with those provided in the Golder Associates' report to 175 Main Street Inc. titled "*Geotechnical Investigation, Proposed Development, Greystone Village – Phases 2 and 3, 175 Main Street, Ottawa, Ontario*" dated May 2017 (Report No. 14-1122-0005-3) with regards to all other aspects of the design.

Foundations

It is considered that the proposed building could feasibly be supported on or within the native silty clay using conventional spread footing foundations in accordance with Part 9 of the Ontario Building Code.

For design purposes, the maximum allowable bearing pressure for strip footing foundations up to 2 metres in width and pad footings up to 5 metres in size could be designed using a Serviceability Limit States (SLS) bearing resistance of 125 kilopascals and a factored Ultimate Limit States (ULS) bearing resistance of 150 kilopascals. The above SLS resistance should be consistent with total and differential settlements not exceeding about 25 and 15 millimetres, respectively, provided that the subgrade at or below founding level is not disturbed during construction.

The above SLS and factored ULS bearing resistances are based on the assumption that the grade raise in the area of the building will be less than about 1.0 m and that the founding elevation will be about 1.0 m below the finished floor elevation of the underground parking level of elevation 60.6 m (i.e., an underside of footing level at about elevation 59.6 m).

The SLS resistance corresponds to a settlement resulting from consolidation of the silty clay. Consolidation of silty clay is a process which takes months or longer and, as such, results from sustained loading. Therefore, the foundation loads to be used in conjunction with the SLS resistance given above should be the full dead load plus sustained live load. The factored dead load plus full factored live load should be used in conjunction with the ULS factored bearing resistance.

Basement Floor Slab

The following guidelines are provided on the basis that a 'drained' foundation system will be provided; i.e., that a water tight foundation is not to be provided.

In preparation for the construction of the basement floor slab, all loose, wet, and disturbed material should be removed from beneath the floor slab.

Provision should be made for a drainage layer consisting of at least 300 millimetres of free draining granular material, such as 16 millimetre clear crushed stone, to underlie the floor slab or pavement (if used). To prevent hydrostatic pressure build up, this granular layer should be drained. This should be achieved by installing rigid perforated pipes in the floor slab bedding at 6 metre centres. The perforated pipes should discharge to a positive outlet such as a sump from which the water is pumped.

If or where an asphalt surface will be provided for the basement level, at least 150 millimetres of OPSS Granular A base should be provided above the clear stone, compacted to at least 100 percent of the material's standard Proctor maximum dry density.

Any bulk fill required to raise the grade to the underside of the clear stone should consist of OPSS Granular 'B' Type I or II. The underslab bulk fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

Corrosion and Cement Type

A soil sample from boreholes 16-212 was submitted to Eurofins Environment Testing for basic chemical analysis related to potential corrosion of exposed buried steel and potential sulphate attack on buried concrete elements. The results of the testing are attached and indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate an elevated potential for corrosion of exposed ferrous metal, which should be considered in the design of substructures.

CLOSURE

We trust that this letter contains sufficient information for your present requirements. If you have any questions concerning this memo, please call us.

Yours truly,

GOLDER ASSOCIATES LTD.

LICENSED PROFESSIONAL ENGINEER
S.A. TRICKEY
100104579
Apr 10/18
PROVINCE OF ONTARIO

Susan Trickey, P.Eng.
Geotechnical Engineer

Michael Snow, P.Eng.
Principal, Senior Geotechnical Engineer

WAM/SAT/MSS/mvrd
n:\active\2015\3 proj\1524337 eq homes building oblates phase 1 ottawa\memos\parcel 1&2 bearing memo\1524337 tm-001 the grove apr 2018.docx

Attachments: Important Information and Limitations of This Report
Figure 1 – Site Plan
Figure 2 – Consolidation Test Results
Figure 3 – Grain Size Distribution Results – Sandy Silt to Silt
Figure 4 – Grain Size Distribution Results – Silty Sand
Record of Borehole Logs
Results of Chemical Analysis – Eurofins Report Number 1700269

