REPORT

Geotechnical Investigation

Creemore Property, Southeast Corner of Mary Street and Louisa Street (County Road 9), Creemore, Ontario

Submitted to:

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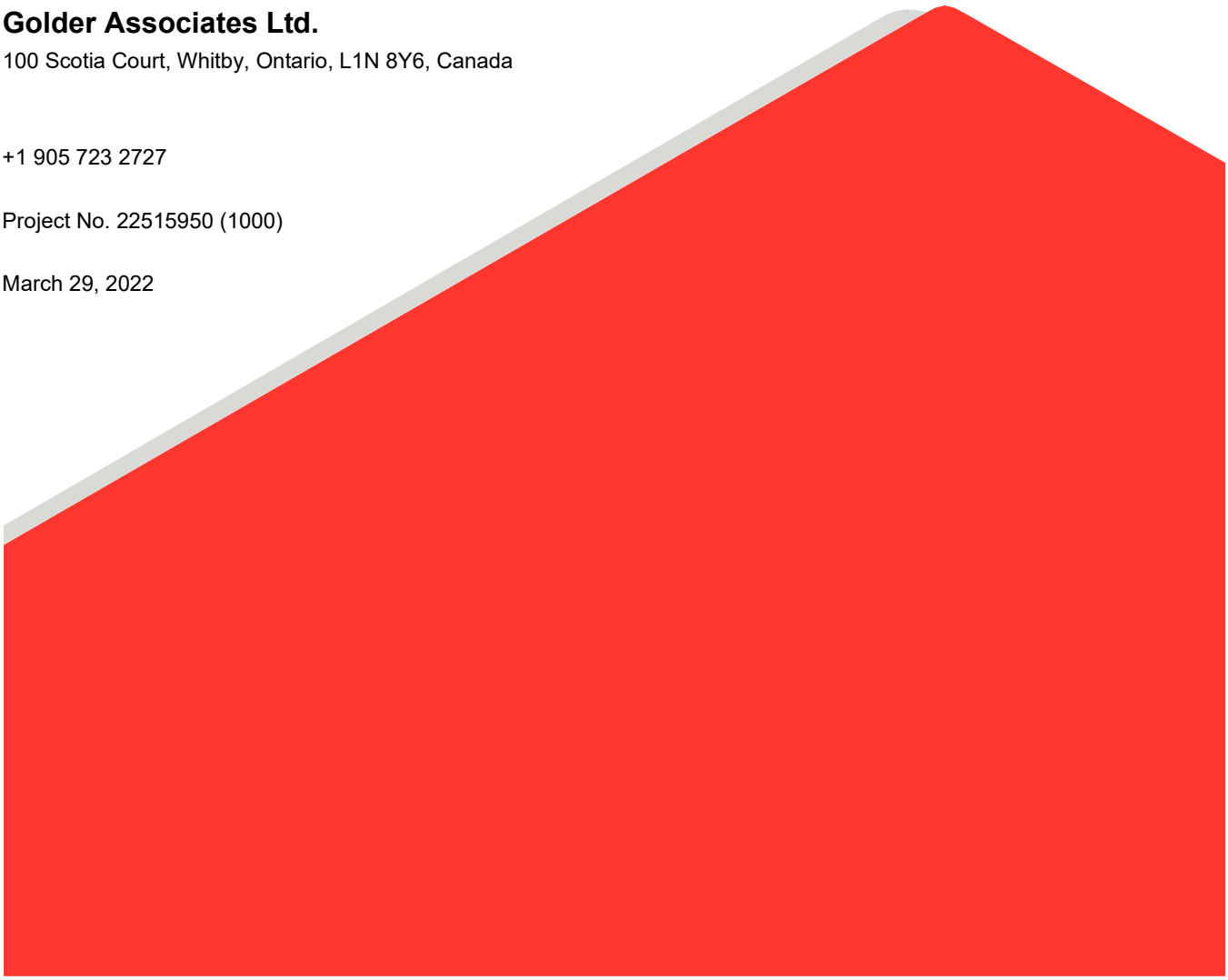

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Table of Contents

1.0 INTRODUCTION 1

2.0 SITE DESCRIPTION 1

3.0 INVESTIGATION PROCEDURES 1

4.0 SITE GEOLOGY AND STRATIGRAPHY 2

4.1 Regional Geology 2

4.2 Previous Geotechnical Investigation 2

4.3 Subsurface Conditions 3

4.3.1 Topsoil 3

4.3.2 Gravel, Sandy Gravel, Gravel and Sand, and Silty Gravel 3

4.3.3 Sand and Gravel, Gravelly Sand, and Sand 4

4.3.4 Silty Sand to Silty Sand and Gravel 4

4.3.5 Silty Clay 4

4.3.6 Sandy Silt 5

4.4 Groundwater 5

5.0 DISCUSSION AND RECOMMENDATIONS 5

5.1 Site Preparation 6

5.2 Engineered Fill 6

5.3 Conventional Shallow Foundation 7

5.4 Seismic Design 9

5.5 Slabs-on-Grade 10

5.6 Stormwater Management Pond 10

5.7 Site Servicing 11

5.7.1 Excavations and Groundwater Control 12

5.7.2 Pipe Bedding and Cover 13

5.7.3 Trench Backfill 13

5.8 Pavement Design 14

6.0 ADDITIONAL CONSIDERATIONS 15

7.0 CLOSURE 15

TABLES

Table 1: Depth to Groundwater 5

ATTACHMENTS

Figure 1: Key Plan
Figures 2: Borehole Location Plan
Figures 3 to 5: Grain Size Distribution Curves
Method of Soil Classification
Abbreviations and Terms used on the Records of Boreholes and Test Pits
List of Symbols
Record of Boreholes 22-1 to 22-14

APPENDICES

APPENDIX A

Important Information and Limitations of This Report

APPENDIX B

Record of Boreholes (21-1 to 21-6)

Laboratory Testing Results of Previous Investigation

1.0 INTRODUCTION

Golder Associates Ltd., a member of WSP, (Golder) was retained by Tribute Creemore Limited Partnership (Tribute) to carry out a geotechnical investigation and a Phase Two Environmental Site Assessment (Phase Two ESA) for the Creemore property, located at the southeast corner of the intersection of Mary Street and Louisa Street (County Road 9) in Creemore, Ontario (the site), as shown on Figure 1. This report provides the results of the geotechnical investigation only; the results of the Phase Two ESA will be submitted under separate cover.

The purpose of the geotechnical investigation was to obtain information on the general subsurface soil and groundwater conditions at the site by means of a limited number of boreholes and based on our interpretation of the borehole data, to provide geotechnical comments and recommendations in support of the proposed site development.

The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location, or elevation, or if the project is not initiated within eighteen months of the date of the report, Golder should be given an opportunity to confirm that the recommendations are still valid. In addition, this report should be read in conjunction with the attached document titled: "*Important Information and Limitations of This Report*" which is included in Appendix A. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2.0 SITE DESCRIPTION

The site is located within the southeast quadrant of the intersection of Mary Street and County Road 9 (Louisa Street) in Creemore, Ontario as shown on the Key Plan, Figure 1, attached.

The site has an approximate area of 39 hectares (96 acres) and consists of undeveloped agricultural lands and cultivated farmland, with associated agricultural structures. At the time of the investigation, single-storey residential buildings were located within the western portion of the site. In general, the ground surface at the site is relatively flat with an undulating topography observed within the central portion of the property. In addition, a pond was observed near the southwest corner of the property. The site was covered in snow during the field investigation.

It is understood that Tribute proposes to potentially develop the site as a residential subdivision. Based on the concept plan provided, entitled "*Concept Plan 3.0*, *Part of Lots 8 & 9 Concession 4, Township of Clearview, County of Simcoe*" dated December 3, 2021, the proposed development will consist of single, detached buildings, townhouses, senior's apartments, condominium apartments, a stormwater management facility, a park, and internal roads. Details of the proposed development (i.e., site grading, structure details, servicing depths, etc.) were not known at the time of preparation of this report.

3.0 INVESTIGATION PROCEDURES

The geotechnical field investigation for this assignment was carried out between February 17 to 28, 2022, during which time fourteen boreholes (designated as Boreholes 22-1 to 22-14) were advanced to approximate depths ranging from 5.1 m to 13.8 m below ground surface (mbgs). Boreholes 22-13 and 22-14 were both utilized for environmental purposes. The approximate borehole locations are shown on the Borehole Location Plan, Figure 2.

The boreholes were advanced using a CME 55 track-mounted drill rig supplied and operated by Davis Drilling of Milton, Ontario under subcontract to Golder. The boreholes were advanced using conventional 150-millimetre

(mm) and 180-mm diameter hollow stem augers. Standard penetration testing (SPT) and sampling in the overburden soils were carried out at regular intervals of depth using conventional 50-mm outer diameter split spoon sampling equipment driven by an automatic hammer in accordance with ASTM International standard D1586: "*Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*". The split-spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 38 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension would not be sampled or represented in the grain size distributions presented on Figures 3 to 5 and discussed in subsequent sections of this report. The results of the in situ field tests (i.e., SPT "N" -values), as presented on the Record of Borehole sheets and summarized in Section 4, are the values measured directly in the field and are unfactored.

Groundwater conditions were noted in the open boreholes during drilling and a 50-mm diameter monitoring well was installed in Boreholes 22-1, 22-3, 22-4, 22-10, 22-12, 22-13 and 22-14 to allow for further monitoring of groundwater levels. The monitoring well installation details are shown on the Record of Borehole sheets together with the encountered and measured groundwater levels. Upon completion of drilling, sampling and installations, the boreholes were backfilled in accordance with the requirements of the Revised Regulations of Ontario (R.R.O.) 1990, Ontario Regulation (O.Reg.) 903 (as amended) of the Ontario Water Resources Act.

The field work was directed by a member of our technical staff who also arranged for the clearance of underground services, observed the drilling, sampling and in situ testing operations, logged the boreholes, and examined and took custody of the recovered soil samples. The samples were identified in the field, placed in appropriate containers, labelled, and transported to our Whitby geotechnical laboratory for further examination and selected laboratory testing. Index and classification tests, consisting of water content determinations as well as selective gradation testing were carried out on the recovered soil samples. The results of the geotechnical laboratory tests are presented on Figures 3 to 5 and on the Record of Borehole sheets.

The Universal Transverse Mercator (UTM) coordinates and ground surface elevations at the borehole locations were surveyed by J.D. Barnes Limited and included on the Record of Borehole sheets.

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geology

The surficial geology aspects of the general site area are referenced from: Chapman, L.J., and Putnam, D.F., 2007, *"The Physiography of Southern Ontario"*; 4th Edition, Ontario Geological Survey. Based on the physiographic mapping tor the vicinity of the site, the site lies within the physiographic region of Southern Ontario known as the Simcoe Lowlands.

The Simcoe Lowlands are often comprised of till that has been eroded and replaced with granular or fine-grained deposits. Subglacial meltwater erosional events occurred near the end of the last glaciation when the ice was melting, and glaciers still covered the Simcoe County area. Vast amounts of meltwater released from the glaciers flowed under the glaciers with velocities high enough to erode tunnel channels 200 m deep and carry coarse gravel in suspension.

4.2 Previous Geotechnical Investigation

Golder previously carried out a preliminary geotechnical investigation at the site as part of the due diligence process in 2021. The results of the preliminary investigation were provided in the following report:

- Report Number 2251590 entitled *"Preliminary Geotechnical Investigation, Acquisition Due Diligence – Creemore Property, Southeast Corner of Mary Street and Louisa Street (County Road 9), Creemore, Ontario"* dated June 22, 2021.

During the subsurface investigation program conducted at the time, six boreholes (designated as Boreholes 21-1 to 21-6) were advanced within the current Site boundary with depths ranging between about 6.6 m and 9.6 mbgs. These borehole records are included in Appendix B and the approximate borehole locations are shown on Borehole Location Plan, Figure 2.

4.3 Subsurface Conditions

The subsurface soil and shallow groundwater conditions encountered in the boreholes, as well as the results of the field and laboratory testing are shown on the Record of Borehole sheets and Figures 3 to 5. Also included in the attachments, are sheets presenting the Method of Soil Classification, and Abbreviations and Symbols to assist in the interpretation of the borehole logs.

The Record of Borehole sheets indicate the subsurface conditions at the borehole locations only. The stratigraphic boundaries shown on the borehole records are inferred from non-continuous sampling, observations of drilling progress, as well as results of the Standard Penetration Tests, and generally represent transitions from one soil type to another rather than exact planes of geological change. Further, the subsurface conditions will vary between and beyond the borehole locations and across the site and caution should be used when interpolating and extrapolating subsurface conditions between and beyond the borehole locations. The following provides an overview of the subsurface conditions encountered in the boreholes advanced during this investigation, followed by more detailed descriptions of the major soil strata, groundwater conditions and testing results.

In general, the subsurface soil conditions within the site consisted of topsoil and reworked native soils underlain by non-cohesive deposits. Interlayers of silty clay and clayey silt were encountered in some boreholes. The following is a detailed description of the major soil strata encountered during the current geotechnical investigation.

4.3.1 Topsoil

A surficial layer of topsoil, with approximate thicknesses of between 0.2 m and 0.8 m, was encountered at the ground surface in all boreholes. Materials designated as topsoil in this report were classified based solely on visual and textural evidence. Testing of organic content, pH, alkalinity, acidity or for other soil nutrients was not carried out. Accordingly, materials classified as topsoil herein cannot necessarily be relied upon for the support and growth of landscaping vegetation without supplemental soil fertility analyses.

4.3.2 Gravel, Sandy Gravel, Gravel and Sand, and Silty Gravel

Non-cohesive deposits consisting of gravel with a trace of fines, gravel and sand with some fines, sandy silty gravel, gravelly sand with some fines, and sand with some fines were encountered in Boreholes 22-1, 22-2, 22-4, 22-6, 22-7, 22-9, and 22-11 underlying the topsoil or non-cohesive silty sand and gravel, gravelly silty sand, and silty sand. Rock fragments were observed within these non-cohesive deposits in some boreholes. The presence of cobbles and/or boulders within the non-cohesive deposits can be inferred from multiple instances of auger grinding during drilling.

