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Geotechnical Investigation
Proposed Residential Development
141 Peter Street
Ottawa, Ontario

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Submitted to:

Caivan (Perth GC) Limited
2934 Baseline Road, Suite 302
Ottawa, Ontario
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Geotechnical Investigation
Proposed Residential Development
141 Peter Street
Ottawa, Ontario

February 3, 2023
Project: 100737.002

experience • knowledge • integrity

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February 3, 2023 File: 100737.002

Caivan (Perth GC) Limited
2934 Baseline Road, Suite 302
Ottawa, Ontario
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Attention: Hugo Lalonde – Director, Land Development

Re: Geotechnical Investigation
Proposed Residential Development
141 Peter Street
Perth, Ontario

Enclosed is our geotechnical investigation report for the above noted project, in accordance with our proposal dated April 12, 2021. This report was prepared by Alex Meacoe, P.Eng. and reviewed by Brent Wiebe, P.Eng.

Alex Meacoe, P.Eng.

Brent Wiebe, P.Eng.

WAM/BC/BW

Enclosures
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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed residential development located at 141 Peter Street in Perth, Ontario. The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of boreholes and, based on the factual information obtained, to provide preliminary engineering guidelines on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

2.0 PROJECT DESCRIPTION AND SITE GEOLOGY

2.1 Project Description

Plans are being prepared for a new residential development at the Perth Golf Course located at 141 Peter Street, and a new sanitary sewer connecting the new development to the existing Cockburn Pumping Station located on Big Ben Trail or possibly connecting to the existing sanitary sewer on Rogers Road, south of South Street in Perth, Ontario

The following is known about the site and project:

- The site is located south of the Tay River and west of Peter Street in Perth, Ontario;
- The site is currently a recreational development (the Perth Golf Club); and,
- Based on the plans provided by Caivan Communities, the proposed development will consist of single detached houses, townhouses, stormwater management ponds, a new pumping station, and new community parks.

GEMTEC completed previous geotechnical investigations at this site for Jp2g Consultants Inc. and Caivan Communities. The results are provided in the following reports:

- Report to Jp2g Consultants Inc. titled “Preliminary Geotechnical Investigation, Proposed Residential Development, Perth West Annex, Perth, Ontario” dated July 24, 2019 (Project No. 63988.75).
- Report to Caivan Communities titled “Preliminary Geotechnical Investigation, Proposed Residential Development, Perth West Annex, 141 Peter Street, Perth, Ontario” dated May 21, 2021 (Project No. 100737.001).

2.2 Site Geology

A review of surficial geology maps, and previous geotechnical investigations at the location of the proposed development and along the proposed sanitary sewer alignment indicate that the site is underlain by organic deposits over shallow bedrock. Bedrock geology maps in the area of the site indicate the overburden is underlain by Precambrian bedrock at depths ranging from about

0 to 3 metres. Several areas of outcropping bedrock were observed within the proposed development during the previous investigation.

3.0 METHODOLOGY

3.1 Geotechnical Investigation

The fieldwork for this investigation was carried out between January 4 and February 2, March 15 and 25, and October 5 and 6, 2022. During those time periods, 37 boreholes (numbered 22-201, 22-202, 22-203, 22-203A, 22-205 to 22-214, 22-214A, 22-214B, 22-215, 22-216, 22-218, 22-219, 22-220, 22-221, 22-221A, 22-222, 22-222A, 22-223, 22-224, 22-225, 22-225A, 22-226, 22-227, 22-228, 22-228A, 22-229, and 22-230, 22-233A, 22-233B, 22-234, and 22-235) and three probeholes (numbered 22-106, 22-107, and 22-108) were advanced at the site for the proposed development, and four boreholes were advanced for installation of monitoring wells within the wetlands (boreholes 22-231, 22-231A, 22-232, and 22-232A). Boreholes 22-204 and 22-217 and probehole 22-105 were deleted from the initially planned program.

Details on the boreholes are provided below.

- The boreholes were advanced, within the overburden, to depths ranging from about 0.3 to 8.0 metres below ground surface. Upon reaching practical auger refusal in boreholes 22-201, 22-203A, 22-208, 22-214, 22-216, 22-221, 22-222 to 22-225, and 22-228, the boreholes were then advanced into the bedrock using rotary diamond drilling techniques while retrieving HQ sized bedrock core. These boreholes were advanced to total depths ranging from about 5.8 to 12.3 metres below ground surface.
- Boreholes 22-214A, 22-214B, 22-221A, 22-225A, and 22-228A were advanced adjacent to boreholes 22-214, 22-221, 22-225, and 22-228, respectively, for the installation of monitoring wells.
- Boreholes 22-233A, 22-233B, 22-234, and 22-235 were advanced, without sampling, using hollow stem augers and tricone advancement, to depths ranging from about 2.9 to 6.9 metres for the installation of monitoring wells.
- Boreholes 22-231, 22-231A, 22-232, and 22-232A were advanced in the wetlands to install monitoring wells. The boreholes were advanced using portable drilling equipment. The boreholes were advanced to depths ranging from about 1.6 to 7.1 metres below the ground surface. Upon reaching the bedrock surface in boreholes 22-231A and 22-232A were advanced into the bedrock using rotary diamond drilling techniques while retrieving NQ sized bedrock core. The coring in boreholes 22-231A and 22-232A was advanced to total depths of about 10.4 and 4.7 metres below the existing ground surface, respectively.
- Probeholes 22-106, 22-107, and 22-108 were advanced, without sampling, to practical auger refusal at depths ranging from about 0.4 to 3.2 metres below ground surface.

The boreholes were advanced using a track mounted hollow stem auger drill rig or portable drilling equipment supplied and operated by CCC Geotechnical and Environmental Drilling of Ottawa, Ontario.

Standard penetration tests, where required, were carried out in the boreholes and samples of the soils encountered were recovered using a 50 millimetre diameter split barrel sampler.

Monitoring wells were installed in boreholes 22-201, 22-203A, 22-205, 22-208, 22-214, 22-214B, 22-216, 22-221, 22-221A, 22-222, 22-222A, 22-223, 22-224, 22-225, 22-225A, 22-228, 22-228A, 22-231, 22-231A, 22-232, 22-232A, 22-233B, 22-234, and 22-235 for subsequent measurement of the groundwater level and hydraulic conductivity testing.

One soil sample from each of boreholes 22-212 and 22-226 was sent to Paracel Laboratories Ltd. for basic chemical testing relating to corrosion of buried concrete and steel.

The fieldwork was supervised throughout by a member of our engineering staff who directed the drilling operations, logged the samples and carried out the in-situ testing. Following the fieldwork, the soil and bedrock samples were returned to our laboratory for examination by a geotechnical engineer. Selected samples of the soil were tested for water content, and grain size distribution testing. Select samples of the bedrock were tested for unconfined compressive strength testing.

The borehole locations were selected by GEMTEC and positioned on site relative to existing features. The ground surface elevations at the borehole locations were determined using precision GPS survey equipment. The elevations are referenced to geodetic datum NAD83 (CSRS) Epoch 2010, vertical network CGVD1928.

Descriptions of the subsurface conditions logged in the boreholes from the current investigation are provided on the Record of Borehole Sheets in Appendix A. The results of the laboratory tests are provided on the borehole logs and in Appendix B. Photographs of the bedrock core are provided in Appendix C. The test hole logs from the previous investigation are provided in Appendix D. The results of chemical testing completed on two soil samples related to corrosion potential are provided in Appendix E. The results of the hydraulic conductivity testing are provided in Appendix F. The approximate locations of the boreholes are shown on the Site Plan, Figure 1.

3.2 Preliminary Geotechnical Investigation

The fieldwork for the previous investigation was carried out between May 3 and 5, 2021. During that time, four boreholes (numbered 21-01 to 21-04, inclusive), four probeholes (numbered 21-101 to 21-104, inclusive), and two hand augerholes (numbered 21-201 and 21-202) were advanced at the site. Details on the test holes are provided below.

- The boreholes were advanced to depths ranging from about 0.4 to 6.7 metres below ground surface. Upon reaching practical auger refusal in boreholes 21-02, 21-03, and

21-04, the boreholes were then advanced into the bedrock using rotary diamond drilling techniques while retrieving HQ sized bedrock core. These boreholes were advanced to total depths of about 3.3 to 5.1 metres below ground surface.

- The probeholes were advanced, without sampling, to practical auger refusal at depths ranging from about 0.2 to 2.1 metres below ground surface.
- The hand augerholes were advanced to refusal at depths of about 1.1 and 0.9 metres below ground surface in hand augerholes 21-201 and 21-202, respectively.

The boreholes and probeholes were advanced using a track mounted hollow stem auger drill rig supplied and operated by CCC Geotechnical and Environmental Drilling of Ottawa, Ontario.

Standard penetration tests were carried out in the boreholes and samples of the soils encountered were recovered using a 50 millimetre diameter split barrel sampler.

The subsurface conditions encountered in the hand augerholes were determined based on visual and tactile examination of the material recovered on the flights of the augers.

The fieldwork was supervised throughout by a member of our engineering staff who directed the drilling operations, logged the samples and carried out the in-situ testing. Following the fieldwork, the soil and bedrock samples were returned to our laboratory for examination by a geotechnical engineer. Selected samples of the soil were tested for water content, and grain size distribution testing. Select samples of the bedrock were tested for unconfined compressive strength testing.