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

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

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

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

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

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

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

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

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

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

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

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

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

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

EVELYN AVENUE
ROSEMERE AVENUE
CONCORD STREET SOUTH
SPRINGHURST AVENUE
PARISH PRIVATE
PARISH PRIVATE
OBLATS AVENUE
SCHOLASTIC DRIVE
DESCHATELETS AVENUE
DESCHATELETS BUILDING
PHASE 3
PHASE 2
BH 16-213
BH 16-211
THE GROVE
BH 14-209
BH 16-212
DESCHATELETS AVENUE
SCHOLASTIC DRIVE
MAIN STREET
HAZEL STREET
DE MAZENOD AVENUE
JEREMIAH KEALEY STREET
PHASE 2
HAZEL STREET
369200
369300
369400
369500
5031500
5031300
5031200

KEY MAP

SCALE 1:50,000

LEGEND

- APPROXIMATE BOREHOLE LOCATION, CURRENT INVESTIGATION
- APPROXIMATE BOREHOLE LOCATION, PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD.
- THE GROVE
- APPROXIMATE PHASE 2 AND PHASE 3 BOUNDARY
- APPROXIMATE DEVELOPMENT BOUNDARY

NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. MEMO NO. 1524337-3000.

REFERENCE(S)

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY NOVATECH.
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

0 15 30 60
1:1,500 METRES

CLIENT
GREYSTONE VILLAGE INC.

PROJECT
GEOTECHNICAL INVESTIGATION
THE GROVE
GREYSTONE VILLAGE DEVELOPMENT
175 MAIN STREET, OTTAWA, ONTARIO

TITLE
SITE PLAN

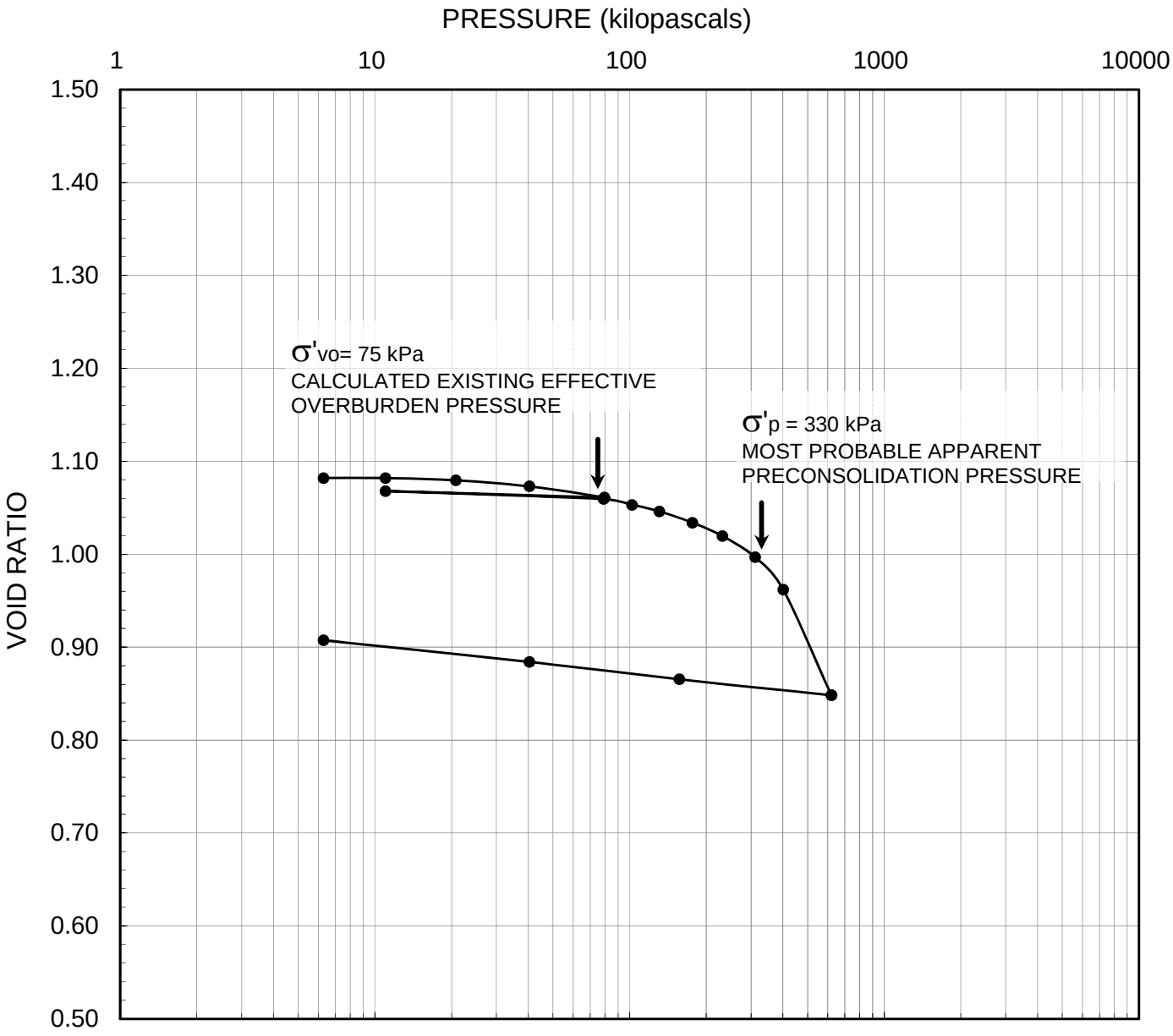
CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-02
DESIGNED	----
PREPARED	ABD/BR
REVIEWED	SAT
APPROVED	MSS