The measured SPT 'N'-values in the non-cohesive deposits ranged from 21 blows to 59 blows per 0.3 m of penetration indicating a compact to very dense state of compactness, but predominantly dense to very dense.

The natural water contents measured on samples of these non-cohesive deposits ranged from about 5 percent to 16 percent but were typically less than 10 percent. A grain size distribution curve for a sample of the sandy gravel deposit is shown on Figure 3.

4.3.3 Sand and Gravel, Gravelly Sand, and Sand

Non-cohesive deposits consisting of sand and gravel, gravelly sand, and sand, with a trace to some fines, were encountered in Boreholes 22-1, 22-2, 22-5, 22-6, 22-8, 22-10, 22-11, and 22-12. The non-cohesive deposits were encountered beneath the topsoil and the native soils consisting of gravel, sandy gravel, silty sand and gravel, and gravelly silty sand. Rock fragments were observed within these non-cohesive deposits in some boreholes. The presence of cobbles and/or boulders within the non-cohesive deposits can be inferred from multiple instances of auger grinding during drilling.

The measured SPT ‘N’-values in the non-cohesive deposits ranged from 2 blows to 73 blows per 0.3 m of penetration indicating a very loose to very dense state of compactness, but predominantly compact to very dense. Very loose to loose soils were only encountered within the sand deposit in Borehole 22-2 between depths of about 4.0 m and 10.5 mbgs.

The natural water contents measured on samples of the non-cohesive deposits ranged from about 4 percent to 28 percent. Grain size distribution curves for four samples of the sand and gravel deposit are shown on Figure 4.

4.3.4 Silty Sand to Silty Sand and Gravel

A non-cohesive deposit ranging in composition from silty sand and gravel to silty sand, gravelly to containing a trace of gravel, were encountered in all boreholes underlying the topsoil, silty clay, sandy gravel, silty gravel, sand and gravel, gravelly sand, and sand. The presence of cobbles and/or boulders in the non-cohesive deposit can be inferred from the multiple instances of auger grinding during drilling as well as the split-spoon sampler not advancing the full sample depth at one sample location.

The measured SPT ‘N’-values in the non-cohesive silty granular deposit ranged from 2 blows per 0.3 m of penetration to 50 blows per 0.1 m of penetration, indicating a very loose to very dense state of compactness, but predominantly compact to very dense. The loose silty sand deposit was encountered in Boreholes 22-2, 22-3 and 22-6 within the upper 2.0 m, and in Boreholes 22-5 and 22-9 at depths of greater than 4.0 mbgs.

The natural water contents measured on samples of the non-cohesive deposit ranged from about 4 percent to 33 percent. Based on previous investigation, it is anticipated that the high water contents are likely due to the presence of clayey silt layers.

Grain size distribution curves for two samples of the non-cohesive deposit (silty sand to silty sand and gravel) are shown on Figure 5.

4.3.5 Silty Clay

A silty clay deposit containing a trace of sand was encountered underlying the topsoil in Borehole 22-5.

An SPT ‘N’-value of 4 blows per 0.3 m of penetration was measured in the cohesive deposit, indicating a firm consistency. The natural water content measured on a sample of the silty clay deposit was about 21 percent.

4.3.6 Sandy Silt

A sandy silt with slight plasticity was only encountered in Borehole 22-1 underlying the sand and gravel deposit, below a depth of about 7.1 mbgs.

An SPT 'N'-value of 17 blows per 0.3 m of penetration was measured in the sandy silt deposit, indicating a compact state of compactness. A natural water content of about 17 percent was measured on a sample of the sandy silt deposit.

4.4 Groundwater

Groundwater levels were measured in the boreholes during and upon completion of drilling. The groundwater levels measured in five monitoring wells (Boreholes 22-1, 22-3, 22-4, 22-10, and 22-12) on March 14, 2022 ranged between depths of about 1.1 m and 7.0 mbgs. Monitoring wells installed in Boreholes 22-13 and 22-14 were observed to be dry on March 14, 2022. The recorded depths to the groundwater level are provided below in Table 1.

Table 1: Depth to Groundwater

Monitoring Well	Groundwater Depth in Monitoring Well
	Depth (m)
22-1	1.1
22-3	1.8
22-4	7.0
22-10	1.1
22-12	1.4
22-13	Dry (to >6.1 m)
22-14	Dry (to >5.2 m)

It should be noted that the observations presented above reflect the groundwater conditions measured in the boreholes and monitoring wells at the borehole locations during the time of the field investigation. Groundwater levels at the site are anticipated to vary between and beyond the borehole locations and to fluctuate with seasonal variations in precipitation and snowmelt.

5.0 DISCUSSION AND RECOMMENDATIONS

This section of the report provides engineering information and recommendations for the geotechnical design aspects of the proposed works based on our interpretation of the borehole information, the laboratory test data and our understanding of the project requirements. The information in this portion of the report is provided for planning and design purposes for the guidance of the design engineers and architects. Where comments are made on construction, they are provided only in order to highlight those aspects of construction which could affect

the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigations, satisfy themselves as to the adequacy of the information for construction, and make their own independent interpretation of the factual data as it affects their proposed construction means and methods, scheduling, costs, and the like.

This report addresses the geotechnical (physical) aspects of the subsurface conditions as encountered at this site. The overall chemical/environmental aspects of the subsurface are beyond the terms of reference for the geotechnical investigation and were not addressed.

5.1 Site Preparation

All surficial vegetation, topsoil or fill, old foundations, existing wells and any existing infrastructure should be stripped from the site. Outside of the parking areas and road allowances, the existing fill may be reused as general lot fill to raise grades or for landscaping purposes.

An existing pond was located at the southwest corner of the property. It is recommended that ponded water be pumped out and any loose soil at the base and side slopes be subexcavated into competent native soils. The exposed native soils should be proofrolled to confirm the competency of the base prior to placing engineered fill.

Finished floor elevations for the proposed buildings had not been determined at the time of this report. However, any filling carried out at the site in conjunction with re-grading (with the exception of future green spaces) should be constructed as engineered fill. Recommendations for the placement of engineered fill are outlined below in Section 5.2.

5.2 Engineered Fill

The existing structure and its foundations, located at the northwest quadrant of the site, will need to be completely removed prior to the proposed residential development. As such, the exposed excavated areas located within the foundation footprint must be removed and replaced with engineered fill up to the final grades.

Where cut and fill are required to achieve final grades within the site, the non-cohesive reworked native soil within the vicinity of Borehole 21-5 and the native non-cohesive soils may be reused as engineered fill, where the water content is below or at its optimum water content for compaction, and provided that the material is free of organics and other deleterious materials. Based on the soil classification and frost group described in Table 13.1 of the Canadian Foundation Engineering Manual (CFEM), the native soils encountered at the site are regarded as being low to moderately susceptible to frost heave. This should be considered for any design elements exposed to freezing temperatures (concrete flatworks, exterior concrete slabs, and the like).

Based on the measured natural water contents, the native cohesive and non-cohesive soils are at, or above, their estimated laboratory optimum water contents for compaction. As such, drying of the non-cohesive native soils will be required prior to being used as engineered fill. Alternatively, imported materials may be used for engineered fill and must be approved by Golder at the source(s), prior to hauling to the site. In this regard, imported granular materials which meet the requirements for Ontario Provincial Standard Specification (OPSS). PROV 1010 (Aggregates) Select Subgrade Material (SSM) or Granular B Type I would be suitable for use as engineered fill.

All oversize cobbles and boulders (i.e., greater than 150 mm in size) or any other deleterious materials should be removed from engineered fill materials.

Prior to placement of engineered fill, any existing foundations, fill and abandoned buried utilities must first be removed from the site. Also, the native non-cohesive soil in the vicinity of Boreholes 21-2, 22-2 to 22-5 and the firm silty clay soil encountered in the vicinity of Borehole 22-5 should be removed and replaced with non-frost susceptible soil. The exposed native subgrade area(s) should be proofrolled and inspected by geotechnical personnel from Golder to confirm that the base is free of ponded water, loosened/softened or any other deleterious materials. Remedial work (further sub-excavation, replacement, etc.) might be needed as per recommendations from Golder during proofrolling.

The engineered fill should be placed in loose lifts not exceeding 300 mm in thickness and uniformly compacted to at least 98 per cent of the material's standard Proctor maximum dry density (SPMDD).

The final surface of the engineered fill should be protected as necessary from construction traffic and should be sloped to provide positive drainage for surface water prior to construction. During periods of freezing weather, additional soil cover should be placed above final subgrade to provide temporary frost protection.

5.3 Conventional Shallow Foundation

At the time of this report, the finished floor elevations for the proposed building had not been finalized. We recommend that the proposed buildings be supported on conventional spread/strip footings founded on the competent engineered fill or within the compact to very dense non-cohesive native soils, above the noted groundwater levels.

A very loose to loose non-cohesive deposit was encountered in Boreholes 21-2, 21-4, 22-2, 22-5 and 22-9 at depths greater than 3 mbgs. It should be noted that these weaker soils are not capable of directly supporting building foundations. A minimum separation of 1.5 m should be maintained between the underside of footings and the upper surface of the very loose to loose non-cohesive soils.

For foundations founded on approved engineered fill uniformly compacted to at least 98 percent of its SPMDD, a factored resistance at Ultimate Limit States (ULS) of 225 kPa and a geotechnical reaction at Serviceability Limit States (SLS) of 150 kPa (for 25 mm of total settlement and about 20 mm of differential settlement) may be assumed for design.

Spread or strip footings founded on the competent native soils may be designed using a factored resistance at Ultimate Limit States (ULS) of 300 kPa and a geotechnical reaction at Serviceability Limit States (SLS) of 200 kPa for 25 mm of total settlement and about 20 mm of differential settlement. The proposed foundations should be founded below the frost depth of 1.6 m based on the final finished grades.

For the soil resistance and reaction values listed above, the footings must have widths not more than 900 mm for strip footings and not more than 2,500 mm for spread footings. Should larger footing sizes be required, Golder must be consulted to provide additional recommendations.

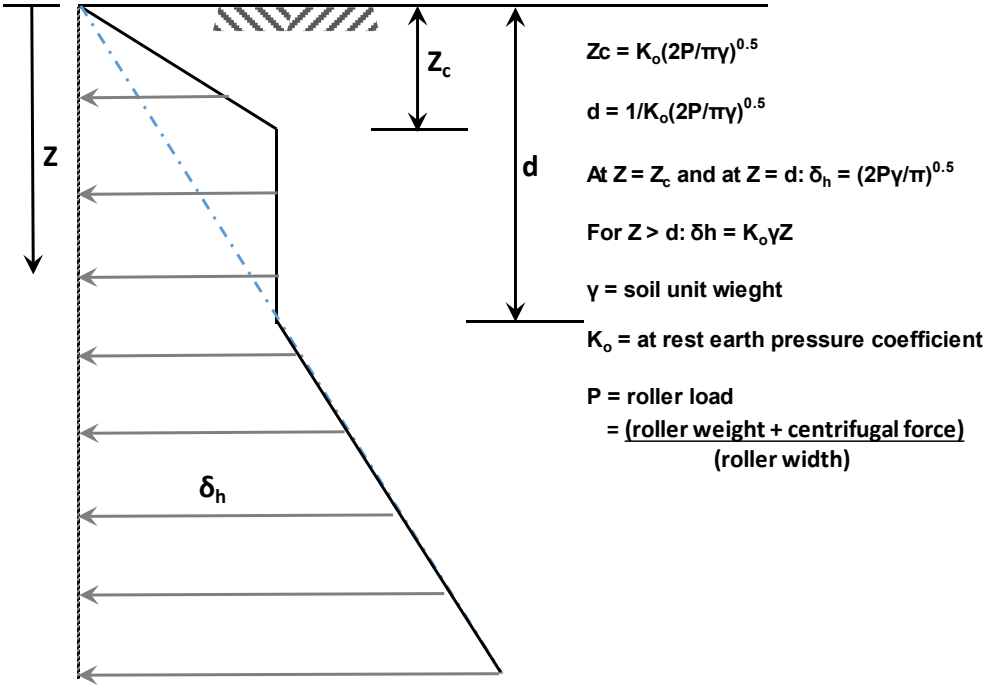
The foundation subgrade for footings founded on engineered fill or native soils is subject to inspection and approval by Golder prior to placing concrete. Remedial actions (sub-excavation and replacement, etc.) may be required during the excavation of footings, especially when footing design elevations coincide with softened or loosened soils or any deleterious materials. These soils must be sub-excavated and replaced with lean mix concrete or engineered fill as directed by geotechnical personnel from Golder.

In general, for any structures placed wholly or in part on engineered fill, it is recommended that the foundation walls be provided with nominal reinforcement with reinforcing steel at the top and bottom of the foundation walls.

This would typically consist of two continuous 10 M bars in both the top and bottom of the walls with lapped connections and corner bars. The bars should be provided with at least 50 mm of concrete cover. Corner bars should have proper factory bends and all tied steel should have at least 600 mm of overlap. At window well locations, two 10 M bars should be placed in the foundation wall as close to the sill as possible (allowing for 50 mm of cover). The bars should extend laterally at least 600 mm beyond the edge of the window opening. The actual design should be approved by the home builder's structural engineer.

The perimeter basement walls should be backfilled with a free draining, non-frost susceptible granular material carefully placed and compacted in lifts. The walls should be designed using a lateral earth pressure coefficient at rest of 0.5 and a unit weight of backfill of 21 kN/m^3. Alternatively, where Site excavated material is to be reused for exterior basement wall backfill, an approved geocomposite drainage system should be used directly against the wall. The upper 0.3 m of backfill should be clayey material to provide a relatively impermeable cap and should be sloped away from the house. Properly filtered perimeter drains at the foundation level leading to a permanent outlet, such as a continuously pumped sump or a direct outlet to a sewer line, should be provided.