The test hole locations were positioned in the field and subsequently surveyed by GEMTEC personnel using our Trimble R10 GPS survey instrument. The elevations are referenced to geodetic datum.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the soil and groundwater conditions identified in the test holes are given on the Record of Test Hole sheets in Appendix A. The logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of excavation, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at other than the test locations may vary from the conditions encountered in the test holes. 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 soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil

involves judgement and GEMTEC does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. Groundwater conditions may vary seasonally or as a consequence of construction activities in the area.

The following presents an overview of the subsurface conditions encountered in the test holes advanced during the current and previous investigation.

4.2 Topsoil

A surficial layer of topsoil was encountered at ground surface at hand augerholes 21-201 and 21-202 and boreholes 22-201 to 22-230 and 22-231, except 22-206. The thickness of the topsoil ranges from about 30 to 280 millimetres.

4.3 Peat

Deposits of peat were encountered extending from the ground surface at boreholes 22-231, 22-231A, 22-232 and 22-232A with thicknesses from about 70 to 560 millimetres.

4.4 Fill Material

Boreholes 21-01 to 21-04 were advanced through the golf course pathway and encountered about 80 to 200 millimetres of silty sand and gravel base material.

A layer of fill material was encountered below the pathway base material in boreholes 21-01 and 21-02, at the ground surface at borehole 22-206, and below the topsoil in boreholes 22-229 and 22-230. The fill material generally consists of silty sand with trace gavel and organic material. The fill material extends to depth ranging from about 0.8 to 2.3 metres below the ground surface.

Standard penetration tests carried out in the fill material gave N values of 4 to greater than 50 blows per less than 0.3 metres of penetration. The results of the in situ testing reflect a very loose to very dense relative density. The higher blow counts likely reflect the presence of the bedrock surface rather than the state of packing of the soil matrix.

The water content measured on three samples of the fill material is about 19 to 48 percent.

4.5 Silty Sand

Native deposits of silty sand with varying amounts of gravel were encountered below the topsoil and fill material, where encountered, in boreholes 22-201, 22-208, and, 22-214. The silty sand deposits extend to depths ranging from about 0.3 to 0.8 metres below existing grade.

Standard penetration tests carried out in the silty sand gave N values of 5 to greater than 50 blows per less than 0.3 metres of penetration. The results of the in situ testing reflect a loose to very

dense relative density. The higher blow counts likely reflect the presence of the bedrock surface rather than the state of packing of the soil matrix.

The water content measured on one sample of the silty sand is about 43 percent.

4.6 Silty Clay

Native deposits of weathered silty clay were encountered below the topsoil in hand augerhole 21-201 and boreholes 22-205, 22-207, 22-215, 22-216, 22-218, 22-221, 22-223, 22-226, 22-231, 22-231A, 22-232 and 22-232A. The weathered silty clay crust extends to depths ranging from about 0.6 to 2.3 metres below the existing ground surface.

Standard penetration tests carried out in the weathered silty clay gave N values of 2 to 23 blows per 0.3 metres of penetration. The results of the in situ testing indicate a stiff to very stiff consistency.

4.7 Glacial Till

Native deposits of glacial till were encountered below the topsoil, fill material, silty sand, and silty clay, where encountered, in all the borehole and hand augerhole locations, except boreholes 22-208, 22-218, 22-223, 22-229, 22-232 and 22-232A at depths ranging from about 0.1 to 2.4 metres below existing grade. Glacial till is a heterogeneous mixture of all grain sizes; however, at this site, the glacial till can be described as brown to grey silty sand to silty, clayey sand with varying amounts of gravel, cobbles and boulders. The glacial till was not fully penetrated in all the test holes, but was proven to depths ranging from about 0.4 to 8.0 metres below existing grade.

The results of grain size distribution testing on six samples of the glacial till are provided on the Soils Grading Chart in Appendix B and summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Testing (Glacial Till)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
21-02	3	1.5 – 2.1	20	50	24	6
22-202	5	3.0 – 3.5	5	56	28	11
22-207	3	1.5 – 2.1	10	53	25	12
22-220	3	1.5 – 2.1	8	38	27	27
22-224	4	2.3 – 2.9	17	51	22	10

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
22-230	4	2.3 – 2.9	6	56	27	11

Moisture content testing carried out on 29 samples of the glacial till indicates moisture contents ranging from about 7 to 37 percent.

4.8 Auger Refusal and Bedrock

Practical auger refusal occurred in probeholes 21-101 to 21-104, 22-106, 22-107, and 22-108, hand augerholes 21-201 and 21-202 and boreholes 22-202, 22-203, 22-205, 22-207, 22-209, 22-210, 22-211, 22-212, 22-213, 22-215, 22-218, 22-219, 22-220, 22-221, 22-222, 22-226, 22-227, 22-229, and 22-230 at depths ranging from about 0.2 to 7.5 metres below ground surface.

Precambrian bedrock was encountered and cored at boreholes 21-02, 21-03, 21-04, 22-201, 22-203A, 22-208, 22-214, 22-216, 22-221, 22-222, 22-223, 22-224, 22-225, 22-228, 22-231A and 22-232A at depths ranging from about 0.3 to 7.1 metres below existing grade.

Bedrock was encountered in boreholes 22-234 and 22-235 at depths of about 2.3 and 1.3 metres below the existing ground surface, respectively. The bedrock depths in these two boreholes were estimated based on the tricone drilling resistance and the drill cuttings and should be taken as approximate (i.e., no samples were recovered).

Auger refusal was encountered in probeholes 22-106, 22-107, and 22-108 at depths ranging from about 0.4 to 3.2 metres below the existing ground surface. Auger refusal may indicate the surface of the bedrock or boulders within the glacial till.

The bedrock surface and refusal depths are summarized in Table 4.2.

Table 4.2 – Summary of Auger Refusal and Bedrock Depths and Elevations

Test Hole Number	Ground Surface Elevation (metres)	Depth to Bedrock Surface (metres)	Bedrock Surface Elevation (metres)
21-01	135.1	> 6.7	< 128.4[2]
21-02	136.3	3.3	133.0
21-03	138.5	0.4	138.1
21-04	134.7	1.1	133.6

Test Hole Number	Ground Surface Elevation (metres)	Depth to Bedrock Surface (metres)	Bedrock Surface Elevation (metres)
21-101	135.3	2.0	133.3[1]
21-102	135.3	2.1	133.2[1]
21-103	134.9	0.6	134.3[1]
21-104	134.9	0.2	134.7[1]
22-106	136.5	0.4	136.1[1]
22-107	135.4	2.7	132.7[1]
22-108	137.4	3.2	134.2[1]
21-201	134.7	1.1	133.6[1]
21-202	135.4	0.9	134.4[1]
22-201	136.0	6.4	129.6
22-202	135.6	7.5	128.2[1]
22-203	135.9	1.0	134.9[1]
22-203A	135.9	0.8	135.2
22-205	135.3	6.1	129.2[1]
22-206	136.3	> 8.0	< 128.3[2]
22-207	135.0	3.4	131.7[1]
22-208	137.5	0.3	137.2
22-209	137.2	1.3	136.0[1]
22-210	135.7	3.2	132.5[1]
22-211	134.8	0.9	133.9[1]
22-212	136.6	2.0	134.6[1]
22-213	137.2	2.2	135.0[1]
22-214	137.9	4.7	133.3

Test Hole Number	Ground Surface Elevation (metres)	Depth to Bedrock Surface (metres)	Bedrock Surface Elevation (metres)
22-214A/B	137.8	4.6	132.9[1]
22-215	135.3	2.4	132.8[1]
22-216	134.6	1.0	133.6
22-218	136.0	0.6	135.4[1]
22-219	136.8	3.5	133.3[1]
22-220	137.5	2.6	135.0[1]
22-221	134.6	1.2	133.4
22-221A	134.7	1.4	133.3[1]
22-222	135.6	1.2	134.5
22-222A	135.7	1.2	134.6
22-223	134.6	1.3	133.3
22-224	135.6	4.5	131.2
22-225	134.9	1.2	133.7
22-225A	135.0	1.4	133.6[1]
22-226	135.6	3.4	132.2[1]
22-227	137.6	1.0	136.6[1]
22-228	138.5	0.9	137.5
22-228A	138.5	0.9	137.5
22-229	135.6	2.1	133.5[1]
22-230	135.0	4.0	130.9[1]
22-231A	136.0	7.1	129.0
22-232A	139.3	1.6	137.7
22-233A	134.9	2.9	132.0[1]

Test Hole Number	Ground Surface Elevation (metres)	Depth to Bedrock Surface (metres)	Bedrock Surface Elevation (metres)
22-233B	134.9	5.9	129.1[1]
22-234	134.4	2.3	132.1[3]
22-235	134.3	1.3	132.9[3]

Notes:

1. Bedrock depth and elevation inferred from practical auger refusal. Auger refusal could occur on boulders within the glacial till or on the bedrock surface.
2. The bedrock surface was not encountered in boreholes 21-01 and 22-206.
3. the bedrock depths were recorded based on the tricone drilling resistance and the drill cuttings and should be taken as approximate (i.e., no samples were recovered).

Precambrian bedrock was encountered at boreholes 21-02, 21-03, 21-04, 22-201, 22-203A, 22-208, 22-214, 22-216, 22-221A, 22-222, 22-222, 22-223, 22-224, 22-225, 22-228, 22-228A, 22-231A, and 22-232A at depths ranging from about 0.3 to 7.1 metres below surface grade and cored using rotary diamond drilling techniques while retrieving HQ and NQ sized bedrock core. The bedrock was cored to depths ranging from about 3.3 to 12.3 metres below surface grade. The recovered bedrock core samples had total core recoveries (TCR's) of about 43 to 100 percent, solid core recovery (SCR) values of about 0 to 100 percent, and rock quality designation (RQD) values of about 0 to 100 percent. Based on these values, the bedrock quality is considered to range from very poor to excellent.