PROJECT NO.	PHASE	REV.	FIGURE
1524337	3000	0	1

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

Path: N:\Active\Spatial_IM\EQ\Homes\Oblates\MultiStorey\Building\99_PROJ\1524337_EQHomes_Oblates\MultiStorey\Building\40_PROD\Phase3000_Geotech_Parcel1&2\1524337-3000-BFG-0001.mxd



LEGEND

Borehole:	16-212	w_i = 39%	S_o = 100%	γ = 18.1 kN/m³
Sample:	6	w_f = 33%	e_o = 1.08	G_s = 2.76
Depth (m):	5.9	w_l = 36%	C_c = 0.60	
Elevation (m):	58.8	w_p = 18%	C_r = 0.011	

GOLDER

SCALE	AS SHOWN
DATE	04/09/18
CADD	N/A
ENTERED	MI
CHECK	CNM
REVIEW	SAT

TITLE

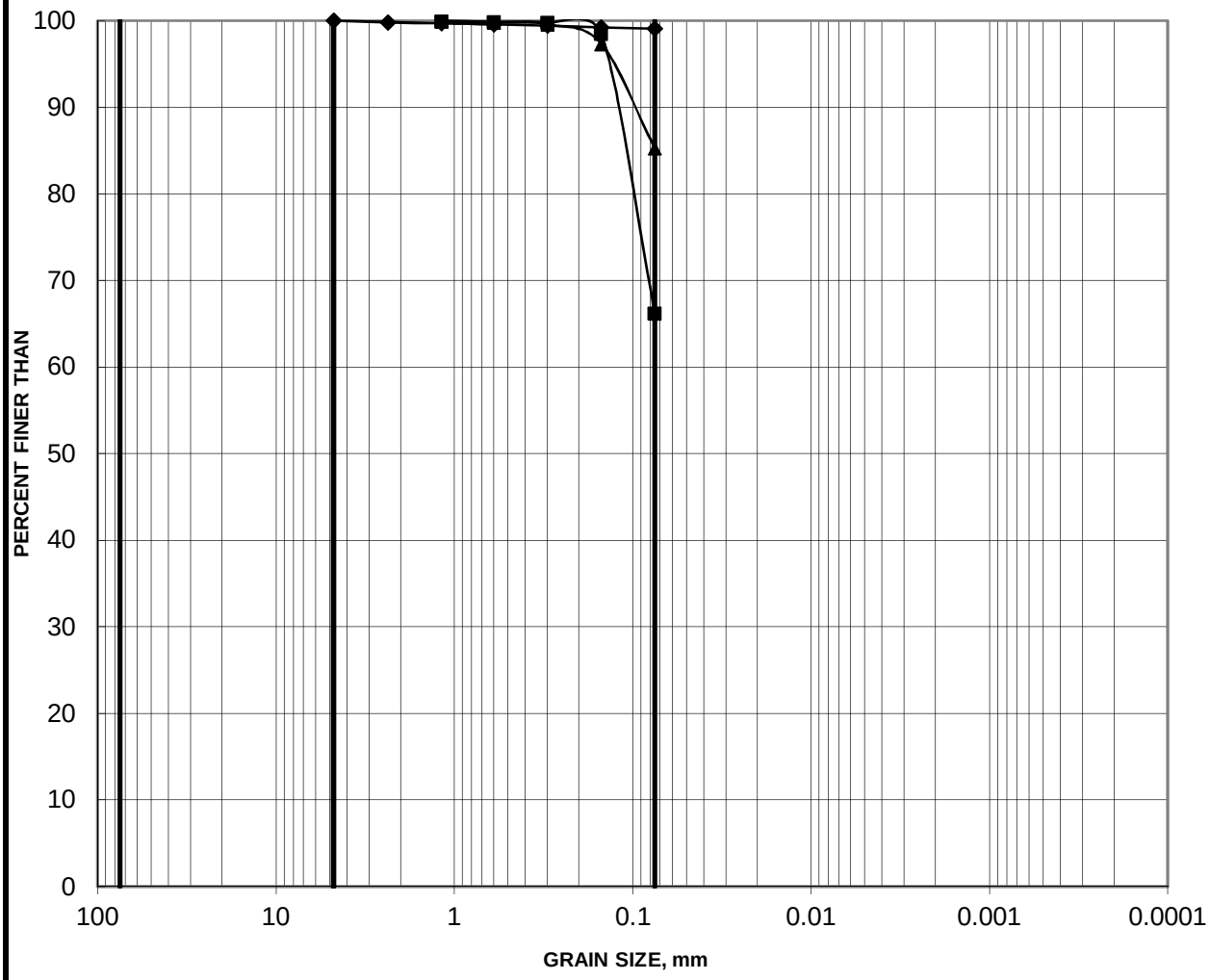
CONSOLIDATION TEST RESULTS

FILE No.	Consolidation summary		
PROJECT No.	1524337 /3000	REV.	2

FIGURE **2**

GRAIN SIZE DISTRIBUTION	FIGURE 3

(ML) Sandy SILT to SILT



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
16-212	12	7.77-8.38
14-209	12	11.43-12.04
14-209	16	16.76-17.37