To account for lateral pressures induced by compactive effort adjacent to foundation walls, the design lateral earth pressure distribution should consist of a combined trapezoidal/triangular distribution as depicted below. Typical roller loads are provided for reference.



Typical Roller Loads

Roller Type	Weight (kN)	Cent. Force (kN)	Width (mm)	P (kN/m)
1-drum walk-behind	2.3	8.3	560	18.9
2-drum walk-behind	1.6	10.1	560	20.9
2-drum walk-behind	12.1	8.8	760	27.5
2-drum walk-behind	9.2	19.8	750	38.7

Heavy ride-on compaction equipment should not be used within 2 metres of the foundation walls.

It is suggested that finalized basement floor elevations be set above the local water table. Underfloor drains and an upgraded level of waterproofing would be necessary in areas of the site where basements are proposed to be located below the local groundwater table and in potentially water bearing soils. Such conditions should be identified in the field by the geotechnical engineer.

If stepped spread footings are constructed at different founding levels, the difference in elevation between individual footings should not be greater than one half the clear distance between the footings. Should this not be possible, Golder should be consulted to provide field inspection to ensure that the footings exceeding the above requirement are stable and the bearing for the upper footing is not compromised. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevations of the upper footings can be adjusted accordingly. Stepped strip footings, if required, should be constructed in accordance with the 2012 Ontario Building Code (2012 OBC), Section 9.15.3.9.

The founding materials are susceptible to disturbance by construction activity especially during wet weather and care should be taken to preserve the integrity of the bearing strata, including engineered fill. Prior to placing concrete for the foundations, the excavation must be inspected by Golder to confirm that the foundations are located in a competent bearing stratum, which has been cleaned of ponded water and loosened or softened material. If the concrete for the footings cannot be placed immediately after excavation and inspection, it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing strata. The bearing soil and fresh concrete must be protected from freezing during cold weather construction.

All exterior footings and footings in unheated areas must be provided with at least 1.6 m of soil cover after final grading or a thermally equivalent thickness of insulation for frost protection.

5.4 Seismic Design

The 2012 Ontario Building Code (2012 OBC) came into effect on January 1, 2014 and contains updated seismic analysis and design methodology. Seismic hazard is defined for an earthquake with a 2 percent probability of exceedance in 50 years (i.e., a return period of 2,400 years) which encompasses a larger earthquake hazard than in prior editions of the OBC. Design earthquakes are commonly defined by an earthquake magnitude, distance, and peak ground acceleration (PGA). The 2012 OBC uses the uniform hazard spectra (UHS) to define the response of the structure to the design earthquake and also considers the effects of the localized Site conditions on the structural response. he 2012 OBC also uses a refined site classification system defined by the average soil/bedrock properties in the top 30 metres of the subsurface profile beneath the structure(s). There are six site classes designated as A to F related to decreasing ground stiffness from A for hard rock to E for soft soil and site Class F for problematic soils (e.g., sites underlain by thick peat deposits and/or liquefiable/collapsible soils). The site class is then used to obtain acceleration- and velocity-based site coefficients, Fa and Fv, respectively, used to modify the reference UHS to account for the effects of site-specific soil conditions in design.

Based on the results of the investigation, the building foundations may be designed using a Site Class C designation. It is possible that the site class could be improved by in situ testing. Should optimization of the site class be recommended by the structural engineer, in situ geophysical testing should be carried out at the site, although a higher site class is not guaranteed.

5.5 Slabs-on-Grade

The floor slabs for any proposed buildings without basements are anticipated to be designed as concrete slabs-on-grade. The floor slabs may be placed over granular under-slab fill bearing on approved engineered fill or the native subgrade. The engineered fill should be placed and compacted as per the requirements of Section 5.2.

Prior to the placement of engineered fill, the exposed subgrade should be proofrolled and inspected by Golder. Remedial work should be carried out on any softened, disturbed, wet or poorly performing zones as directed by Golder. Any low areas may then be brought up to within at least 200 mm of the underside of the floor slab, as required, using OPSS Granular 'B', Type I material or other approved material, placed in maximum 200-mm thick loose lifts and uniformly compacted to at least 100 percent of the material's SPMDD.

The final lift of granular fill beneath floor slab should consist of a minimum thickness of 200 mm of OPSS Granular 'A', uniformly compacted to at least 100 percent of SPMDD. This should provide a modulus of subgrade reaction, for a 0.3-m square plate placed directly on the subgrade material, k_{v1}, of approximately 30 MPa/m. Special care should be taken to ensure adequate compaction is achieved around columns and adjacent to foundation walls. Any filling operations should be monitored and tested by Golder. It should be noted that this is an unfactored value for a hypothetical loaded area with dimensions of 0.3 m by 0.3 m and needs to be modified based on the actual size/area of the slab using the following equation:

$k= k_{v1}\{(B+0.3)/2B\}^2$, where:

k_{v1} is the unit modulus for a 0.3-m X 0.3-m loaded area (MPa/m);

B is the maximum horizontal dimension of the continuous slab in metres; and

k is the factored modulus (MPa/m).

It is recommended that the design be checked using k_{v1} values of 25 and 35 MPa/m to evaluate the sensitivity of the design to this input.

The floor slabs should be structurally separate from the foundation walls and columns and sawcut control joints should be provided at regular intervals and along column lines to address shrinkage cracking and to allow for any differential settlement of the floor slabs.

In general, where the floor slab is at or above the exterior final grade, no perimeter drainage at the footing level is required. Where the finished floor slab will be below exterior grade, a perimeter drainage system should be provided. The footing drainage system should be provided with a permanent frost-free outlet.

5.6 Stormwater Management Pond

A stormwater management pond is to be located within the southeast portion of the property. Details, such as type, depth, and permanent water level, were not available at the time of the preparation of this report; accordingly, the following comments and recommendations are general in nature, should be considered preliminary and are provided to assist in the preliminary design and location and of the pond. Once the pond design is more advanced, the recommendations should be revised and updated as appropriate.

Based on the subsurface conditions encountered in Boreholes 22-10, 22-11 and 22-12, the subsurface native soil conditions in the pond area are expected to generally consist of compact to very dense saturated non-cohesive deposits. The groundwater level measured in the monitoring wells installed within the proposed pond area ranged

between depths of about 1.1 m and 2.3 mbgs. Depending on the final site grades and pond excavation depths, ballast may be required to counterbalance the anticipated hydrostatic upward pressures within the water bearing granular deposits. In addition, the pond bottom is anticipated to be within the water bearing non-cohesive deposits, and a low hydraulic conductivity liner would be required for detention.

Any constructed berms around the pond should have a top width of at least 3 m where maintenance access is not located on the berm. The material used to construct the berms should be approved by the geotechnical engineer prior to placement. In this regard, excavated silty clay till materials would be suitable for reuse provided that the soil's water content is within +/- 2 percent of its optimum water content at compaction. The approved material used to construct berms should be placed in maximum 300 mm loose lifts and uniformly compacted to at least 98 percent of the materials SPMDD. Care should be taken to ensure homogeneity of the constructed berm (i.e., no erodible layers). The prepared foundation for the berm should be inspected by the geotechnical engineer prior to placement of berm fill material. A key trench, a minimum of 0.6 m deep and 2 m wide, keyed into the cohesive till deposits, should be provided along the full length of the constructed berm in order to provide a cut-off to water seepage under the base of the berm.

Pond side slopes above the permanent water level in the pond should be inclined no steeper than 3 horizontal to 1 vertical (3:1); side slopes below the permanent water level should be 4:1 or flatter. These recommendations should be revisited after the pond details are known and further information on the groundwater is available.

Cut side slopes of the pond should be inspected by the geotechnical engineer during construction. Where erodible seams (e.g., sand or silt seams) are encountered, some form of blanketing, flattening of the slope angles or the like would be required. The need for, and the design of, any blanketing or other remedial measures should be determined during construction by the geotechnical engineer. The pond should be equipped with an emergency spillway or similar structure(s) designed to preclude the possibility of over-topping of the berms.

Where pipes enter or exit the pond, they should be provided with anti-seepage collars (concrete or steel) and be backfilled with a relatively impermeable material (e.g., clayey silt or silty clay) to minimize preferential flow through the pipe bedding and backfill and possible loss of ground. Pipes entering or exiting the pond should be sized and designed to allow for cleaning. The exposed end of the riser portion should be provided with a protective wire mesh or the like to prevent unauthorized access (e.g., by children).

Regular inspection by the geotechnical engineer should be carried out during the pond construction. The final pond side slopes should be sodded or otherwise treated to reduce erosion. Maintenance will be required over the first several years until the vegetative mat has taken root.

5.7 Site Servicing

Details of underground servicing for the proposed site development were not finalized at the time of this report and as such, for the purpose of this report, we have assumed that the maximum depth of the underground services will be within about 3 m below the final site grades. Once detailed design is completed, a review of the site servicing recommendations should be completed by Golder.

The founding levels for the proposed services are anticipated to be within the native compact to very dense non-cohesive deposits. In general, these soils are considered to be suitable for supporting sewers and watermains, provided that the materials are adequately dewatered, and the integrity of the base can be maintained during construction. However, if softened/loose, organic soil/topsoil or deleterious materials are

encountered at the proposed founding level, these materials must be removed and replaced with approved engineered fill to provide a suitable founding stratum.

Excavated non-cohesive deposits would likely require drying prior to placement as backfill which will be slow, especially during periods of wet or cold weather. As such, imported material can be used to backfill trenches for underground services if insufficient time can be allowed for adequate drying. Care will be required to ensure that sufficient effort is consistently put into placement and compaction of the trench backfill in order to limit settlements, especially if a trench liner box is used. The general trench backfill should be placed in maximum 300-mm thick loose lifts and uniformly compacted to at least 95 percent of SPMDD. The upper 1 m of the trench backfill that will form a new pavement subgrade should be placed in maximum 300-mm thick loose lifts and uniformly compacted to at least 98 per cent of SPMDD.

5.7.1 Excavations and Groundwater Control

Excavations for foundations and site servicing are generally anticipated to extend through the surficial topsoil and reworked materials/fill into the native non-cohesive deposits. Conventional excavation equipment should be suitable to excavate through these soils. The presence of cobbles and boulders should be anticipated within the native non-cohesive strata.

It is anticipated that the excavations will likely consist of conventional temporary open cuts. All excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. Based on the OHSA, the anticipated soil types would be generally classified as Type 3 soils and all excavations in excess of 1.2 m in depth through these soils should be sloped no steeper than 1 horizontal to 1 vertical above the groundwater level. However, it is anticipated that some areas in the vicinity of Boreholes 21-2, 21-4, 22-2, 22-5 and 22-9 will encounter very loose to loose native soils and as such would be classified as Type 4 soils under OHSA requiring open cut trenches with side slopes not steeper than 3H:1V or temporary support (shoring). Depending upon the construction procedures adopted by the contractor, the success of the contractor's groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of the slopes may be required.

The groundwater levels in the monitoring wells installed in selected boreholes across the site varied between depths of about 1.1 m and 7.0 mbgs. As such, it is anticipated that trench excavations will mostly be below the groundwater level with only a few areas being above the groundwater level, depending to some extent on the final grades. Proactive groundwater control consisting of well points or eductors will be required to maintain the groundwater level within the excavation at least 0.5 m below the base, to address the potential for base heave, piping failure and/or basal uplift.

It is imperative that any underground services or existing structures located within the zone of influence of the excavation, as defined by a line drawn upwards and outwards from the base of the excavation at an inclination of 1 horizontal to 1 vertical, be accurately located prior to construction and adequate support provided where required. In addition, excavations should be left open for as short a duration as possible and completely backfilled at the end of each working day. All excavated material should be stockpiled well away from the sides of the excavation (a minimum lateral offset equal to the depth of the excavation).

Where there is not sufficient space to excavate temporary sloped open cuts, it is recommended that a trench liner box or shoring system consisting of braced soldier pile and lagging or potentially a slide rail system designed by a Professional Engineer including assessment of the potential for basal heave be utilized. If shoring is implemented at the site, the requirements of OPSS.PROV 539 should be followed. Design of temporary works will be entirely

the responsibility of the contractor. Any voids between the excavation walls and the exterior of the trench liner box should be filled immediately to restore lateral support.

Excavation is not permitted within the zones of influence of any existing building foundations as defined by a line drawn at an inclination of 1 horizontal to 1 vertical down and away from the edges of the footings.

The rate and volume required for dewatering will be dependent on the depth of the required excavations, the groundwater levels at the time of construction and the construction methods and staging chosen by the Contractor. It should be noted that groundwater control measures that extract more than 50,000 L/day of water are subject to regulation by the Ontario Ministry of the Environment, Conservation and Parks (MECP). A registration on the Environmental Activity Section Registry (EASR) of the MECP should be submitted in the event that the pumping volumes exceed 50,000 L/day. Under the EASR, a Permit to Take Water (PTTW) is not required for water taking for construction site dewatering for volumes less than 400,000 L/day. Based on the measured groundwater levels, the predominantly granular nature of the native soils, and the assumed maximum excavation depth (i.e., 3 m), an EASR registration or PTTW would likely be required for this site.

5.7.2 Pipe Bedding and Cover

The bedding for watermains and sewers should be compatible with the size, type, and class of pipe, surrounding soil and loading conditions and should be designed in accordance with the Regional and Municipal standards. Where granular bedding is deemed to be acceptable, it should consist of at least 150 mm of OPSS Granular ‘A’ or 19 mm crusher run limestone material. Additional bedding thicknesses will likely be required for services founded within the weaker soils, depending upon the success of the contractor’s groundwater control measures.

Clear stone should not be used as bedding material or to stabilize the base. Sand cover may be used from the spring line to 300 mm above the obvert of the pipes. All bedding material and cover should be placed in maximum 150-mm thick loose lifts and uniformly compacted to a minimum of 98 percent of the material's SPMDD.