Photographs of the bedrock core are provided on Figures C1 to C12 in Appendix C.

The results of testing carried out on 11 samples of the recovered bedrock core indicate unconfined compressive strengths ranging from about 33 to 231megapascals, but more generally between 115 and 230 megapascals, which indicates a strong to very strong classification. The two unconfined compressive strength results of 33 and 42 megapascals were likely the result of breakage along existing cracks within the bedrock core.

4.9 Groundwater Levels

Well screens were sealed in the overburden at boreholes 22-201, 22-205, 22-214B, 22-221A, 22-224, 22-225A, 22-231, 22-232, 22-233B, 22-234, and in the bedrock at boreholes 22-203A, 22-208, 22-214, 22-216, 22-221, 22-222, 22-222A, 22-223, 22-225, 22-228, 22-228A, 22-231A, 22-232A, and 22-235 for measurement of the groundwater levels. The groundwater levels in the monitoring wells were measured on February 9, 2022, and October 14, 15, and 17, 2022. The groundwater level depth and elevations are summarized in Table 4.4.

Table 4.4 – Summary of Groundwater Levels

Borehole/Test Pit Number	Groundwater Depth (metres)	Groundwater Elevation (metres)	Date
22-201	0.9	135.1	February 9, 2022
22-203A	1.2	134.7	February 9, 2022
22-205	0.5	134.9	February 9, 2022
22-208	2.7	134.8	February 9, 2022
22-214	2.0	136.0	February 9, 2022
22-214B	1.7	136.1	February 9, 2022
22-216	0.7	133.9	February 9, 2022
22-221	0.5	134.2	February 9, 2022
22-221A	0.6	134.1	February 9, 2022
22-222	1.1	134.5	February 9, 2022
22-222A	1.3	134.4	February 9, 2022
22-223	0.3	134.3	February 9, 2022
22-224	0.5	135.1	February 9, 2022
22-225	0.8	134.1	February 9, 2022
22-225A	0.9	134.1	February 9, 2022
22-228	4.1	134.3	February 9, 2022
22-228A	4.0	134.4	February 9, 2022
22-231	0.7	135.8	October 15, 2022
22-231A	0.8	135.3	October 15, 2022

Borehole/Test Pit Number	Groundwater Depth (metres)	Groundwater Elevation (metres)	Date
22-232	1.4	137.1	October 17, 2022
22-232A	1.3	138.1	October 17, 2022
22-233B	1.0	133.9	October 14, 2022
22-234	1.1	133.3	October 14, 2022
22-235	1.0	133.3	October 14, 2022

The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

4.10 Hydraulic Conductivity Results

Hydraulic conductivity testing was completed in all monitoring wells as part of the hydrogeological investigation and is reported under separate cover.

4.11 Chemistry Relating to Corrosion

Soil samples obtained from boreholes 22-212 and 22-216 were sent to Paracel Laboratories for basic chemical testing relating to corrosion of buried concrete and steel. The results of chemical testing are provided in Appendix E and summarized in Table 4.5 below.

Table 4.5 – Summary of Corrosion Testing

Parameter	Borehole 22-212 Sample 3	Borehole 22-226 Sample 3
Chloride Content (µg/g)	< 5	< 5
Resistivity (Ohm.m)	96.4	49.7
Conductivity (µs/cm)	104	201
pH	7.26	7.53
Sulphate Content (µg/g)	< 5	16

5.0 GEOTECHNICAL RECOMMENDATIONS AND GUIDELINES

5.1 General

The information in the following sections is provided for the guidance of the design engineers and is intended for the design of this project only. As such, lot specific subgrade evaluations should be carried out by experienced geotechnical personnel to support the lot development plans and to confirm the recommendations presented in this report. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from off-site sources are outside the terms of reference for this report.

A Phase One and Two Environmental Site Assessment for this property was prepared by GEMTEC and submitted under a separate report.

5.2 Grade Raise Restrictions

The site is underlain by native deposits of weathered silty clay crust, silty sand, and glacial till.

Based on the borehole information, there are no grade raise restrictions at the site, from a geotechnical perspective. The settlement due to compression of the native soils as a result of fill placement should be relatively small and should occur during or shortly after the fill placement.

5.3 Proposed Houses

5.3.1 Overburden Excavation

The excavations for the foundations should be taken through any surficial topsoil, fill material, and into the native overburden deposits. The sides of the excavations should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the shallow native overburden deposits can be classified as Type 3 and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical extending upwards from the base of the excavation.

Excavation of the native soils above the groundwater should not present any excavation constraints. In contrast, excavation in the native sandy deposits below the groundwater level could present constraints. Groundwater inflow from the sandy deposits could cause sloughing of the sides of the excavation and disturbance to the soils at the bottom of the excavation. Flatter

side slopes of 3 horizontal to 1 vertical will be required if excavation is required below the groundwater level in sandy deposits.

Based on our observations on site, groundwater inflow from the overburden deposits into the excavations should be controlled by pumping from filtered sumps within the excavations. It is not expected that short term pumping during excavation will have any significant affect on nearby structures and services.

The silty clay deposits are sensitive to disturbance from ponded water, vibration and construction traffic. As such, care should be taken when excavating to avoid disturbance to the silty clay deposits, and it is suggested that final trimming to subgrade level be carried out using a hydraulic shovel equipped with a flat blade bucket. Allowance should be made to remove and replace any disturbed silty clay with compacted sand and gravel, such as that meeting OPSS Granular A or Granular B Type II, where required.

5.3.2 Bedrock Excavation

Localized removal of competent bedrock at this site, if required, could be carried out using hoe ramming techniques in conjunction with line drilling on close centres.

Line drilling on close centres could be used to reduce, not prevent, over break and under break of the bedrock excavation and to define the limit of excavation next to existing structures and services. For the bedrock at this site, it is suggested that allowance be made for line drilling 75 to 100 millimetre diameter holes on 200 to 300 millimetre centres. The vibration effects of hoe ramming are usually minor and localized.

Provided that good bedrock excavation techniques are used, the bedrock could be excavated using vertical side walls. Any loose rock should be scaled from the sides of the excavation.

If significant bedrock removal is required for the site development, blasting may be required. Guidelines on blasting are provided in Section 5.4.2.

5.3.3 Groundwater Pumping

The groundwater levels measured on February 9, 2022 range from about 0.3 to 4.0 metres below existing ground surface.

Any groundwater inflow into the excavations should be handled from within the excavations by pumping from filtered sumps. It is not expected that short term pumping during excavation will have a significant effect on nearby structures.

Suitable detention and filtration will be required before discharging the water to ground surface or sewer. Given the high groundwater table and the likelihood for multiple excavations open simultaneously for the construction of houses or building foundations, the water taking at this site

may exceed 400,000 litres per day and, therefore, a Category 3 Permit to Take Water (PTTW) will be required.

In order to reduce, not eliminate, the requirement for long term pumping from basement sump pumps it is recommended that the underside of footing elevations be set a minimum of 0.3 metres above the seasonally high groundwater level. Where possible, the perimeter foundation drainage should outlet by gravity to the storm sewer and the drains should be equipped with suitable backflow prevention. Further comments on underside of footing elevations could be provided as the design progresses.

5.3.4 Placement of Engineered Fill

Imported granular material (engineered fill) should be used to raise the grade in areas where the proposed founding level is above the level of the native soil, or where subexcavation of disturbed material is required below proposed founding level. The engineered fill should consist of granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II and should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. To allow spread of load beneath the footings, the engineered fill should extend horizontally at least 0.3 metres beyond the footings and then down and out from the edges of the footings at 1 horizontal to 1 vertical, or flatter. The excavations should be sized to accommodate this fill placement.

In areas where wet sandy soils are encountered at subgrade level, it may be necessary to place a non-woven geotextile meeting the requirements of OPSS 1860 Class I below the engineered fill and to statically compact the first lift of granular material to prevent subgrade disturbance. All seams in the geotextile should overlap at least 0.5 metres.

5.3.5 Spread Footing Design

The proposed houses could be founded on spread footings bearing on or within the native soil or bedrock, or on engineered fill above the native deposits or bedrock. The topsoil and fill material are not considered suitable for the support of the proposed houses, buildings or concrete floor slabs and should be removed from the proposed building areas.

Based on the results of the borehole investigation, the following allowable bearing pressures should be used to size the spread footing foundations:

Table 5.1 – Allowable Bearing Pressures for Foundations

Subgrade Material	Allowable Bearing Pressure for Foundations (kilopascals)
Silty clay, silty sand and sand	100
Glacial till	150

Subgrade Material	Allowable Bearing Pressure for Foundations (kilopascals)
Engineered fill material, over undisturbed, native deposits (minimum thickness of 0.6 metres of engineered fill)	150
Bedrock	250

It is pointed out that the deposits of silty sand near or below the groundwater level may become disturbed following excavation. If disturbance to the sandy deposits occurs, one solution would be to wait several days to allow the porewater pressures to dissipate. Alternatively, the groundwater level could be lowered in advance of excavation by pumping from sump pits, possibly combined with ditching around the perimeter of the excavations.

The native soils at this site are sensitive to construction operations, from ponded water and frost action. The construction operations should therefore be carried out in a manner that minimizes disturbance of the subgrade surfaces.