Project: 1524337 /3000

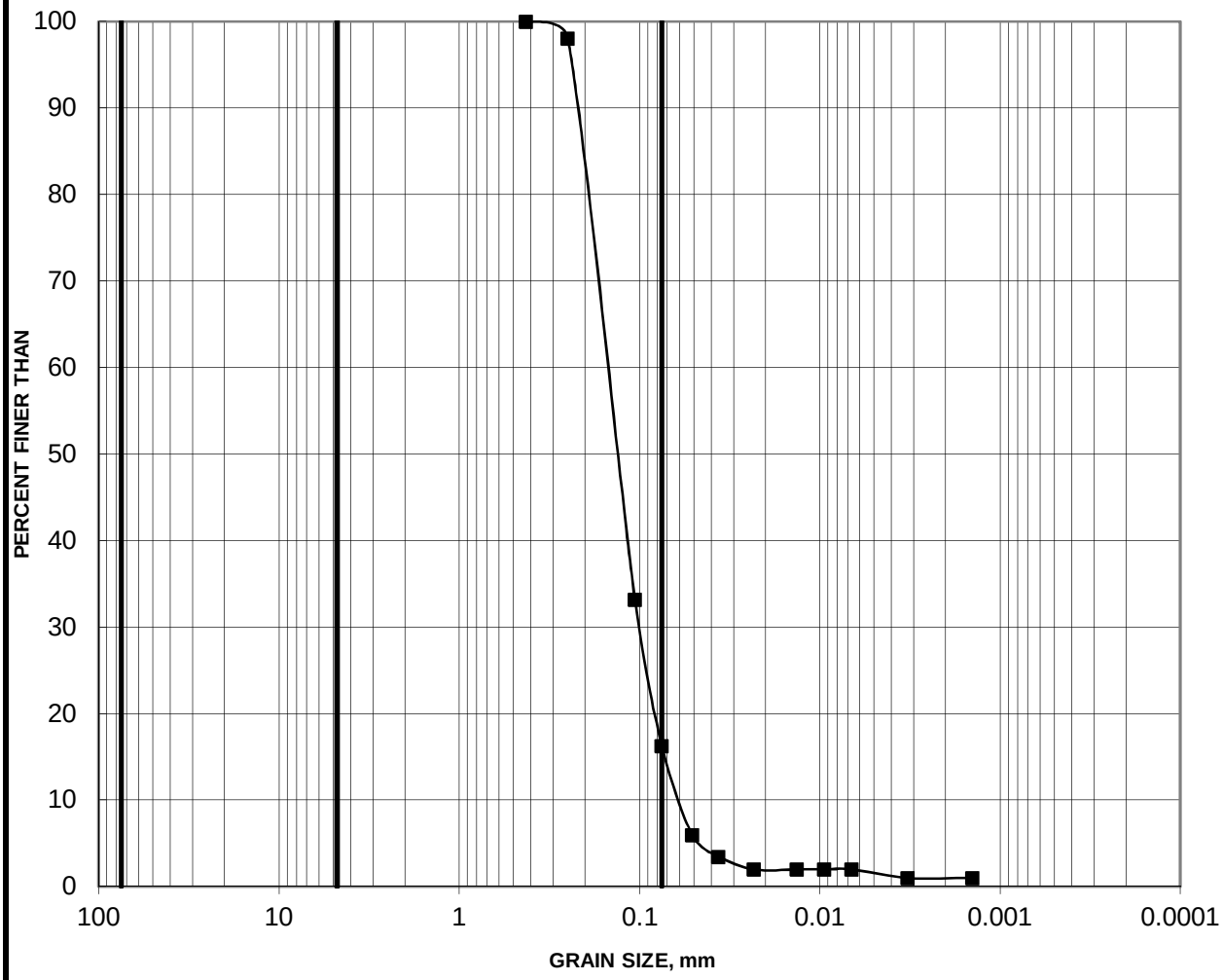
Golder Associates

Created by: MI
Checked by: CNM

GRAIN SIZE DISTRIBUTION

FIGURE 4

(SM) Silty SAND



Cobble	coarse	fine	coarse	medium	fine	SILT AND CLAY
Size	GRAVEL SIZE		SAND SIZE			

Borehole	Sample	Depth (m)
16-211	13	12.95-13.56

Project: 1524337 /3000

Golder Associates

Created by: MI
Checked by: CNM

PROJECT: 1524337-3000

RECORD OF BOREHOLE: 16-211

SHEET 1 OF 2

LOCATION: N 5030285.4 ;E 369382.7

BORING DATE: November 14, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		64.71							
0	Power Auger 200 mm Diam. (Hollow Stem)	ASPHALTIC CONCRETE		0.00							
		FILL - (SP) gravelly SAND, angular; grey (PAVEMENT STRUCTURE); non-cohesive, moist		0.10 / 64.41	1	GRAB	-				
		FILL - (SM) SILTY SAND; brown; non-cohesive, moist, loose		0.30							
1					2	SS	9				
		FILL - (CL/CI) SILTY CLAY; grey brown; cohesive, w>PL		63.49 / 1.22							
2					3	SS	7				
		(ML-CI/CH) SILTY CLAY to CLAYEY SILT, some sand; grey brown (WEATHERED CRUST); non-cohesive w>PL, stiff to very stiff		62.42 / 2.29	4	SS	5				
3					5	SS	4				
4					6	SS	1				
		(CI/CH) SILTY CLAY to CLAY; grey, with black organic mottling; cohesive, w>PL, stiff to very stiff		60.37 / 4.34							
5					7	TP	PH	⊕ ⊕ + +			
6					8	SS	WH				
7								+ +			
8					9	SS	WH		○		
9								+ +			
10					10	SS	WH				
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1524337.GPJ GAL-MIS.GDT 4/9/18 JEM/ZS

PROJECT: 1524337-3000

RECORD OF BOREHOLE: 16-211

SHEET 2 OF 2

LOCATION: N 5030285.4 ;E 369382.7

BORING DATE: November 14, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Power Auger 200 mm Diam. (Hollow Stem)	(CI/CH) SILTY CLAY to CLAY; grey, with black organic mottling; cohesive, w>PL, stiff to very stiff						⊕ ⊕ + +			
11					11	SS	WH		○		
12								>96+ >96+			
		(SM) SILTY SAND; grey; non-cohesive, wet, very loose to loose		52.24 / 12.47	12	SS	WH				