5.7.3 Trench Backfill

The majority of the excavated materials from the site will generally consist of native cohesive and non-cohesive deposits, with the majority of soils excavated during underground service installation anticipated to be above their estimated optimum water contents for compaction. As a result, extensive drying of the soils may be required prior to placement and compaction.

The native non-cohesive deposits at suitable water contents may be reused as trench backfill, provided they are free of significant amounts of topsoil, organic or other deleterious materials. The cohesive deposits should not be reused as trench backfill due to the high-water contents, associated long-term consolidation settlements and difficulty in achieving compaction. All trench backfill from the top of the cover material to the top of subgrade should be placed in maximum 300-mm thick loose lifts and uniformly compacted to at least 95 percent of the material’s SPMDD.

Alternatively, if placement water contents at the time of construction are too high, or if there is a shortage of suitable in situ materials, then an approved imported sandy material which meets the requirements for OPSS SSM may be used. Backfilling during cold weather must avoid inclusions of frozen lumps of material, snow, and ice.

Normal post-construction settlement of the compacted trench backfill should be anticipated, with the majority of such settlement taking place within about six months following the completion of trench backfilling operations.

This settlement will be reflected at the ground surface and in pavement construction areas and may be compensated for where necessary by placing additional granular material prior to asphalt paving. However, since it is anticipated that the asphalt binder course will be placed shortly following the completion of trench backfilling operations, any settlement that may be reflected by subsidence of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding. In any event, it is recommended that the surface course asphalt not be placed over the binder course asphalt (across the full pavement width) for at least twelve months. Post-construction settlement of the restored ground surface in any boulevard/ditch trench areas is also expected and those areas should be topped-up and re-landscaped, as required.

It is recommended that, where the utility trench encounters high permeability non-cohesive soils below the groundwater table, strategically located trench plugs should be constructed to prevent preferential groundwater flow through the granular bedding and trench backfill. As such, it should be included in the contract as a provisional item.

5.8 Pavement Design

This section of the report provides preliminary engineering information for the pavement structures within the residential development. Based on the drawing provided entitled "*Concept Plan 3.0*, *Part of Lots 8 & 9 Concession 4, Township of Clearview, County of Simcoe*" dated December 3, 2021, the proposed local roads (Streets A to J) within the site will consist of an 8.0 m, 20.0 m, and 26.0 m rights-of-way (ROWs).

Based on the subsoil conditions encountered at the site, the following pavement design may be considered for the proposed internal roads.

Material	Thickness of Pavement Components (mm)
HL 3 (Surface Course)[1]	40
HL 8 (Binder Course)[1]	50
Granular A, Base[3]	150
Granular B, Type 1 Subbase[3]	300
Subgrade	Existing Subgrade (proofrolled and graded for drainage)

Notes:
The above pavement designs satisfies the minimum design standards outlined in the Pavement Design and Rehabilitation Guideline (2019)
[1] Asphaltic Material shall be in accordance with OPSS.MUNI 310 (November 2017) and OPSS.MUNI 1151 (April 2018)
[2] Concrete Material shall be in accordance with OPSS 350 (March 1998), OPSS 1350 (November 2019), and TS 3.40 (September 2017)
[3] Granular Materials shall be in accordance with OPSS.MUNI 1010 (November 2013)

In preparation for pavement construction, all deleterious material (i.e., topsoil, surficial silty clay, loose non-cohesive soils or material containing organic material) should be removed from all pavement areas. The pavement subgrade is assumed to be compact to very dense non-cohesive deposits. Prior to placing the granular subbase, the exposed subgrade should be proof-rolled and inspected by the geotechnical engineer. Any soft or poorly performing areas should be subexcavated and reinstated with approved granular material placed in loose lifts not exceeding 300 mm in thickness and uniformly compacted to at least 98 percent of the material's SPMDD. The granular subbase materials should follow the same compaction procedures.

The granular base materials should be uniformly compacted to at least 100 percent of their SPMDD. The asphalt materials should be compacted to a minimum of 92 percent of their Maximum Relative Density in accordance with

OPSS 310, as measured in the field using a nuclear density gauge. The asphalt cement for the HL 8 and HL 3 hot mix asphalt mixes should be Category B, PG 58-28 performance graded asphalt cement in accordance with OPSS.MUNI 1101.

Drainage of the pavement layers is critical to the long-term performance of the pavement. As such, the surface of the subgrade should be shaped and crowned to promote drainage of the pavement base and subbase. Continuous subdrains could be placed around the perimeter of the parking lot and stub drains placed around internal catch basin locations. The inverts of the subdrains should extend at least 300 mm below the bottom of the subbase layer and should be sloped to drain towards the catch basins. The subdrains should consist of perforated pipe wrapped in a suitable geotextile and surrounded with a minimum thickness of 150 mm of clean free draining sand such as concrete sand.

In areas where the existing grade is lower than the design top of subgrade elevation, it is recommended that sufficient additional granular material be provided, properly compacted, and built up to the top of subgrade.

It is recommended that tack coat be applied to all milled asphalt surfaces and butt joints and between all new lifts of asphalt. Tack coat is to be provided in accordance with OPSS 308.

Where new pavement abuts existing pavement, proper longitudinal lap joints, at least 500 mm wide and 50 mm deep, should be constructed to key the new asphalt into the existing surface. The existing asphalt edges should be saw cut to provide a clean, straight edge prior to keying in the new asphalt. Any undermining or broken edges resulting from the construction activities should be removed by saw cutting.

6.0 ADDITIONAL CONSIDERATIONS

Monitoring wells have been installed in selected boreholes to permit monitoring of the groundwater levels at the site. O.Reg. 903, as amended, of the Ontario Water Resources Act, requires that these wells be properly abandoned/decommissioned by an MECP-licensed Water Well Contractor. It is recommended that the decommissioning of the wells be carried out as part of the construction activities at the site so that water level measurements can be taken immediately prior to construction and so that the well can potentially be used to assist in evaluating the effectiveness of dewatering during construction. If requested, Golder could aid the owner in arranging for the decommissioning of the monitoring wells by a licensed water well drilling contractor.

7.0 CLOSURE

We trust that this geotechnical report provides geotechnical engineering information to support the proposed development. If conditions that differ from those assumed in this report are encountered during construction, Golder must be given the opportunity to review the analyses presented herein.

If you have any questions regarding the content of this technical memorandum, please do not hesitate to contact this office.

Signature Page

Golder Associates Ltd.

Timi Olumuyiwa, M.Sc., P.Eng., PMP
Geotechnical Engineer

Mark A. Swallow, M.A.Sc., P.E., P.Eng.
Geotechnical Engineer VIII, Fellow

TO/MAS/mes

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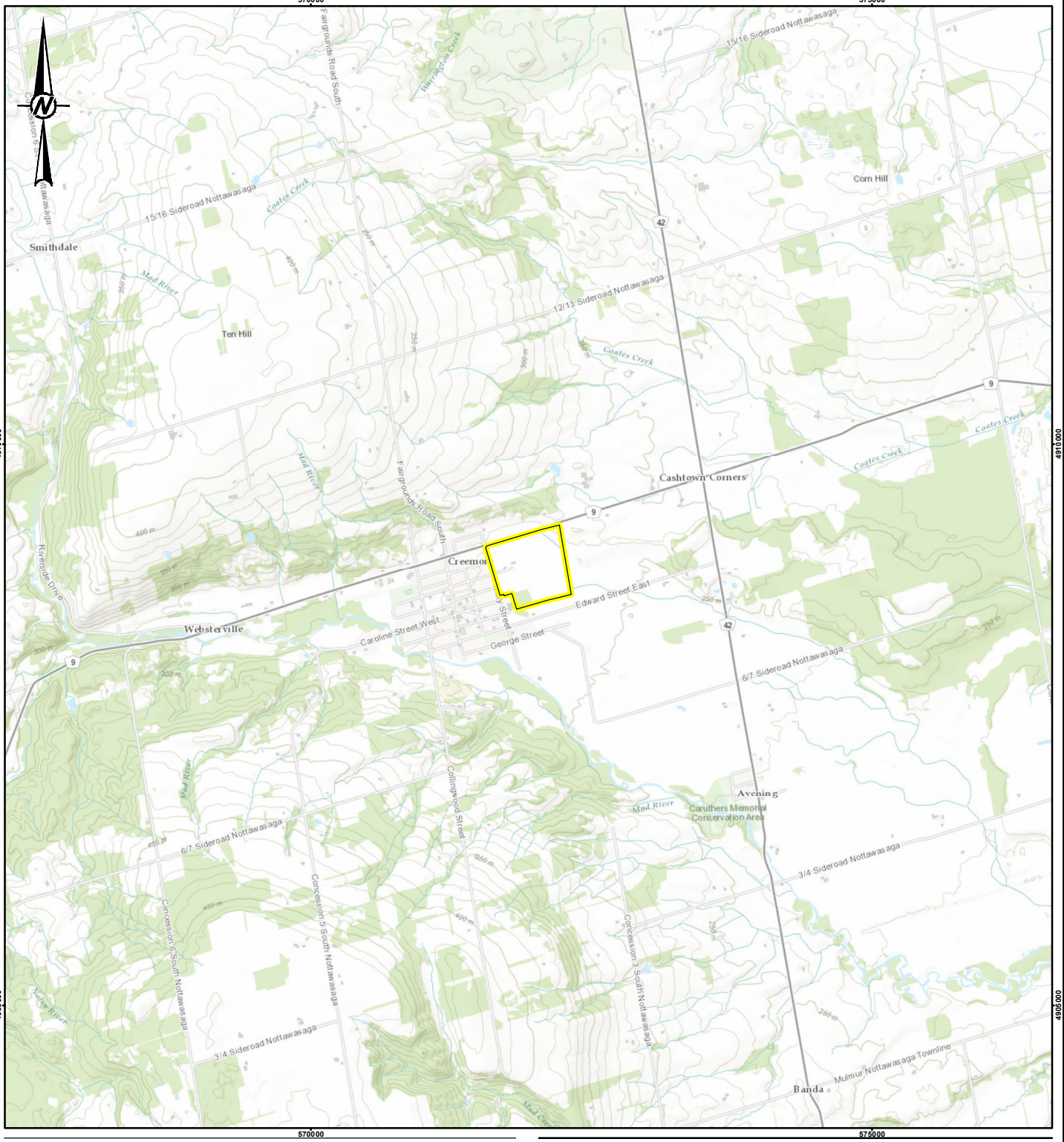

LEGEND

SITE BOUNDARY

0 1,000 2,000

1:50,000 METRES

NOTE(S)

REFERENCE(S)

1. BASE MAP - SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
2. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 17

CLIENT
TRIBUTE CREEMORE LIMITED PARTNERSHIP

PROJECT
GEOTECHNICAL INVESTIGATION
CREEMORE PROPERTY, SOUTHEAST CORNER OF MARY STREET AND LOUISA STREET (COUNTY ROAD 9), CREEMORE, ONTARIO

TITLE
KEY PLAN

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-03-28
DESIGNED	TO
PREPARED	JT
REVIEWED	TO
APPROVED	MAS

PROJECT NO.	CONTROL	REV.	FIGURE
22515950	0001	A	1

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

25mm

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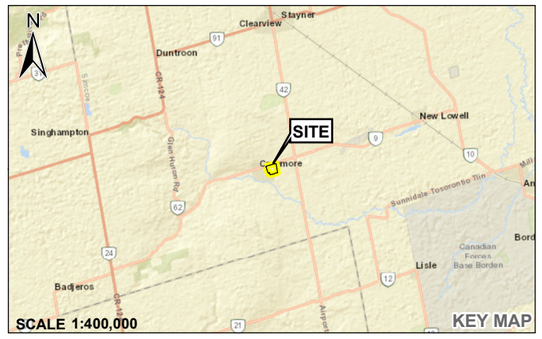
LEGEND

- APPROXIMATE BOREHOLE LOCATION
- APPROXIMATE MONITORING WELL LOCATION
- SITE BOUNDARY



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NOTE(S)

REFERENCE(S)

1. BASE PLAN PROVIDED BY CELESTE PHILLIPS, DATED DECEMBER 3, 2021.
2. BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
3. PROJECTION: TRANSVERSE MERCATOR NAD 1983 UTM ZONE 17

CLIENT
TRIBUTE CREEMORE LIMITED PARTNERSHIP

PROJECT
GEOTECHNICAL INVESTIGATION
CREEMORE PROPERTY, SOUTHEAST CORNER OF MARY STREET AND LOUISA STREET (COUNTY ROAD 9), CREEMORE, ONTARIO