The post construction total and differential settlement of footings should be less than 25 and 15 millimetres, respectively, provided that all loose or disturbed soil is removed from the bearing surfaces and provided that any engineered fill material is compacted to the required density.

The foundation walls for the houses should be reinforced, both top and bottom, in areas where the footings transition from overburden to bedrock. The reinforcing steel should extend at least 3 metres on both sides of the transition zone.

As indicated above, the underside of footing level should be set a minimum of 0.3 metres above the seasonally high groundwater level.

5.3.6 Frost Protection of Foundations

All exterior footings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleaned of snow cover during the winter months should be provided with a minimum of 1.8 metres of earth cover. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. Further details regarding the insulation of foundations could be provided at the detailed design stage, if necessary.

5.3.7 Basement Foundation Wall Backfill and Drainage

In accordance with the Ontario Building Code, the following alternatives could be considered for drainage of the basement foundation walls:

- Damp proof the exterior of the foundation walls and backfill the walls with free draining, non-frost susceptible sand or sand and gravel such as that meeting OPSS requirements for Granular B Type I or II; or,
- Damp proof the exterior of the foundation walls and install an approved proprietary drainage system on the exterior of the foundation walls and backfill the walls with native material or imported soil.

A perforated plastic foundation drain with a surround of clear crushed stone should be installed on the exterior of the foundation walls at the underside of footing level. A nonwoven geotextile should be placed between the top of the clear stone and any sandy foundation wall backfill material to avoid loss of sand backfill into the voids in the clear stone (and possible post construction settlement of the ground around the houses). The top of the drain should be located below the bottom of the floor slab. The drain should outlet to a sump from which the water is pumped or should drain by gravity to the storm sewer system.

5.3.8 Garage Foundation and Pier Backfill

To avoid adfreeze between the unheated garage foundation walls and the wall backfill and possible jacking (heaving) of the foundation walls, the interior and exterior of the garage foundation walls should be backfilled with free draining, non-frost susceptible sand or sand and gravel such as that meeting OPSS requirements for Granular B Type I or II. The backfill within the garage should be compacted in maximum 300 millimetres thick lifts to at least 95 percent of the standard Proctor dry density value using suitable vibratory compaction equipment.

Alternatively, the interior of the garages could be filled with 19 millimetre clear crushed stone. A suitable nonwoven geotextile should be placed over the subgrade prior to the placement of clear stone to prevent ingress of fines into voids in the clear stone and possible settlement/cracking of the slab. Clear, crushed stone should be nominally compacted (at least 2 passes of a diesel plate compactor) in maximum 300 millimetre thick lifts to reduce the potential for post construction densification of the material.

The backfill against isolated (unheated) walls or piers should consist of free draining, non-frost susceptible material, such as sand or sand and gravel meeting OPSS Granular B Type I or II requirements. Other measures to prevent frost jacking of these foundation elements could be provided, if required.

5.3.9 Lateral Earth Pressures

Foundation walls that are backfilled with granular material such as that meeting OPSS Granular B Type I or II requirements should be designed to resist “at rest” earth pressures calculated using the following formula:

$P_o = 0.5\ K_o\ \gamma\ H^2$

where;

- P_o: Static “At Rest” thrust (kilonewtons per metre);
- γ: Moist material unit weight (kilonewtons per cubic metre);
- K_o: “At Rest” earth pressure coefficient;
- H: Wall height (metre).

Seismic shaking can increase the forces on the retaining wall. The total “At Rest” thrust acting on the walls (P_{oe}) during a seismic event is composed of a static component (P_o) and a dynamic component (P_e), that is:

$P_{oe} = P_o + P_e$

The dynamic at rest thrust component (P_e), which acts only during seismic loading conditions, should be calculated using the following formula:

$P_e = 0.5\ (K_{oe} – K_o)\ \gamma\ H^2$

where;

- P_e: Total “At Rest” thrust (kilonewtons per metre);
- γ: Moist material unit weight (kilonewtons per cubic metre);
- K_o “At Rest” earth pressure coefficient
- K_{oe}: Dynamic “At Rest” earth pressure coefficient;
- H: Wall height (metre).

The static thrust component (P_o) acts at a point located H/3 above the base of the wall. During seismic shaking, the dynamic at rest thrust component (P_o) acts at a point located about 0.6H above the base of the wall.

For design purposes, the parameters provided in Table 5.2 can be used to calculate the thrust acting on the walls during static and seismic loading conditions.

Table 5.2 – Summary of Design Parameters (Building Foundation Walls)

Parameter	OPSS Granular B Type I	OPSS Granular B Type II
Material Unit Weight, γ (kilonewtons per cubic metre)	22	22

Parameter	OPSS Granular B Type I	OPSS Granular B Type II
Estimated Friction Angle (degrees)	34	38
"At Rest" Earth Pressure Coefficient, K_o, assuming horizontal backfill behind the structure	0.44	0.38
Dynamic "At Rest" Earth Pressure Coefficient, K_{oe}, assuming horizontal backfill behind the structure	0.34[1]	0.29[1]

Notes:

1) According to the 2015 National Building Code of Canada, the peak ground acceleration (PGA) for this site is 0.10 for Site Class C. The dynamic at rest earth pressure coefficient was calculated using the method suggested by Mononobe and Okabe, assuming a horizontal seismic coefficient, kh, of 0.05 and assuming that the vertical seismic coefficient, kv, is zero.

Heavy construction traffic should not be allowed to operate adjacent to foundation walls for the proposed houses and buildings (within about 2 metres horizontal) during construction, without the approval of the designers.

5.3.10 Basement Concrete Slab Support

To provide predictable settlement performance of the basement slab, all topsoil, fill material, disturbed soil, and other deleterious materials should be removed from the slab area.

The base for the floor slab should consist of 19 millimetre clear crushed stone. Allowance should be made for between 150 and 200 millimetres of granular base material.

The clear crushed stone should be nominally compacted in maximum 300 millimetre thick lifts with at least 2 passes of a diesel plate compactor. A suitable nonwoven geotextile should be placed over the subgrade prior to the placement of clear stone to prevent ingress of fines into voids in the clear stone and possible settlement/cracking of the slab.

Underfloor drainage should be provided below the floor slab. If clear crushed stone is used below the floor slab, underfloor drains are not considered essential provided that stub drains are installed to link any hydraulically isolated areas in the basement. The clear stone below the floor slab should by hydraulically connected to the sump pit or to the perimeter drain if drainage to the storm sewer system is possible.

Basement floor slabs should be constructed in accordance with guidelines provided in ACI 302.1R-04 "Guide for Concrete Floor and Slab Construction".

A polyethylene vapour barrier should be installed below the basement floor slabs.

5.3.11 Swimming Pools

With the exception of shallow bedrock in some areas, we do not anticipate any geotechnical concerns with swimming pool construction in the residential development.

5.3.12 Seismic Site Classification and Liquefaction Potential

Based on the results of the standard penetration carried out as part of this investigation, it is recommended that seismic Site Class C be used for the design of residential structures in the residential development.

Also, based on the results of the standard penetration testing, in our opinion, the native overburden deposits, which are composed of silty sand, silty clay, and glacial till are not prone to liquefaction.

5.4 Site Services

5.4.1 Overburden Excavation

The overburden excavations for the site services will be carried out through topsoil, fill material, silty sand, and glacial till.

In the overburden, the excavation for flexible service pipes should be in accordance with Ontario Provincial Standard Drawing (OPSD) 802.010 for Type 3 Soil. The excavation for rigid service pipes should be in accordance with OPSD 802.031 for Type 3 soil.

The sides of the excavations within overburden soils should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, most of the soils at this site can be classified as Type 3 soils. Therefore, for design purposes, allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes.

Excavation of the native soils above the groundwater should not present any excavation constraints. In contrast, excavation in the native silty sand and sand below the groundwater level could present constraints. Groundwater inflow from the silty sand and sand deposits could cause sloughing of the sides of the excavation and disturbance to the soils at the bottom of the excavation. Flatter side slopes may be required if excavation is required below the groundwater level in sand and silty sand deposits.

As an alternative or where space constraints dictate, the service installations could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose.

Based on our observations on site, groundwater inflow from the overburden deposits into the excavations should be controlled by pumping from filtered sumps within the excavations. It is not expected that short term pumping during excavation will have any significant affect on nearby structures and services.

5.4.2 Bedrock Excavation

In bedrock, the excavation for flexible service pipes should be in accordance with OPSD 802.013 for bedrock. The excavation for rigid service pipes should be in accordance with OPSD 802.033 for bedrock.

Localized removal of competent bedrock at this site could be carried out using (a) drill and blasting, (b) hoe ramming techniques in conjunction with line drilling on close centres or (c) a combination of both. Provided that good bedrock excavation techniques are used, the competent bedrock could be excavated using vertical side walls.

Any blasting should be carried out under the supervision of a blasting specialist engineer. As a guideline for blasting, the suggested peak vibration limits at the nearest structure or service are provided in Table 5.2.

Table 5.2 – Peak Vibration Limits

Frequency of Vibration (Hz)	Vibration Limits (millimetres/second)
<10	5
10 to 40	5 to 50 (interpolated)
>40	50

It is pointed out that these criteria, although conservative, were established to prevent damage to existing buildings and services that are in good condition; more stringent criteria may be required to prevent damage to freshly placed (uncured) concrete or vibration sensitive equipment or utilities. Monitoring of the blasting should be carried out to ensure that the blasting meets the limiting vibration criteria. Pre-construction condition surveys of nearby structures, water supply wells, and existing buried services are considered essential. The effects due to vibration from blasting can be controlled by limiting the size and amount of charge, using delayed detonation techniques, and the like. To reduce the effects of vibration on nearby services, we suggest that the separation distance between any blasting and existing underground services be at least 3 metres. Any bedrock removal within these limits could be carried out using hoe ramming techniques in conjunction with line drilling on close centres. It is noted that the cost of bedrock removal generally increases the closer the bedrock removal is to any existing structures or services.