13					13	SS	WH		○	MH	
14					14	SS	5				
		End of Borehole		50.38 / 14.33							
15											
16											
17											
18											
19											
20											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: DG
CHECKED: WAM

MIS-BHS 001 1524337.GPJ GAL-MIS.GDT 4/9/18 JEM/ZS

PROJECT: 1524337-3000

RECORD OF BOREHOLE: 16-212

SHEET 1 OF 2

LOCATION: N 5030259.2 ;E 369390.1

BORING DATE: November 10 & 11, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		64.71							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL - (SP) SAND; brown; non-cohesive, moist		0.00							
1		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, very stiff		63.64 1.07	1	SS	8				
2					2	SS	9				
		(ML-CI/CH) SILTY CLAY to CLAYEY SILT, some sand; brown (WEATHERED CRUST); cohesive, w>PL, stiff		62.42 2.29	3	SS	3				
3		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, stiff		61.66 3.05	4	SS	2				
		(CI/CH) SILTY CLAY to CLAY; grey, with black organic mottling; cohesive, w>PL, stiff to very stiff		61.11 3.60	5	TP	PH				
4											
5											
					6	TP	PH			C	
6											
7								>96+			
8					7	SS	1				
9											
					8	SS	WH				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1524337.GPJ GAL-MIS.GDT 4/9/18 JEM/ZS

PROJECT: 1524337-3000

RECORD OF BOREHOLE: 16-212

SHEET 2 OF 2

LOCATION: N 5030259.2 ;E 369390.1

BORING DATE: November 10 & 11, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Power Auger 200 mm Diam. (Hollow Stem)	(CI/CH) SILTY CLAY to CLAY; grey, with black organic mottling; cohesive, w>PL, stiff to very stiff						⊕ + ⊕ +			
11					9	SS	2				
					10	SS	WH				
12				52.52							
		(ML) sandy SILT; grey; non-cohesive, wet, very loose to loose		12.19	11	SS	2				
13					12	SS	7		○	M	
				51.15							
		End of Borehole		13.56							
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1524337.GPJ GAL-MIS.GDT 4/9/18 JEM/ZS