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-03-28
DESIGNED	TO
PREPARED	JT
REVIEWED	TO
APPROVED	MAS

PROJECT NO.	CONTROL	REV.	FIGURE
22515950	0001	A	2

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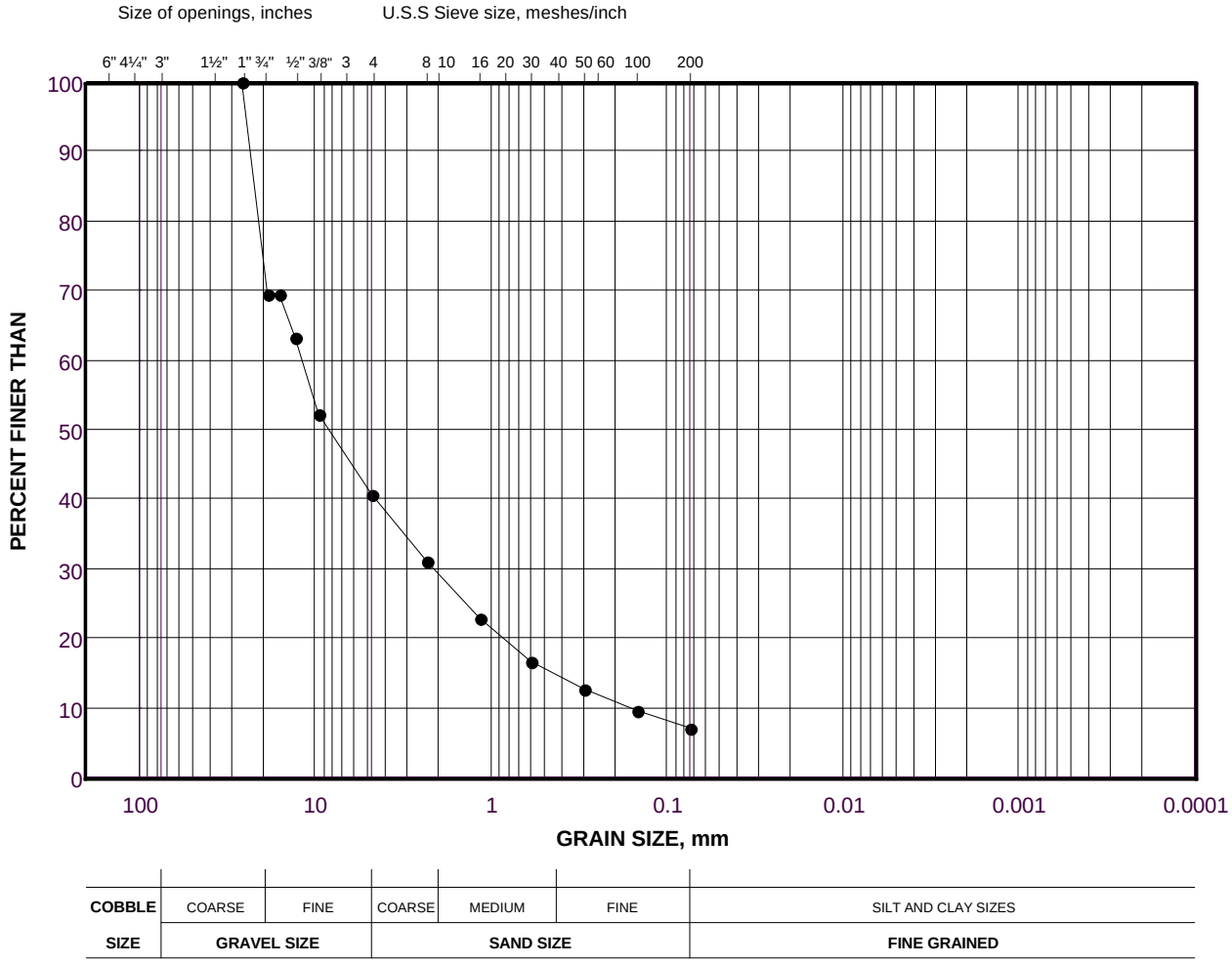
GRAIN SIZE DISTRIBUTION

(GP-GM) Sandy GRAVEL

FIGURE 3



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 22-6	3	1.8

Project Number: 22515950 (1000)

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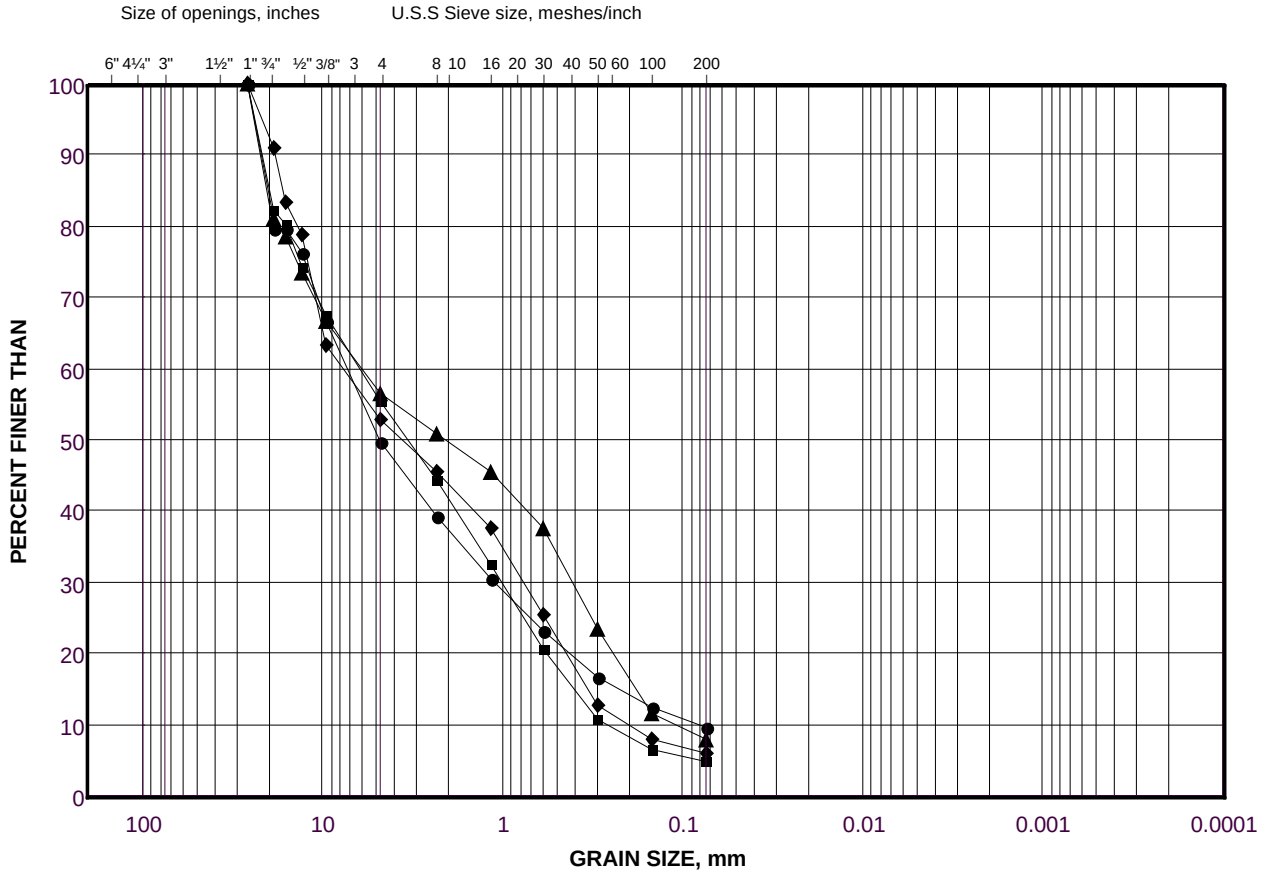
Golder Associates

Date: 17-Mar-22

GRAIN SIZE DISTRIBUTION

(SP-SM) to (SP) SAND and GRAVEL

FIGURE 4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 22-12	3	1.8
■	BH 22-2	5	3.3
◆	BH 22-10	6	4.8
▲	BH 22-11	7	6.4

Project Number: 22515950 (1000)

Checked By: TO

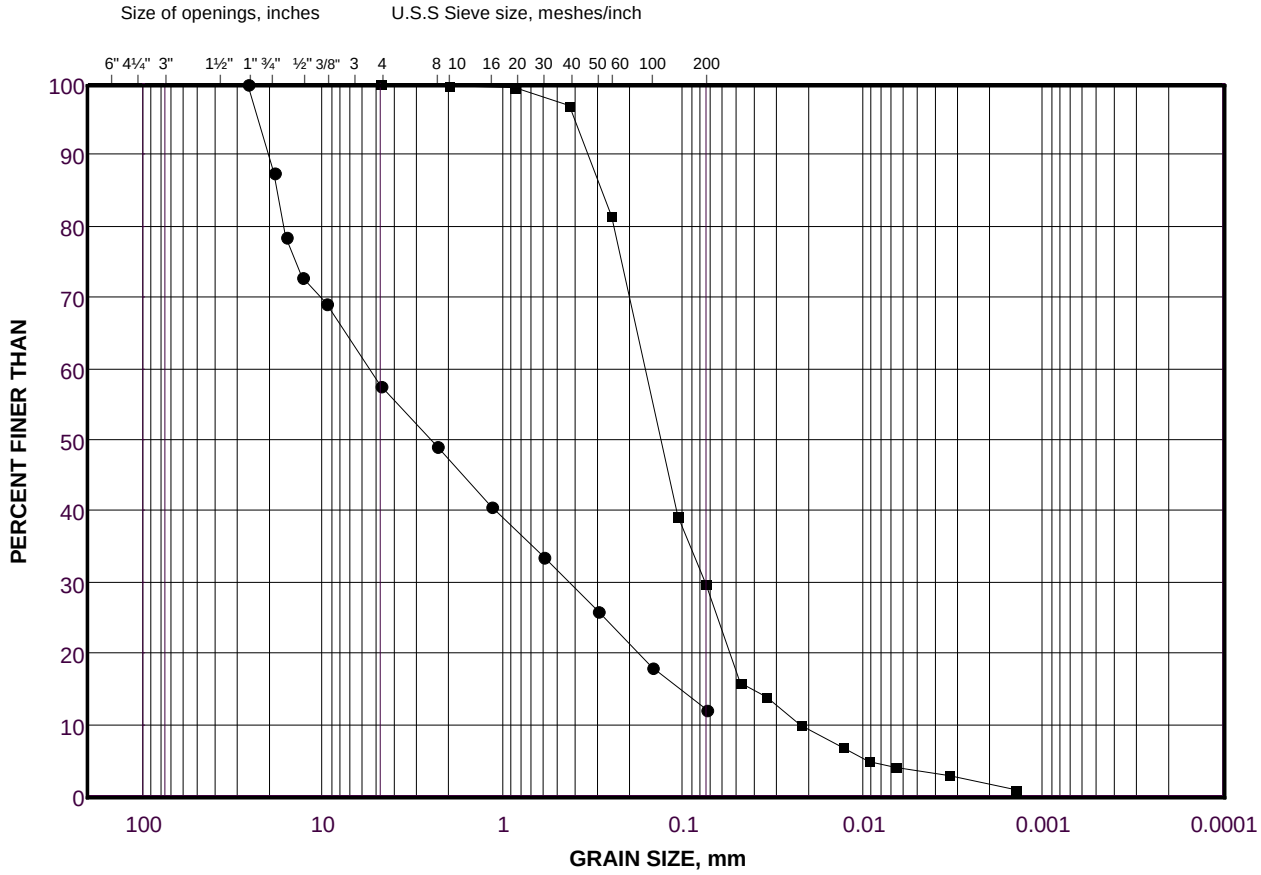
Golder Associates

Date: 17-Mar-22

GRAIN SIZE DISTRIBUTION

(SM) SILTY SAND to SILTY SAND and GRAVEL

FIGURE 5



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 22-8	4	2.6
■	BH 22-3	7	6.3

Project Number: 22515950 (1000)

Checked By: TO

Golder Associates

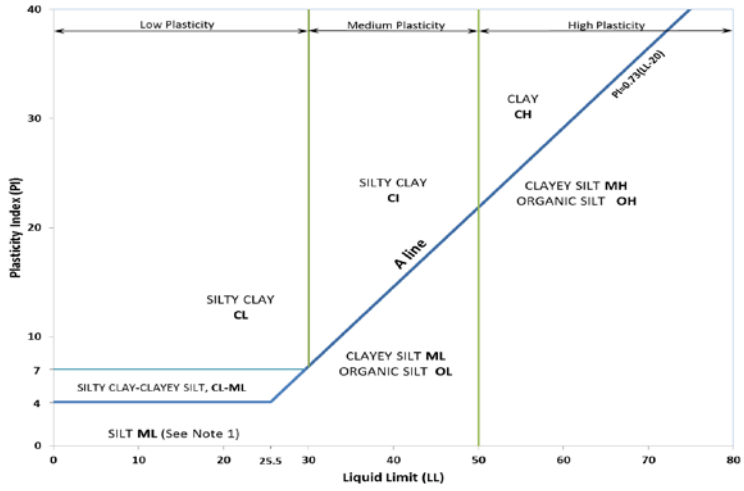
Date: 17-Mar-22

METHOD OF SOIL CLASSIFICATION

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

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

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



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

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

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

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

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

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

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

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

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

Cone Penetration Test (CPT)

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

Dynamic Cone Penetration Resistance (DCPT); N_d:

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

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

SAMPLES

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

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

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

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

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

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

Field Moisture Condition

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

COHESIVE SOILS

Consistency

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

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

Water Content

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

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

I. GENERAL

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

II. STRESS AND STRAIN

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

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

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

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

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

(c) Consolidation (one-dimensional)

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

(d) Shear Strength

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

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

PROJECT: 22515950

LOCATION: N 4909103.09; E 571626.05

RECORD OF BOREHOLE: 22-1

BORING DATE: February 17, 2022

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1	SS	8				Bentonite
		(SM) SILTY SAND and GRAVEL; brown; non-cohesive, moist, compact		0.68	2	SS	11				
1											March 14, 2022
					3	SS	19				Sand
2		- Auger grinding at 1.4 m									
		(GP) GRAVEL, trace sand, trace fines; grey and white, limestone fragments; non-cohesive, wet, compact		2.13	4	SS	25				
3		(SP) SAND and GRAVEL, trace fines; trace fines; brown; non-cohesive, wet, compact to dense		2.90	5	SS	22				
		- Auger grinding between 3.6 m and 4.2 m									
4											
					6	SS	28				Filter/Screen
5											
6											
					7	SS	36				
7		(ML) sandy SILT, slight plasticity; grey; non-cohesive, wet		7.09							
8					8	SS	17				
		END OF BOREHOLE		8.08							
9		NOTES: 1. Water was encountered at 2.3 mbgs during drilling. 2. Borehole was augered with mud support from 2.3 mbgs to reduce potential for sand heaving. 3. Groundwater level was measured in monitoring well at a depth of 1.1 mbgs on March 14, 2022.									
10											