As an alternative to blasting, bedrock removal could be carried out using large hydraulic excavation equipment in combination with hoe ramming. Line drilling on close centres could be used to reduce, not prevent, over break and under break of the bedrock excavation and to define the limit of excavation next to existing structures and services. For the bedrock at this site, it is suggested that allowance be made for line drilling 75 to 100 millimetre diameter holes on 200 to

300 millimetre centres. The vibration effects of hoe ramming are usually minor and localized. Monitoring of the hoe ramming could be carried out, at least initially, to measure the vibrations to ensure that they are below the acceptable threshold value.

Provided that good bedrock excavation techniques are used, the bedrock could be excavated using vertical side walls. Any loose rock should be scaled from the sides of the excavation.

The bedrock at this site has near horizontal bedding planes. Therefore, some over break of the bedrock should be expected. Bedrock over breaks will naturally occur along the bedding planes; as such, additional granular bedding material should be expected for the site services and additional granular fill/concrete should be expected for the house foundations.

5.4.3 Permit to Take Water (PTTW)

The groundwater levels measured on February 9, 2022 range from about 0.3 to 4.0 metres below existing ground surface.

It is expected that any groundwater inflow into the excavations can be handled from within the excavations by pumping from filtered sumps; although, it is noted that if significant bedrock removal or deep excavations are required (e.g. pump station or stormwater management pond), groundwater lowering in advance of construction may be required. It is not expected that short term pumping during excavation will have a significant effect on nearby structures.

Given the high groundwater table, proximity to the Tay River, anticipated excavation depths of four to five metres for the installation of municipal series and the likelihood for multiple excavations open simultaneously (i.e., multiple crews), the water taking at this site is expected to exceed 400,000 litres per day and, therefore, a Category 3 Permit to Take Water (PTTW) will be required. A hydrogeological investigation in support of a Category 3 PTTW is provided under a separate cover.

5.4.4 Bedding and Cover

The bedding and cover for the proposed utilities should consist of least 150 millimetres of OPSS Granular A backfill placed in accordance with the applicable OPSD for the type of underground utility installed. The use of 19 millimetre clear stone is not recommended as bedding or cover.

The native silty sand and silty clay deposits below the groundwater level are sensitive to disturbance. Allowance should be made for a subbedding composed of at least 300 millimetres of OPSS Granular B Type II where these materials are encountered at subgrade level below the pipe.

Bedding, subbedding and cover materials should be placed in lifts not exceeding 200 millimetres thick and compacted to at least 95 percent of standard Proctor density (ASTM D698).

5.4.5 Trench Backfill

In areas where the service trench will be located below or in close proximity to existing or future areas of hard surfacing (i.e., access roadways and parking), acceptable native materials should be used as backfill between the roadway subgrade level and the depth of seasonal frost penetration in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent hard surfaced area. The depth of frost penetration in exposed areas can normally be taken as 1.8 metres below finished grade. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I.

It is anticipated that most of the inorganic overburden materials encountered during the subsurface investigation will be acceptable for reuse as trench backfill. Topsoil or other organic material should be wasted from the trench. If on-site blast rock is used as backfill within the service trench, it should be mostly 300 millimetres, or smaller, in size and should be well graded. To prevent ingress of fine material into voids in the blast rock, the upper surface of the blast rock should be covered with a thin layer of compacted, well graded crushed stone, such as OPSS Granular B Type II.

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, curbs, driveways, etc., the trench backfill should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. Rock fill should be placed in maximum 500 millimetre thick lifts and compacted with a large drum roller, the haulage and spreading equipment, or a combination of both. The specified density for compaction of the backfill materials may be reduced where the trench backfill is not located below or in close proximity to existing or future areas of hard surfacing and/or structures, provided that some settlement above the trench is acceptable.

The silty sand and silty clay deposits may have water contents that are too high for adequate compaction. Furthermore, depending on the weather conditions at the time of construction, some wetting of materials could occur. As such, the specified densities may not be possible to achieve and, as a consequence, some settlement of these backfill materials should be expected. Consideration could be given to implementing one or a combination of the following measures to reduce post construction settlement above the trenches, depending on the weather conditions encountered during the construction:

- Allow the overburden materials to dry prior to compaction;
- Reuse any wet materials in the lower part of the trenches and make provision to defer final paving of surface course (i.e., the Superpave 12.5 asphaltic concrete) in the roadways for 3 months, or longer, to allow the trench backfill settlement to occur and thereby improve the final roadway appearance.

5.4.6 Seepage Barriers

The granular bedding in the service trench could act as a “French Drain”, which could promote groundwater lowering. As such, we suggest that seepage barriers be installed along the service trenches at strategic locations at a horizontal spacing of about 100 metres. The seepage barriers should begin at subgrade level and extend vertically through the granular pipe bedding and granular surround to within the native backfill materials, and horizontally across the full width of the service trench excavation. The seepage barriers could consist of 1.5 metre wide dykes of compacted weathered silty clay. The weathered silty clay should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. The locations of the seepage barriers could be provided as the design progresses.

5.5 Internal Roadways

5.5.1 Subgrade Preparation

In preparation for roadway construction at this site, all surficial topsoil, fill material, and any soft, wet, disturbed, or deleterious materials should be removed from the proposed roadways. Any subexcavated areas could be filled with compacted earth borrow. Similarly, should it be necessary to raise the roadway grades at this site, material which meets OPSS specifications for Select Subgrade Material or Earth Borrow may be used. The select subgrade material or earth borrow should be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment. Prior to placing granular material for the roadways, the exposed subgrade should be heavily proof rolled under suitable (dry) conditions, and inspected and approved by geotechnical personnel. Any soft areas evident from the proof rolling should be subexcavated and replaced with suitable earth borrow approved by the geotechnical engineer.

The subgrade should be shaped and crowned to promote drainage of the roadway granular materials.

It is understood that the roadways within Phase 9 of the development have been stripped of topsoil and peat, and backfilled with blast rock fill.

5.5.2 Pavement Design

The following minimum pavement structure is suggested for local roadways at this site, assuming that the roadways will not be used as collector roads or bus routes:

- 90 millimetre thick layer of asphaltic concrete (40 millimetres of Superpave 12.5 Traffic Level B over 50 millimetres of Superpave 12.5 Traffic Level B); over
- 150 millimetre thick layer of base (OPSS Granular A); over
- 400 millimetre thick layer of subbase (OPSS Granular B Type II);

In the absence of detailed traffic data, the thickness of asphaltic concrete and OPSS Granular B Type II subbase should be increased for collector/arterial roadways and bus routes, as follows:

- 120 millimetre thick layer of asphaltic concrete (50 millimetres of Superpave 12.5 Traffic Level D over 70 millimetres of Superpave 19.0 Traffic Level D); over
- 150 millimetre thick layer of base (OPSS Granular A); over
- 600 millimetre thick layer of subbase (OPSS Granular B Type II);

If the rock fill is open graded, and a significant amount of voids are present at the surface of the rock fill, a non-woven geotextile should be placed between the rock fill and the Granular B Type II subbase layer to prevent loss of material into the rock fill.

5.5.3 Effects of Soil Disturbance

The above pavement structures assume that the roadway subgrade surface is prepared as described in this report. If the roadway subgrade surface is disturbed or wetted due to construction operations or precipitation, the granular thickness given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or to incorporate a woven geotextile separator between the roadway subgrade surface and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction. In our experience, a geotextile will likely be required in most cases where the subgrade consists of overburden, if the roadway construction is planned during the wet period of the year (such as the spring or fall).

Similarly, if the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the Granular B Type II, install a woven geotextile separator between the roadway subgrade surface and the granular subbase material, or a combination of both, to prevent pumping and disturbance to the subbase material. The contractor should be made responsible for their construction access.

5.5.4 Granular Material Compaction

The pavement granular materials should be compacted in maximum 300 millimetre thick lifts to at least 99 percent of standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.5.5 Asphaltic Cement

Performance graded PG 58-34 asphaltic cement is recommended for local roadways while performance graded PG 64-34 asphalt is recommended for collector/arterial roadways and bus routes.

5.5.6 Transition Treatments

In areas where the new pavement structure will abut existing pavements, the depths of the granular materials should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the depths of the granular material(s) exposed in the existing pavement.

5.5.7 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long term performance of the pavement at this site. It is suggested that storm sewer catch basins be equipped with 3 metre stub drains extending in at least 2 directions. The stub drains should be installed at the subgrade level. In any areas where ditches are used, it is suggested that the pavement granular material extend to the ditches. The bottom of the OPSS Granular B Type II should be at least 0.3 metres above the bottom of the ditch.

Further details on pavement drainage can be provided as the design progresses.

5.6 Corrosion of Buried Concrete and Steel

According to Canadian Standards Association (CSA) “Concrete Materials and Methods of Concrete Construction”, the concentration of sulphate in the soil samples recovered from boreholes 22-212 and 22-226 can be classified as low. For low exposure conditions, any concrete that will be in contact with the native soil or groundwater could be batched with General Use (GU) type cement. The effects of freeze thaw in the presence of de-icing chemical (sodium chloride) near the buildings should be considered in selecting the air entrainment and the concrete mix proportions for any exposed concrete.