PROJECT: 1524337-3000

RECORD OF BOREHOLE: 16-213

SHEET 1 OF 2

LOCATION: N 5030289.1 ;E 369399.3

BORING DATE: November 11, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		64.81							
0	Power Auger 200 mm Diam. (Hollow Stem)	ASPHALTIC CONCRETE		0.00							
		FILL - (SP) gravelly SAND, angular; grey (PAVEMENT STRUCTURE); non-cohesive, moist		0.10 / 64.48	1	GRAB	-				
		FILL - (GP) sandy GRAVEL, angular; grey (PAVMENT STRUCTURE); non-cohesive, moist		0.33 / 64.12							
1		FILL - (SM) SILTY SAND; brown; non-cohesive, moist, loose		0.69 / 63.51	2	SS	8				
		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL, stiff to very stiff		1.30	3	SS	9				
2					4	SS	6				
3					5	SS	2				
		(ML-CI/CH) SILTY CLAY to CLAYEY SILT, some sand; brown (WEATHERED CRUST); cohesive, w>PL, stiff		3.35 / 61.46							
4					6	SS	2				
		(CI/CH) SILTY CLAY to CLAY; grey, with black organic mottling; cohesive, w>PL, stiff		4.27 / 60.54							
5					7	SS	WH				
6					8	TP	PH				
7											
8					9	SS	WH				
9											
10					10	SS	WH				
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: DG

CHECKED: WAM

MIS-BHS 001 1524337.GPJ GAL-MIS.GDT 4/9/18 JEM/ZS

PROJECT: 1524337-3000

RECORD OF BOREHOLE: 16-213

SHEET 2 OF 2

LOCATION: N 5030289.1 ;E 369399.3

BORING DATE: November 11, 2016

DATUM: CGVD28

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	Power Auger 200 mm Diam. (Hollow Stem)	(CI/CH) SILTY CLAY to CLAY; grey, with black organic mottling; cohesive, w>PL, stiff						+			
11					11	SS	1				
12					12	SS	2				
13					13	SS	2				
				51.40	14	SS	2				
		(SM) SILTY SAND; grey; non-cohesive, wet, loose to compact		13.41							
14					15	SS	10				
				50.48							
		End of Borehole		14.33							
15											
16											
17											
18											
19											
20											

DEPTH SCALE
1 : 50

GOLDER

LOGGED: DG
CHECKED: WAM

MIS-BHS 001 1524337.GPJ GAL-MIS.GDT 4/9/18 JEM/ZS

Certificate of Analysis

eurofins | Environment Testing

Client: Golder Associates Ltd. (Ottawa)
1931 Robertson Road
Ottawa, ON
K2H 5B7
Attention: Ms. Susan Trickey
PO#:
Invoice to: Golder Associates Ltd. (Ottawa)

Report Number: 1700269
Date Submitted: 2017-01-06
Date Reported: 2017-01-13
Project: 1524337
COC #: 814751

				Lab I.D.	1276618	1276619	1276620
				Sample Matrix	Soil	Soil	Soil
				Sample Type			
				Sampling Date	2016-11-22	2016-11-15	2016-11-10
				Sample I.D.	16-201 sa3	16-208 sa2	16-212 sa2
Group	**Analyte**	**MRL**	**Units**	**Guideline**			
Agri. - Soil	pH	2.0			7.1	7.9	7.3
General Chemistry	Cl	0.002	%		0.034	0.004	0.013
	Electrical Conductivity	0.05	mS/cm		0.78	0.17	0.36
	Resistivity	1	ohm-cm		1280	5880	2780
	SO4	0.01	%		0.01	<0.01	<0.01

Guideline = *** = Guideline Exceedence**

All analysis completed in Ottawa, Ontario (unless otherwise indicated by ** which indicates analysis was completed in Mississauga, Ontario).
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

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