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

GOLDER

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PROJECT: 22515950

LOCATION: N 4909084.00; E 571913.31

RECORD OF BOREHOLE: 22-2

BORING DATE: February 17, 2022

SHEET 1 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1A	SS	4				
		(SM) SILTY SAND; brown; non-cohesive, moist, loose		0.46	1B						
		(GP) sandy GRAVEL, trace fines; brown and grey, limestone fragments; non-cohesive, moist, compact		0.68	2	SS	22				
1					3	SS	22				
2		(SP) SAND and GRAVEL, trace fines; brown, limestone fragments; non-cohesive, wet, compact		2.13	4	SS	25				▽ February 22, 2022
3					5	SS	19			M	
4		(SP-SM) SAND, some fines; brown; non-cohesive, wet, loose to compact		4.04	6	SS	6				
5											
6					7	SS	2				
7											
8					8	SS	4				
9					9	SS	6				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

GOLDER

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PROJECT: 22515950

LOCATION: N 4909084.00; E 571913.31

RECORD OF BOREHOLE: 22-2

BORING DATE: February 17, 2022

SHEET 2 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
10	CME-55 Track Mount; 180 mm O.D. Hollow Stem Auger	(SP-SM) SAND, some fines; brown; non-cohesive, wet, loose to compact									
11					10	SS	19		W		
12					11	SS	9		W		
13		END OF BOREHOLE		12.65							
14		NOTES: 1. Water was encountered at 2.3 mbgs during drilling. 2. A 0.6m thick sand heave was encountered at 4.5 mbgs. Borehole was cleaned to 4.5 mbgs prior to sampling. 3. Borehole was augered using mud support from 4.5 m to final depth.									
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4909198.00; E 572148.00

RECORD OF BOREHOLE: 22-3

BORING DATE: February 22, 2022

SHEET 1 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE									
		TOPSOIL		0.00	1A				○		
		(SM) SILTY SAND, containing rootlets; brown; non-cohesive, moist to wet, very loose		0.20	1B	SS	2		○		
1					2	SS	2		○		Bentonite
					3A				○		
					3B	SS	2		○		March 14, 2022
2		- Gravelly between 2.1 m and 4.0 m									
		(SM) SILTY SAND and GRAVEL to SILTY SAND; brown; non-cohesive, wet, compact to very dense		2.13	4	SS	25		○		Sand
3		- gravelly between 2.1 m and 4.0 m - Silty clay layers between 3.1 m and 3.5 m			5	SS	20		○		
4											
					6	SS	14		○		Screen
5											
6					7	SS	21		○	MH	
7											
					8	SS	24		○		Bentonite
8											
9					9	SS	17		○		
10		*CONTINUED NEXT PAGE*									

CME-55 Track Mount

180 mm O.D. Hollow Stem Auger

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4909198.00; E 572148.00

RECORD OF BOREHOLE: 22-3

BORING DATE: February 22, 2022

SHEET 2 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
10	CME-55 Track Mount; 180 mm O.D. Hollow Stem Auger	(SM) SILTY SAND and GRAVEL to SILTY SAND; brown; non-cohesive, wet, compact to very dense									
11					10	SS	18				
12											Bentonite
13					11	SS	36				
		- Rock fragments between 13.7 m and 13.8 m			12	SS	50/0.10				
14		END OF BOREHOLE		13.82							
15		NOTES: 1. Water was encountered at 1.8 mbgs during drilling. 2. Borehole caved at 7.0 mbgs upon completion of drilling. 3. Groundwater level was measured in monitoring well at 1.8 mbgs on March 14, 2022.									
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

PROJECT: 22515950

LOCATION: N 4908956.00; E 571888.00

RECORD OF BOREHOLE: 22-4

BORING DATE: February 28, 2022

SHEET 1 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00							
		(SM) gravelly SILTY SAND; brown; non-cohesive, wet, loose		0.30	1	SS	6		○		
		(GP-GM) sandy GRAVEL, some fines; brown; non-cohesive, moist		0.68	2	SS	48		○		
1		- Auger grinding between 0.8 m and 2.3 m			3	SS	49		○		
2		(GP) GRAVEL, some fines; grey, limestone fragments; non-cohesive, wet, very dense to dense		2.13	4	SS	59		○		Bentonite
3		- Auger grinding between 2.1 m and 2.4 m			5	SS	45		○		
4		- Auger grinding between 4.1 m to 4.3 m									
		(GP-GM) sandy GRAVEL, some fines; brown; non-cohesive, wet, dense		4.04	6A				○		Sand
5		(SM) SILTY SAND; brown; non-cohesive, wet, dense to compact		4.88	6B	SS	35		○		
6					7	SS	33		○		Screen
7											March 14, 2022
8					8	SS	22		○		Sand
		END OF BOREHOLE		8.08							
9		NOTES: 1. Water was encountered at 2.3 mbgs during drilling. 2. Borehole was augered with mud support from 2.3 mbgs to final depth.									
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908956.00; E 571888.00

RECORD OF BOREHOLE: 22-4

BORING DATE: February 28, 2022

SHEET 2 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		3. A 0.3m thick sand heave was observed at 7.3 mbgs prior to well installation. 4. Groundwater level was measured in monitoring well at 7.0 mbgs on March 14, 2022.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4909073.00; E 572171.00

RECORD OF BOREHOLE: 22-5

BORING DATE: February 22, 2022

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, 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) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE									
0	CME-55 Track Mount 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00							
		(CL) SILTY CLAY, trace sand; brown; cohesive, w>PL, firm		0.30	1	SS	4				
		(SM) gravelly SILTY SAND; brown, rock fragments; non-cohesive, moist, loose to dense		0.68	2	SS	7				
1					3	SS	42				
2		(SP-SM) SAND, some fines; brown; non-cohesive, wet, very dense		2.13	4	SS	64				
		(SM) SILTY SAND; brown; non-cohesive, wet, loose to very dense - Gravel between 3.1 m and 3.5 m		2.90	5	SS	19				
3											
4											
5					6	SS	8				
6											
7					7	SS	52				
8					8	SS	34				
		END OF BOREHOLE		8.08							
9		NOTES: 1. Groundwater level was measured at 1.8 mbgs upon completion of drilling. 2. Borehole was augered under mud support from 1.8 m to final depth.									
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908841.00; E 571835.00

RECORD OF BOREHOLE: 22-6

BORING DATE: February 28, 2022

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, 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) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount, 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00							
		(SM) SILTY SAND, trace gravel; brown; non-cohesive, moist, loose		0.30	1	SS	4				
1		(GP-GM) sandy GRAVEL, some fines; brown; non-cohesive, moist, dense		0.68	2	SS	37				
					3	SS	37			M	▽ February 28, 2022
2		(GP) GRAVEL, trace sand, some fines; brown and grey; non-cohesive, wet, dense		2.13	4	SS	35				
3		(GP-GM) sandy GRAVEL, some fines; brown; non-cohesive, wet, compact		2.90	5A						
		(SM) SILTY SAND, trace gravel; brown; non-cohesive, wet, compact - Auger grinding between 3.4 m and 4.0 m		3.35	5B	SS	29				
4		(GP-GM) sandy GRAVEL, some fines; brown; non-cohesive, wet, dense		4.04	6	SS	40				
5											
6		(SP-SM) gravelly SAND, some fines; brown; non-cohesive, wet, compact - Auger grinding from 6.4 m to 7.6 m		5.60	7	SS	14				
7											
		(SM) SILTY SAND; brown; non-cohesive, moist, compact		7.62	8	SS	23				
8		END OF BOREHOLE		8.08							
9		NOTES: 1. Water was encountered at 2.3 mbgs during drilling. 2. Borehole was augered under mud support from 2.3 m to final depth. 3. Groundwater level was measured at 1.8 mbgs upon completion of drilling.									
10											

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

GOLDER

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PROJECT: 22515950

LOCATION: N 4908814.00; E 572169.00

RECORD OF BOREHOLE: 22-7

BORING DATE: February 28, 2022

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. +, 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) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount; 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1	SS	10				
		(SM) SILTY SAND and GRAVEL; brown, limestone fragments; non-cohesive, moist to wet, very dense		0.68							
1		- Auger grinding between 1.5 m and 2.1 m			2	SS	65				
					3	SS	53				February 28, 2022 ▽
2					4	SS	64				
3		(GP) sandy SILTY GRAVEL; brown and grey, limestone fragments; non-cohesive, wet, dense		2.90	5	SS	34				
		- Auger grinding between 3.1 m and 4.3 m									
4		(SM) SILTY SAND; grey; non-cohesive, wet, dense to compact		3.96	6	SS	37				
5											
6					7	SS	30				
7											
8					8	SS	26				
		END OF BOREHOLE		8.08							
9		NOTES: 1. Water encountered at 2.3 mbgs during drilling. 2. Groundwater level was measured at 1.5 mbgs upon completion of drilling. 3. Borehole was augered using mud support from 2.3 m to final depth.									
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908615.00; E 572015.00

RECORD OF BOREHOLE: 22-8

BORING DATE: February 25, 2022

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, 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) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00							
		(SM) SILTY SAND and GRAVEL; brown, rock fragments; non-cohesive, moist to wet, dense to very dense		0.30	1	SS	5				
1					2	SS	42				
		- Auger grinding between 1.5 m and 2.3 m			3	SS	65				
2					4	SS	44			M	
		- Auger grinding between 3.1 m and 3.7 m			5	SS	41				▽ February 28, 2022
4		(SP-SM) gravelly SAND, some fines; brown; non-cohesive, wet, compact		4.04	6	SS	20				
5											
		(SM) SILTY SAND; brown; non-cohesive, wet, compact		5.56	7	SS	12				
6											
7											
8					8	SS	18				
		END OF BOREHOLE		8.08							
9		NOTES: 1. Water encountered at 3.0 mbgs during drilling. 2. Borehole caved at 1.5 mbgs upon completion of drilling.									
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908627.40; E 572109.71

RECORD OF BOREHOLE: 22-9

BORING DATE: February 24, 2022

SHEET 1 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1	SS	12				
		(SM) SILTY SAND and GRAVEL, rock fragments; brown; non-cohesive, moist, very dense to dense		0.46							
1		- Auger grinding between 0.6 m and 1.5 m			2	SS	64				▽ February 24, 2022
					3	SS	46				
2		- Auger grinding at 1.8 m									
		(GP) sandy GRAVEL, some fines; brown, rock fragments; non-cohesive, wet, compact to dense		2.13	4	SS	27				
3					5	SS	46				
4		(SM) SILTY SAND; brown; non-cohesive, wet, loose to dense		4.04							
					6	SS	8				
5											
6					7	SS	16				
7											
8					8	SS	32				
9											
					9	SS	13				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

WSP GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908627.40; E 572109.71

RECORD OF BOREHOLE: 22-9

BORING DATE: February 24, 2022

SHEET 2 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	CME-55 Track Mount	(SM) SILTY SAND; brown; non-cohesive, wet, loose to dense			10	SS	22		W		
11		END OF BOREHOLE		11.13							
		NOTES:									
		1. Water encountered at 2.3 mbgs during drilling.									
12		2. Borehole was augered using mud support from 4.0 m to final depth.									
		3. Borehole caved at 4.0 mbgs upon completion of drilling.									
		4. Groundwater level was measured at 1.2 mbgs upon completion of drilling.									
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908805.00; E 572107.75

RECORD OF BOREHOLE: 22-10

BORING DATE: February 25, 2022

SHEET 1 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1	SS	7				
		(SM) SILTY SAND and GRAVEL; brown, rock fragments; non-cohesive, moist, dense to compact		0.46							
1		- Auger grinding at 0.61 m			2	SS	31				March 14, 2022
		- Auger grinding between 0.9 m and 1.5 m			3	SS	27				
2		(SP-SM) SAND and GRAVEL, some fines; brown; non-cohesive, wet, compact to dense		2.13	4	SS	17				Bentonite
3					5	SS	20				
4		- Gravelly between 4.6 m and 6.6 m			6	SS	14			M	Sand
5											
6					7	SS	18				Screen
7		(SM) SILTY SAND; brown; non-cohesive, wet, compact to dense		7.09							
8					8	SS	19				Sand
9					9	SS	34				
		END OF BOREHOLE		9.60							
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908805.00; E 572107.75

RECORD OF BOREHOLE: 22-10

BORING DATE: February 25, 2022

SHEET 2 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, 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) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		NOTES: 1. Water was encountered at 2.3 mbgs during drilling. 2. Borehole was augered with mud support from 7.8 mbgs to reduce potential for sand heaving. 3. Groundwater level was measured in monitoring well at a depth of 1.1 mbgs on March 14, 2022.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908774.00; E 572256.00

RECORD OF BOREHOLE: 22-11

BORING DATE: February 25, 2022

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, 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) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount; 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1	SS	8				
		(SM) SILTY SAND and GRAVEL; brown; non-cohesive, moist, compact		0.68	2	SS	18				
1		- Auger grinding between 1.2 m and 1.4 m									
		(GP-GM) sandy GRAVEL, some fines; brown, rock fragments; non-cohesive, wet, compact to dense		1.45	3	SS	21				
2		- Auger grinding between 1.4 m and 2.1 m			4	SS	33				
3					5	SS	32				
4		- Auger grinding between 4.9 m and 5.8 m									
					6	SS	23				
5											
		(SP-SM) SAND and GRAVEL, some fines; brown; non-cohesive, wet, compact to dense		5.56							
6					7	SS	25			M	
7											
					8	SS	41				
8		END OF BOREHOLE		8.08							
9		NOTES: 1. Water encountered at 2.3 mbgs during drilling. 2. Borehole caved at 0.9 mbgs upon completion of drilling. 3. Borehole was augerd using mud support from 2.3 m to final depth.									
10											