Based on the resistivity and pH of the soil samples tested the soil can be generally classified as non aggressive toward unprotected steel. It is noted that the corrosivity of the soil could vary throughout the year due to the application sodium chloride for de-icing.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Winter Construction

Provision must be made to prevent freezing of any soil below the level of any footings, slabs or services. Freezing of the soil could result in heaving related damage.

Any service trenches should be opened for as short a time as practicable and the excavations should be carried out only in lengths which allow all of the construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the trenches should not be allowed to freeze. In addition, the backfill should be excavated, stored and replaced without being disturbed by frost or contaminated by snow or ice.

6.2 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, excavation, hoe ramming, foundation construction etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source, but may be felt at nearby structures. Comments on preconstruction surveys are provided in Section 5.4.2.

6.3 Disposal of Excess Soil

It is noted that the professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination, including naturally occurring source of contamination, are outside the terms of reference for this report. A Phase One and Two Environmental Site Assessment will be provided in a separate report.

6.4 Design Review and Construction Observation

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the final design drawings be reviewed by the geotechnical engineer as the design progresses to ensure that the guidelines provided in this report have been interpreted as intended.

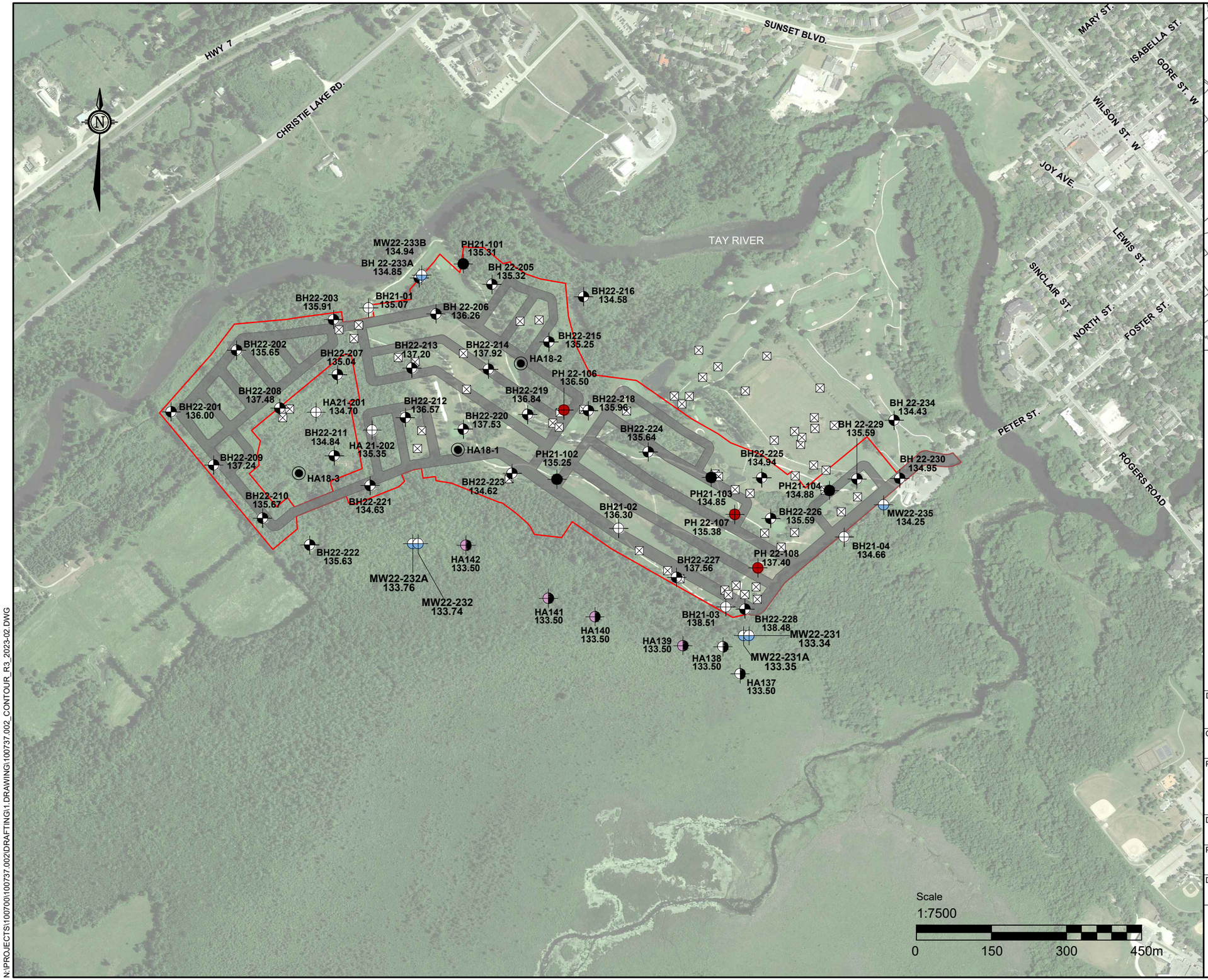
The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces the individual houses, residential buildings, site services and roadways should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications. In accordance with Ontario Building Code requirements, full time compaction testing is required for engineered fill below buildings.

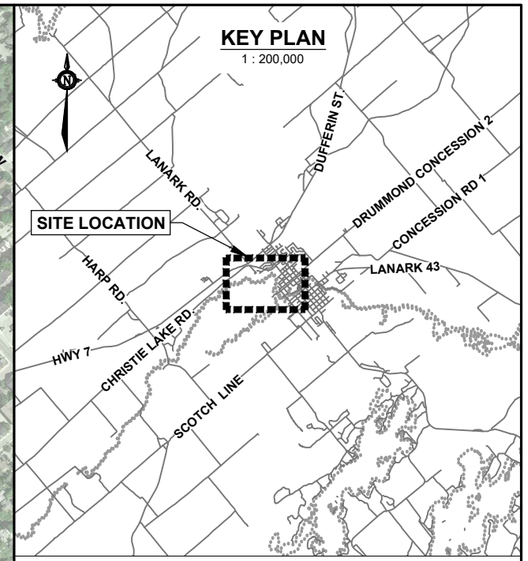
7.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Alex Meacoe, P.Eng.
Senior Geotechnical Engineer

Brent Wiebe, P.Eng.
VP Operations - Ontario





LEGEND

BH/ PH/ HA # ← BOREHOLE/ PROBEHOLE/ HAND AUGERHOLE ID
XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

- **BOREHOLE** (current investigation by GEMTEC)
- **BOREHOLE** (previous investigation by GEMTEC)
- **PROBEHOLE** (current investigation by GEMTEC)
- **PROBEHOLE** (previous investigation by GEMTEC)
- **HAND AUGERHOLE** (previous investigation by GEMTEC)
- **HAND AUGER HOLE** (previous investigation by GEMTEC, 2018)
- **HAND AUGER HOLE** (current investigation by GEMTEC)
- **HAND AUGER HOLE** (current investigation by GEMTEC,elevations are based on DEM (not surveyed data))
- **MONITORING WELL** (current investigation by GEMTEC)
- **BEDROCK OUTCROPS OBSERVED**
- **APPROXIMATE DEVELOPMENT BOUNDARY**
- **APPROXIMATE DEVELOPMENT BOUNDARY**

DRAWING
BEDROCK CONTOUR PLAN

CLIENT
CAIVAN (PERTH GC) LIMITED

PROJECT
PROPOSED DEVELOPMENT
PERTH GOLF COURSE
151 PETER STREET
PERTH, ONTARIO

DRAWN BY	CHECKED BY
S.L.	W.A.M.
PROJECT NO.	REVISION NO.
100737.002	3
DATE	FIGURE NO.
FEBRUARY 2023	**FIGURE 1**

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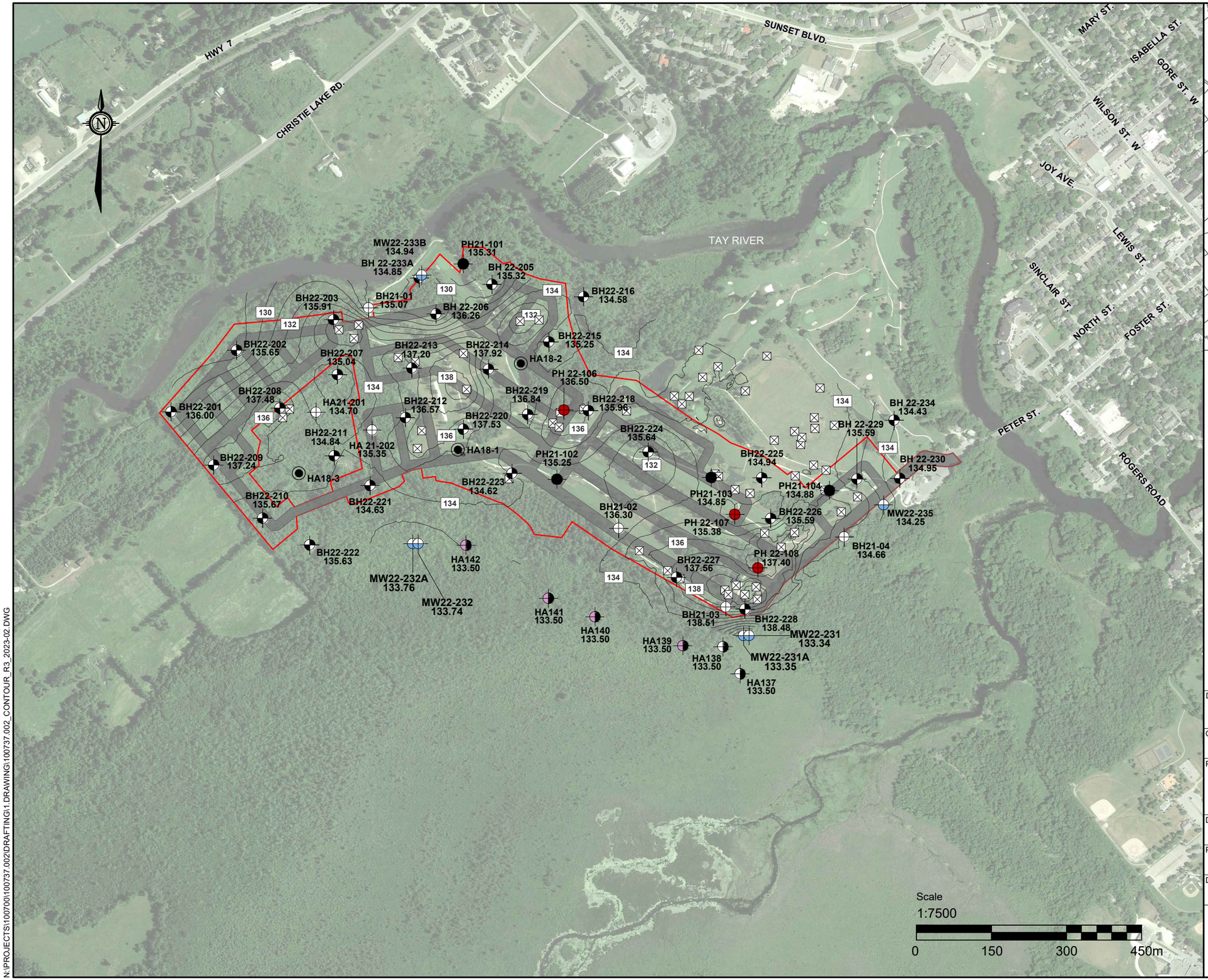

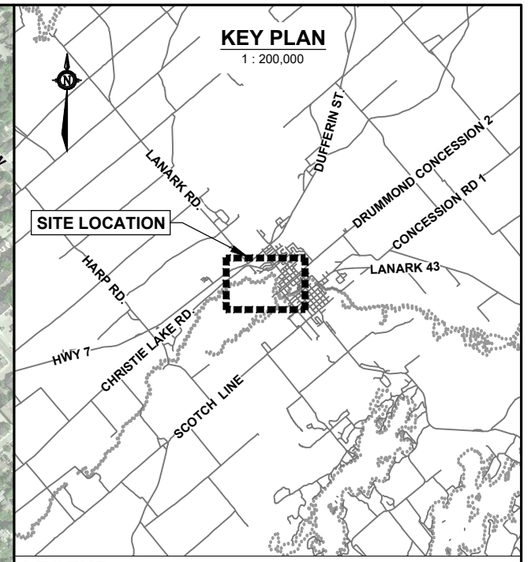

LEGEND

- BH/ PH/ HA # ← BOREHOLE/ PROBEHOLE/ HAND AUGERHOLE ID
- XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM
- **BOREHOLE** (current investigation by GEMTEC)
- **BOREHOLE** (previous investigation by GEMTEC)
- **PROBEHOLE** (current investigation by GEMTEC)
- **PROBEHOLE** (previous investigation by GEMTEC)
- **HAND AUGERHOLE** (previous investigation by GEMTEC)
- **HAND AUGER HOLE** (previous investigation by GEMTEC, 2018)
- **HAND AUGER HOLE** (current investigation by GEMTEC)
- **HAND AUGER HOLE** (current investigation by GEMTEC,elevations are based on DEM (not surveyed data))
- **MONITORING WELL** (current investigation by GEMTEC)
- **BEDROCK OUTCROPS OBSERVED**
- **APPROXIMATE DEVELOPMENT BOUNDARY**
- **BEDROCK CONTOUR (METRES, m)**

DRAWING
BEDROCK CONTOUR PLAN

CLIENT
CAIVAN (PERTH GC) LIMITED

PROJECT
PROPOSED DEVELOPMENT
PERTH GOLF COURSE
151 PETER STREET
PERTH, ONTARIO

DRAWN BY	CHECKED BY
S.L.	W.A.M.
PROJECT NO.	REVISION NO.
100737.002	3
DATE	FIGURE NO.
FEBRUARY 2023	**FIGURE 2**

GEMTEC
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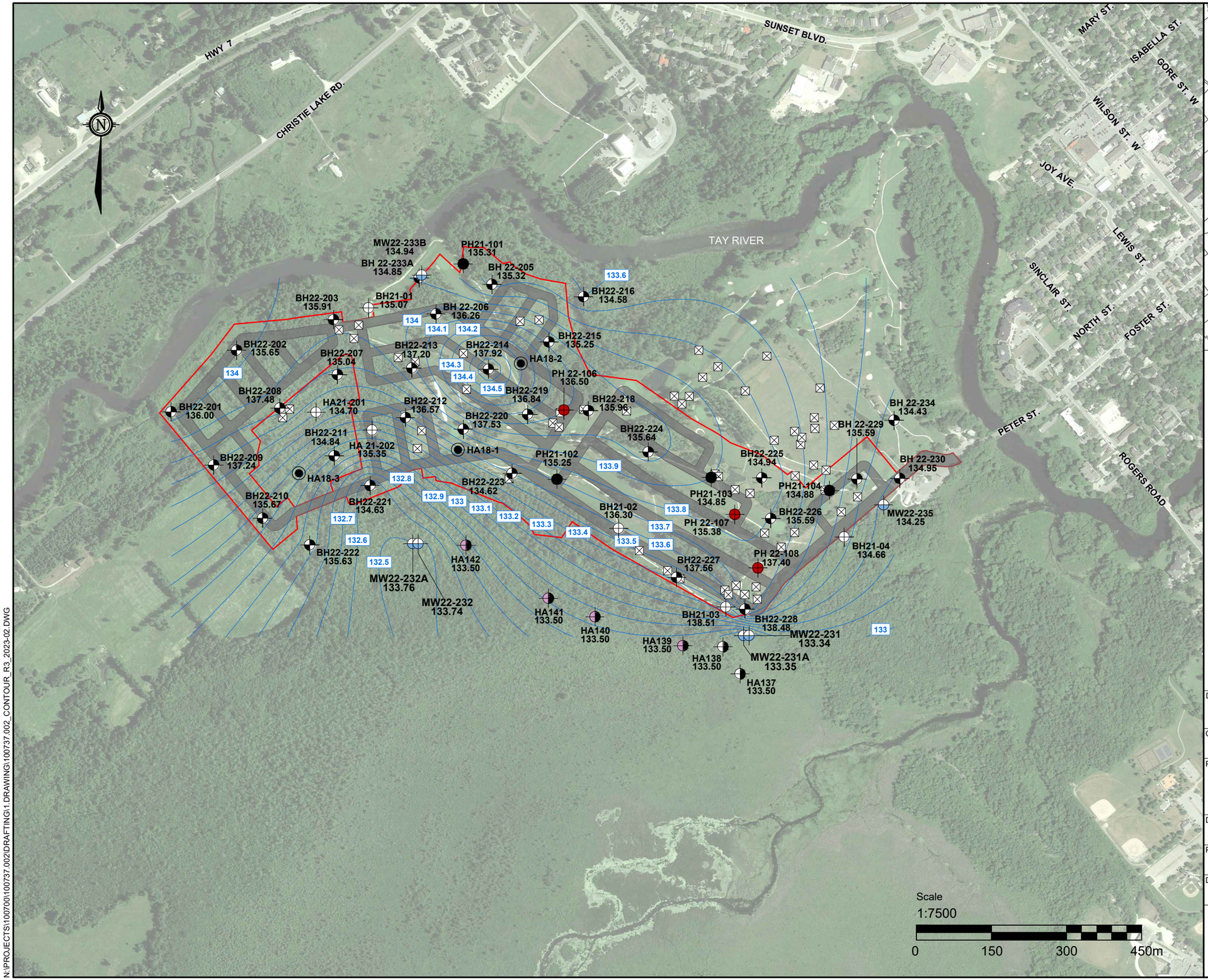
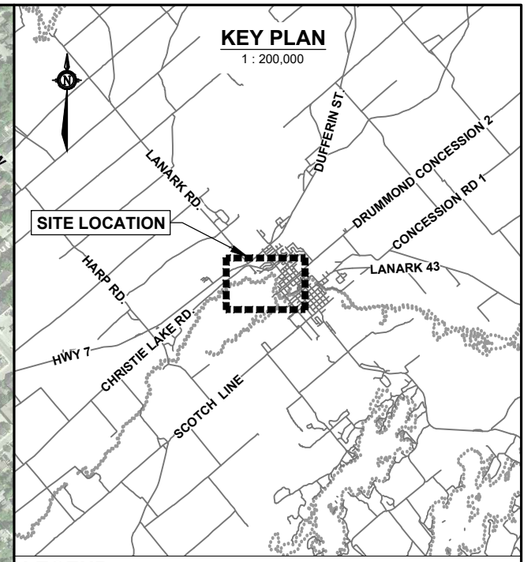
32 Steacie Drive
Ottawa, ON, K2K 2A9
Tel: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