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

GOLDER

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PROJECT: 22515950

LOCATION: N 4908656.00; E 572213.00

RECORD OF BOREHOLE: 22-12

BORING DATE: February 24, 2022

SHEET 1 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, 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) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount; 180 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1A						
		(SP-SM) SAND and GRAVEL, some fines; brown, rock fragments; non-cohesive, moist to wet, compact to very dense		0.30	1B	SS	22				
1		- Auger grinding between 0.6 m and 1.5 m			2	SS	40				
					3	SS	73			M	
2					4	SS	51				March 14, 2022
											Bentonite
3		- Auger grinding between 3.1 m, 3.7 m and 4.3 m			5	SS	37				
4											
					6	SS	30				
5											Sand
		(SM) SILTY SAND; brown; non-cohesive, wet, compact to dense		5.56							
6					7	SS	27				
7											Screen
					8	SS	36				
8											
9					9	SS	37				Sand
		END OF BOREHOLE		9.60							
10		NOTES:									
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

WSP GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4908656.00; E 572213.00

RECORD OF BOREHOLE: 22-12

BORING DATE: February 24, 2022

SHEET 2 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		1. Water encountered at 2.3 mbgs during drilling. 2. Borehole was augered using mud support from 2.3 m to final depth. 3. Borehole caved at 8.8 mbgs upon completion of drilling. 4. Groundwater level was measured at 2.3 mbgs upon completion of drilling. 5. Groundwater level was measured in monitoring well at 1.4 mbgs on March 14, 2022.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4909241.00; E 572203.00

RECORD OF BOREHOLE: 22-13

BORING DATE: February 22, 2022

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected (100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ ND = Not Detected (100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount; 150 mm O.D. Hollow Stem Auger	TOPSOIL		0.00	1	AS		ND			
1		(SM) SILTY SAND; brown to light brown; non-cohesive, moist		0.76							Bentonite
2											
3					2	AS		ND			Sand
4					3	AS		ND			
5					4	AS		ND			Screen
6		END OF BOREHOLE		6.10							
7		NOTES: 1. Borehole was open and dry upon completion. 2. Borehole was dry on March 14, 2022.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

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PROJECT: 22515950

LOCATION: N 4909232.00; E 572217.00

RECORD OF BOREHOLE: 22-14

BORING DATE:

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected (100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ ND = Not Detected (100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	CME-55 Track Mount; 150 mm O.D. Hollow Stem Auger	TOPSOIL		0.00							
		(SM) SILTY SAND; brown to light brown; non-cohesive, moist to wet		0.41	1	AS		ND	○		Bentonite
1											Sand
2											
3					2	AS		ND	○		Screen
4		- Wet at 4.6 m			3	AS		ND	○		
					4	AS		ND	○		
5											Bentonite
		END OF BOREHOLE		5.18							
6		NOTES:									
		1. Water was encountered at 4.6 mbgs during drilling.									
7		2. Borehole was dry on March 14, 2022.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: AS

CHECKED: TO

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APPENDIX A

Important Information and Limitations of This Report

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 practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

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

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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 can not be responsible for use of portions of the report without reference to the entire report.

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

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, 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.

APPENDIX B

Record of Boreholes (21-1 to 21-6)

Laboratory Testing Results of Previous Investigation

PROJECT: 21468209

RECORD OF BOREHOLE: 21-1

SHEET 1 OF 2

LOCATION: See Figure 2

BORING DATE: June 2, 2021

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Power Augers, 200 mm O.D. Hollow Stem Augers	TOPSOIL		0.00	1A						
		(SP-SM) gravelly SAND, some fines; brown; non-cohesive, moist, compact		0.15	1B	SS	26				
1					2	SS	24		○		
		- Auger grinding between depths of 1.5 m and 2.7 m			3	SS	17		○		
2		- Auger grinding between depths of 2.1 m and 3.1 m									
		(GP-GM) GRAVEL and SAND, some fines; brown and grey; non-cohesive, wet, compact		2.13	4	SS	16		○	MH	
3					5	SS	27				
4		(CL) SILTY CLAY, trace sand; brown; cohesive, w~PL, hard		4.04	6A						
		(SM) SILTY SAND, some gravel; brown; non-cohesive, wet, dense to compact		4.88	6B	SS	40				
5											
6		- Auger grinding at a depth of 6.1 m			7A	SS	16				
		(CL) SILTY CLAY, trace sand; brown; cohesive, w~PL, stiff		6.50	7B						
7											
		(SM) SILTY fine SAND, brown; non-cohesive, wet, compact		7.65	8A				○		
8					8B	SS	12				
		- Containing thin layers of clayey silt									
9					9	SS	26				
		END OF BOREHOLE		9.60							
10		NOTES:									
		CONTINUED NEXT PAGE									

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DEPTH SCALE

1 : 50

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CHECKED: TO

PROJECT: 21468209

RECORD OF BOREHOLE: 21-1

SHEET 2 OF 2

LOCATION: See Figure 2

BORING DATE: June 2, 2021

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		1. Water encountered at a depth of 2.3 m during drilling. 2. Water was added at a depth of 4.6 m to support drilling. 3. Borehole caved to a depth of 2.4 m upon completion of drilling.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AM

CHECKED: TO

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PROJECT: 21468209

LOCATION: See Figure 2

RECORD OF BOREHOLE: 21-2

BORING DATE: June 2, 2021

SHEET 1 OF 1

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Power Augers, 200 mm O.D. Hollow Stem Augers	TOPSOIL		0.00	1	SS	4				50 mm Dia. Monitoring Well
		(SM) SILTY SAND, brown; non-cohesive, moist, loose		0.61	2	SS	9				
1		(SP-SM) gravelly SAND, some fines; brown; non-cohesive, moist to wet, very dense to compact		1.37	3	SS	46				
		- Auger grinding between depths of 1.5 m and 2.4 m									Bentonite
2					4A	SS	17				June 16, 2021
		(SM) SILTY SAND, trace gravel; brown; non-cohesive, moist to wet, loose to compact		2.44	4B						
3					5	SS	8				
		- Contains thin clayey silt layers between 3.1 m and 5.0 m									
4											
					6	SS	7				Sand
5											
6											
					7	SS	15				Screen and Sand
7											
					8	SS	37				Cave
8		END OF BOREHOLE		8.08							
		NOTES:									
		1. Water encountered at a depth of 1.5 m during drilling.									
9		2. Groundwater level was measured in monitoring well at 2.0 mbgs on June 16, 2021									
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AM

CHECKED: TO

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PROJECT: 21468209

RECORD OF BOREHOLE: 21-3

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: June 2, 2021

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Power Augers, 200 mm O.D. Hollow Stem Augers	TOPSOIL		0.00	1	SS	13				
		(GM) sandy SILTY GRAVEL, brown; non-cohesive, moist, dense to very dense		0.61	2	SS	45		○		
1		- Auger grinding between depths of 1.5 m and 2.0 m			3	SS	50/0.13		○		
		(GP-GM) GRAVEL and SAND, some fines; brown; rock fragments; non-cohesive, wet, very dense		1.83							
2		- Auger grinding between depths of 2.3 m and 2.7 m			4	SS	66		○		
		(SM) gravelly SILTY SAND, brown; non-cohesive, wet, very dense to dense		2.90	5	SS	52		○		
3											
4		- Auger grinding between depths of 2.9 m and 5.0 m									
					6	SS	34		○		
5											
		(CL) sandy SILTY CLAY, some gravel; brown; cohesive, w~PL, very stiff		5.56							
6					7	SS	25		⊕———	MH	
7		(SM) SILTY SAND, trace gravel; brown; non-cohesive, wet, compact		7.09							
					8	SS	18		○		
8		END OF BOREHOLE		8.23							
		NOTES:									
9		1. Water encountered at a depth of 2.3 m during drilling.									
		2. Water measured in open borehole at a depth of 2.1 m upon completion of drilling.									
10		3. Borehole caved to a depth of 2.6 m upon completion of drilling.									

DEPTH SCALE

1 : 50

GOLDER
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CHECKED: TO

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PROJECT: 21468209

LOCATION: See Figure 2

RECORD OF BOREHOLE: 21-4

BORING DATE: June 1 to 2, 2021

SHEET 1 OF 2

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Power Augers; 200 mm O.D. Hollow Stem Augers	TOPSOIL		0.00	1A	SS	7				50 mm Dia. Monitoring Well
		(SM) gravelly SILTY SAND, brown; non-cohesive, wet, compact		0.56	1B						
1					2	SS	25		○		
		(GP-GM) GRAVEL and SAND, some fines; brown; non-cohesive, wet, dense to compact		1.37							
2					3	SS	33		○		▽ June 16, 2021
					4	SS	24		○		
3		(SM) gravelly SILTY SAND, brown; non-cohesive, wet, dense		2.90	5	SS	32		○		Bentonite
4		(SP-SM) SAND, some fines; brown; non-cohesive, wet, very loose to dense		4.04	6	SS	3		○		
5											
6					7	SS	31		○		
7											Sand
					8	SS	9		○		
8											Screen and Sand
9					9	SS	22		○		
		END OF BOREHOLE		9.60							
10		NOTES:									
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AM

CHECKED: TO

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PROJECT: 21468209

RECORD OF BOREHOLE: 21-4

SHEET 2 OF 2

LOCATION: See Figure 2

BORING DATE: June 1 to 2, 2021

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		1. Water encountered at a depth of 2.3 m during drilling. 2. Sand blow back was observed at a depth of 7.6 m. Blow back was flushed out with water prior to taking SPT. 3. Groundwater level was measured in monitoring well at 2.1 mbgs on June 16, 2021									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AM

CHECKED: TO

PROJECT: 21468209

RECORD OF BOREHOLE: 21-5

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: June 1, 2021

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Power Augers 200 mm O.D. Hollow Stem Augers	REWORKED NATIVE - (SM) SILTY SAND and GRAVEL, brown, trace rootlets, rock fragments; non-cohesive, moist, loose to compact		0.00	1	SS	14		○		50 mm Dia. Monitoring Well
1					2	SS	12		○		
		(GP-GM) GRAVEL and SAND, some fines; brown; non-cohesive, moist to wet, very dense to dense		1.37	3	SS	65		○		
2		- Auger grinding between depths of 1.4 m and 4.0 m			4	SS	37		○		Bentonite ▽ June 16, 2021
3					5	SS	76		○		
4		(SM) SILTY SAND, trace gravel; brown; non-cohesive, wet, compact		4.04	6	SS	20		○		
5											Sand
		(SP-SM) SAND, some fines; brown; non-cohesive, wet, compact to dense		5.60	7	SS	16		○		
6											Screen and Sand
7											
8					8	SS	36		○	M	
		END OF BOREHOLE		8.08							
9		NOTES: 1. Water encountered at a depth of 2.3 m during drilling. 2. Borehole caved to a depth of 7.3 m upon completion of drilling. 3. Groundwater level was measured in monitoring well at 2.7 mbgs on June 16, 2021									
10											

DEPTH SCALE

1 : 50

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LOGGED: AM

CHECKED: TO

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PROJECT: 21468209

RECORD OF BOREHOLE: 21-6

SHEET 1 OF 1

LOCATION: See Figure 2

BORING DATE: June 1, 2021

DATUM: -

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE									
0	Power Augers; 200 mm O.D. Hollow Stem Augers	TOPSOIL		0.00	1A	SS	60				50 mm Dia. Monitoring Well
		(GP) GRAVEL, grey; non-cohesive, moist, very dense		0.20	1B						
		(SM) SILTY SAND and GRAVEL; brown; non-cohesive, moist to wet, very dense to dense		0.61	2	SS	65		○		
		- Auger grinding between depths of 1.5 m and 5.0 m			3	SS	88/ 0.25		○		Bentonite
											June 16, 2021
					4	SS	32		○		
					5	SS	58		○		Sand
					6	SS	48		○		
		(CL) sandy SILTY CLAY, trace gravel; brown; cohesive, w>PL, hard		5.56							Screen and Sand
					7	SS	45		○		Sand
		- Inferred cobble/boulder between 6.5 m and 6.6 m		6.55							
		END OF BOREHOLE									

NOTES:

1. Water encountered at a depth of 2.3 m during drilling.

2. Water was added in borehole at 4.6 m to support drilling.

3. Groundwater level was measured in monitoring well at 2.0 mbgs on June 16, 2021.

DEPTH SCALE

1 : 50

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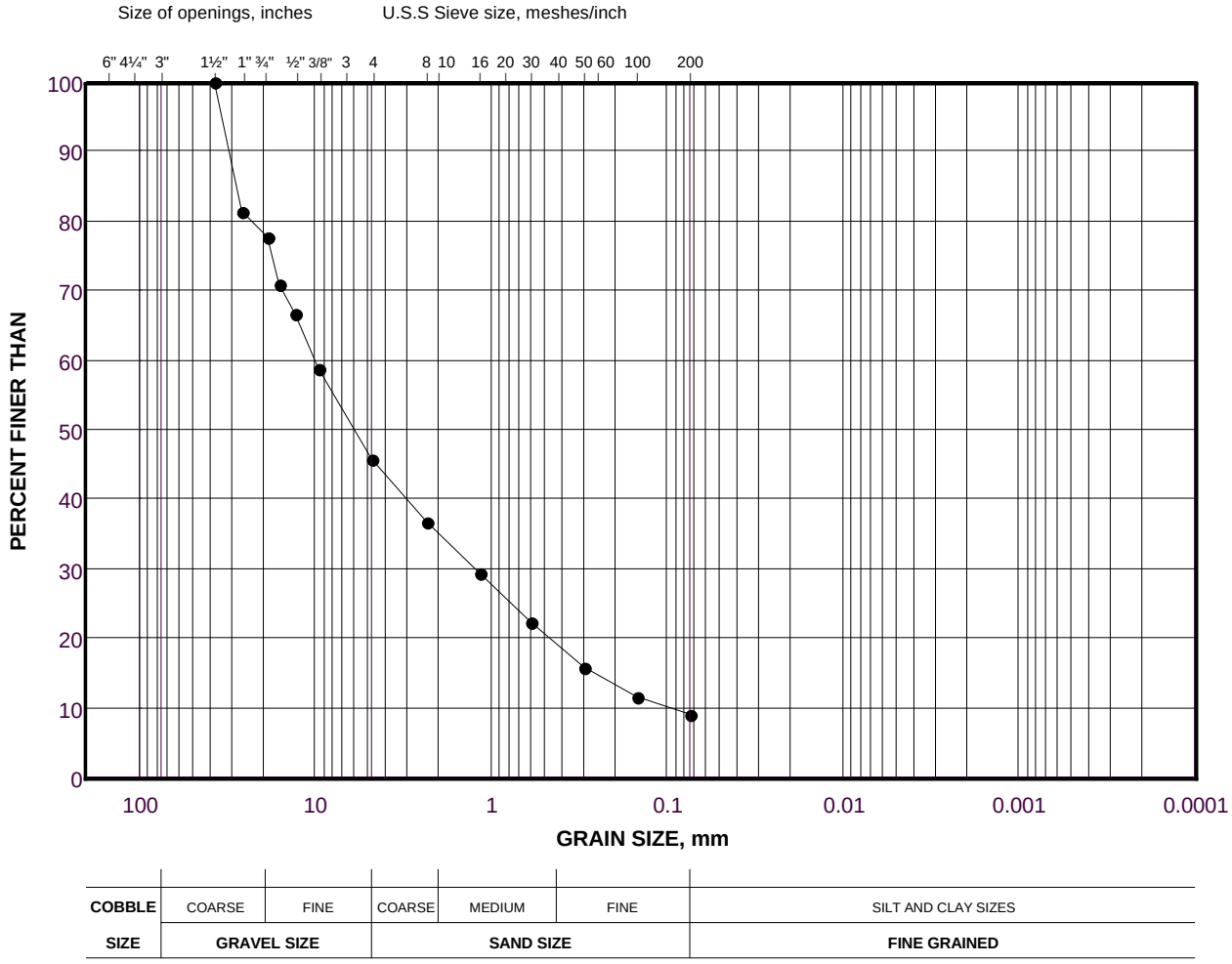
GRAIN SIZE DISTRIBUTION

(GP-GM) GRAVEL and SAND

FIGURE 3



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	21-1	4	2.6

Project Number: 21468209 (2000)

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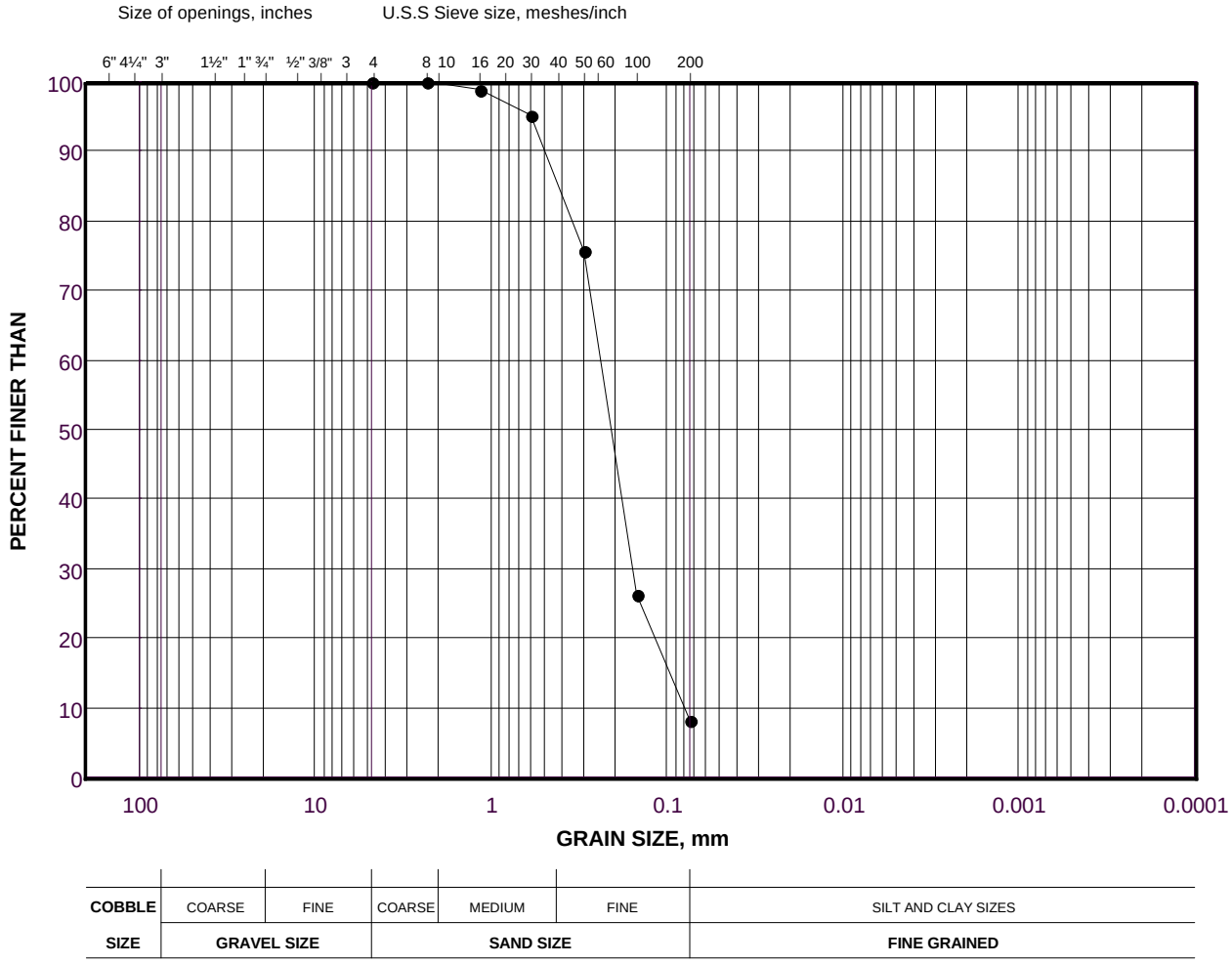
Golder Associates

Date: 18-Jun-21

GRAIN SIZE DISTRIBUTION

(SP-SM) SAND

FIGURE 4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	21-5	8	7.8

Project Number: 21468209 (2000)

Checked By: TO

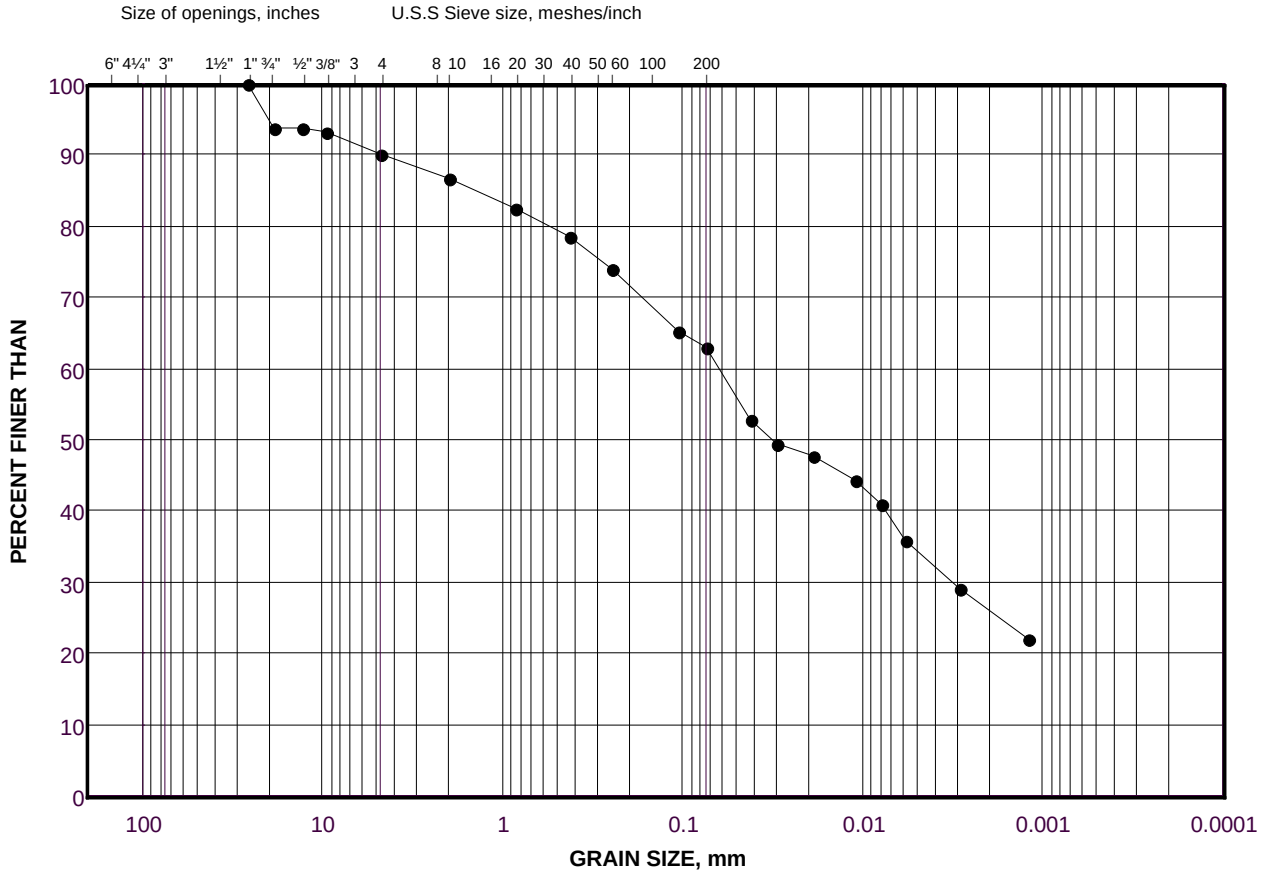
Golder Associates

Date: 18-Jun-21

GRAIN SIZE DISTRIBUTION

(CL) sandy SILTY CLAY

FIGURE 5



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	21-3	7	6.4

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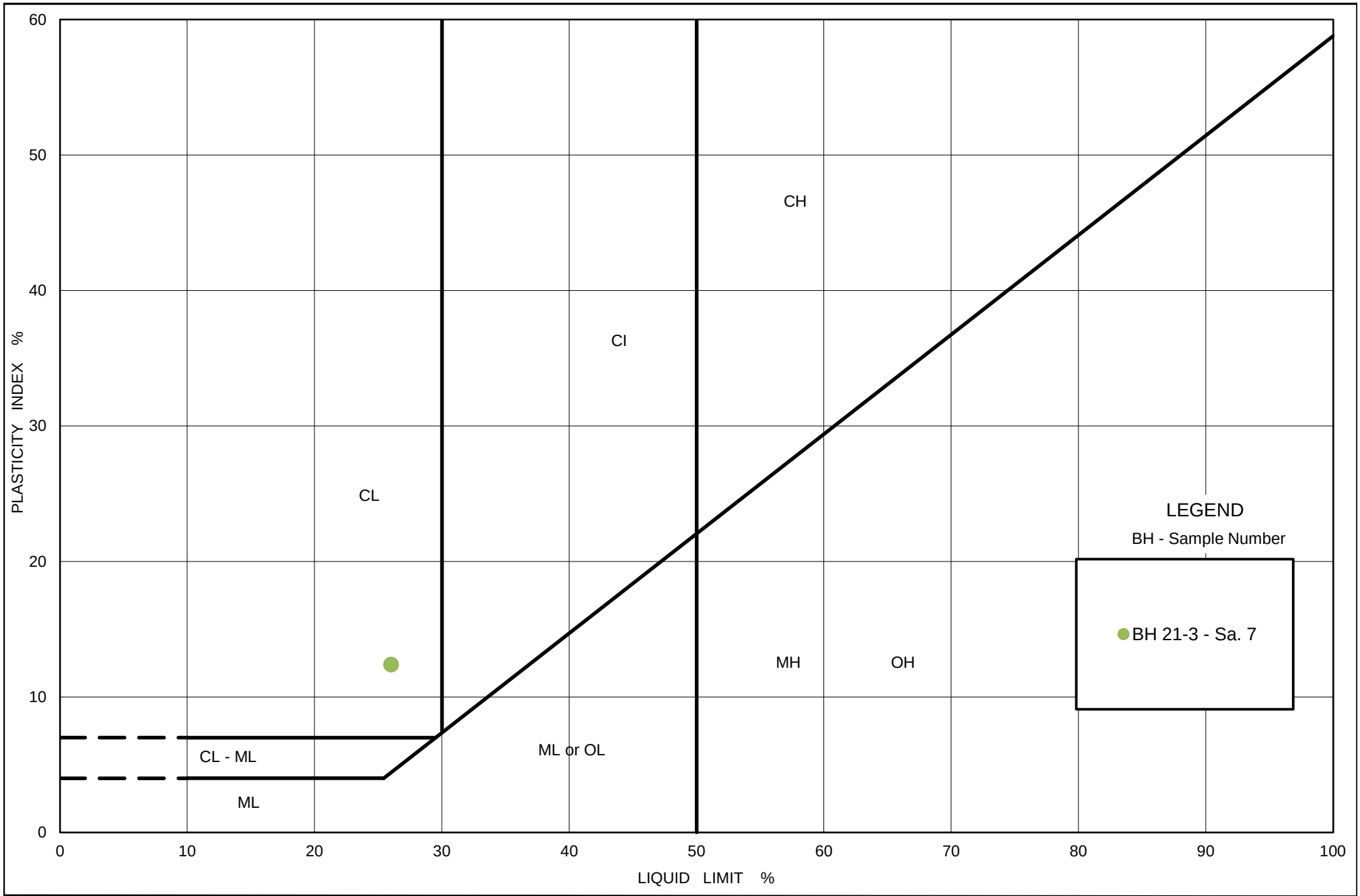
Golder Associates

Date: 18-Jun-21

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

(CL) sandy SILTY CLAY

Figure No.: 6

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