N:\PROJECTS\100700\100737.002\DRAFTING\1.DRAWING\100737.002_CONTOUR_R3_2023-02.DWG





LEGEND

BH/ PH/ HA # ← BOREHOLE/ PROBEHOLE/ HAND AUGERHOLE ID
XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

- **BOREHOLE** (current investigation by GEMTEC)
- **BOREHOLE** (previous investigation by GEMTEC)
- **PROBEHOLE** (current investigation by GEMTEC)
- **PROBEHOLE** (previous investigation by GEMTEC)
- **HAND AUGERHOLE** (previous investigation by GEMTEC)
- **HAND AUGER HOLE** (previous investigation by GEMTEC, 2018)
- **HAND AUGER HOLE** (current investigation by GEMTEC)
- **HAND AUGER HOLE** (current investigation by GEMTEC,elevations are based on DEM (not surveyed data))
- **MONITORING WELL** (current investigation by GEMTEC)
- **BEDROCK OUTCROPS OBSERVED**

- **APPROXIMATE DEVELOPMENT BOUNDARY**
- **WATER LEVEL CONTOUR (masl)**

DRAWING	GROUNDWATER ELEVATION CONTOUR PLAN
CLIENT	CAIVAN (PERTH GC) LIMITED
PROJECT	PROPOSED DEVELOPMENT PERTH GOLF COURSE 151 PETER STREET PERTH, ONTARIO
DRAWN BY: S.L.	CHECKED BY: W.A.M.
PROJECT NO.: 100737.002	REVISION NO.: 3
DATE: FEBRUARY 2023	FIGURE NO.: **FIGURE 3**

GEMTEC
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APPENDIX A

Record of Borehole Logs – Current Investigation
List of Abbreviations and Symbols
22-201 to 22-203, 22-205 to 22-216, and 22-218 to 22-230

RECORD OF BOREHOLE 22-201

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

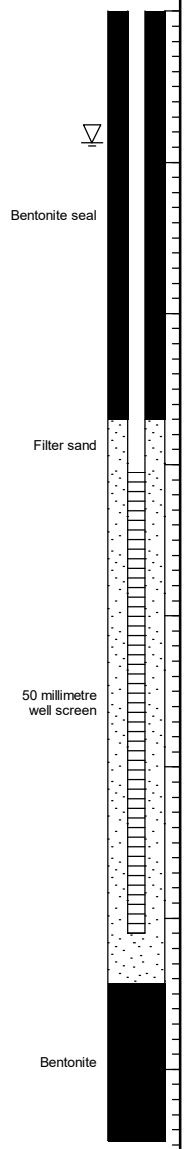
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 18 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface	136.00				
0		TOPSOIL	0.10				
		Loose, brown SILTY SAND		1	SS	150	5
			135.24				
		Very loose to compact, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	0.76	2	SS	305	2
1							
				3	SS	280	18
2							
				4	SS	255	16
	Power Auger / Hollow Stem Auger (210mm OD)		133.10				
3		Compact to very dense, grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	2.90				
				5	SS	150	>50 for 100mm
4							
				6	SS	125	>50 for 100mm
5							
				7	SS	230	>50 for 180mm
6			129.57				
	Diamond Rotary Core / HQ (89mm OD)	Slightly weathered to fresh, fine grained, medium strong, greenish grey to pinkish grey Precambrian BEDROCK	6.43	8	RC		TCR = 98%; SCR = 89%; RQD = 89%
7			128.53				
		End of Borehole	7.47				
8							
9							
10							

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.9 ▽	135.1

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-202

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 14 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		135.65						
		TOPSOIL		0.10						
		Very loose, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	150	2		
1					2	SS	255	2		
				134.13						
		Compact to very dense, grey SILTY SAND, some clay, trace gravel, with cobbles and boulders (GLACIAL TILL)		1.52	3	SS	455	18		
2					4	SS	75	>50 for 130 mm		
3					5	SS	255	>50 for 130 mm	MH	Native backfill
4					6	SS	280	>50 for 100 mm		
					7	SS	150	>50 for 100 mm		
5					8	SS	75	>50 for 150 mm		
6					9	SS	205	>50 for 75 mm		
7					10	SS	180	>50 for 75 mm		
		End of Borehole Auger Refusal		128.16 7.49						
8										
9										
10										

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

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LOGGED: CS
CHECKED: WAM

RECORD OF BOREHOLE 22-203

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 18 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		135.91							
	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		0.08							
		Loose to very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	330	7	●		Native backfill
					2	SS	75	>50 for 75 mm	▲		
1		End of Borehole Auger Refusal		134.92 0.99							
2											
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

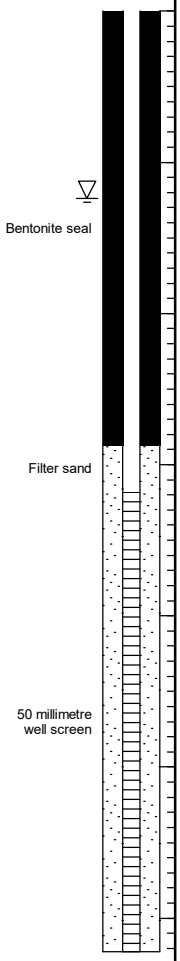
RECORD OF BOREHOLE 22-203A

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 20 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Wash Casing HW (114mm OD)	Ground Surface	135.91							
		TOPSOIL	0.08							
		Brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	135.15							
1	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, greenish grey to pink Precambrian BEDROCK	0.76	1	RC		TCR = 100%; SCR = 37%; RQD = 0%			
2				2	RC		TCR = 100%; SCR = 91%; RQD = 91%			
3				3	RC		TCR = 100%; SCR = 87%; RQD = 95%			
4				4	RC		TCR = 98%; SCR = 60%; RQD = 60%			
5				5	RC		TCR = 100%; SCR = 100%; RQD = 88%			
6		End of Borehole	129.69 6.22							
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	1.2 ▽	134.7

GEMTEC
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LOGGED: BWW
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-205

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

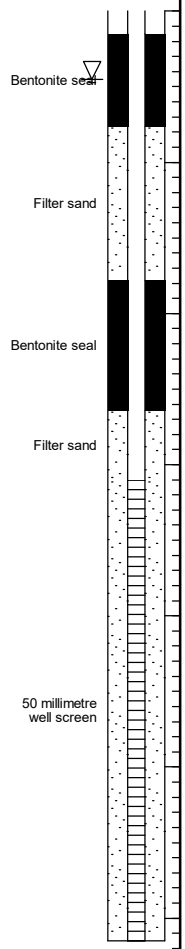
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 10 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0		Ground Surface		135.32				
		TOPSOIL		0.10				
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			1	SS	355	4
				134.56				
1	Power Auger / Hollow Stem Auger (210mm OD)	Compact to very dense, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		0.76	2	SS	100	20
					3	SS	510	20
2					4	SS	405	26
3					5	SS	455	81
4					6	SS	455	84
5					7	SS	455	77
					8	SS	510	82
6				129.17	9	SS	50	>50 for 50 mm
		End of Borehole Auger Refusal		6.15				
7								
8								
9								
10								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.5 ▽	134.9

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Consulting Engineers and Scientists

LOGGED: CS/ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-206

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 20 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		136.26				
0	Power Auger Hollow Stem Auger (210mm OD)	Very loose to loose, dark brown to brown silty sand, some gravel (FILL MATERIAL)			1	SS	330	4
				135.50 / 0.76				
1		Loose to compact, grey brown SILTY SAND, trace to some gravel, with cobbles and boulders (GLACIAL TILL)			2	SS	455	5
					3	SS	355	10
2				133.97 / 2.29				
		Very dense, grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			4	SS	610	57
3					5	SS	405	>50 for 130 mm
4	Wash Casing HW (114mm OD)				6	RC	150	DD
					7	SS	50	>50 for 75 mm
					8	RC	255	DD
5					9	RC	150	DD
6					10	RC	75	DD
					11	SS	125	>50 for 50 mm
7					12	RC	75	DD
					13	SS	150	>50 for 75 mm
8				128.28 / 7.98				
		End of Borehole Sampler Refusal						
9								
10								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Native backfill

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LOGGED: BWW/CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-207

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 12 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		135.04						
0		TOPSOIL		134.91						
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		0.13	1	SS	100	9		
				134.28						
1	Power Auger Hollow Stem Auger (210mm OD)	Loose to very dense, brown SILTY SAND, some clay and gravel, with cobbles and boulders (GLACIAL TILL)		0.76	2	SS	510	8		
					3	SS	455	13	MH	Native backfill
2					4	SS	50	10		
3					5	SS	180	>50 for 50 mm		
				131.69						
		End of Borehole Auger Refusal		3.35						
4										
5										
6										
7										
8										
9										
10										

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-208

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 12 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger	Ground Surface		137.48							
		TOPSOIL		0.08	1	SS	100	>50			
	Hollow Stem Auger (210mm OD)	Very dense, brown SILTY SAND, with organics		137.18							
		Slightly weathered to fresh, fine grained, very strong, pinkish grey Precambrian BEDROCK		0.30							
1	Diamond Rotary Core HQ (89mm OD)				2	RC		TCR = 100%; SCR = 63%; RQD = 67%			Bentonite seal
2					3	RC		TCR = 95%; SCR = 43%; RQD = 59%			Filter sand
3											
4					4	RC		TCR = 100%; SCR = 86%; RQD = 86%			50 millimetre well screen
5					5	RC		TCR = 100%; SCR = 96%; RQD = 96%			
6				131.41							
		End of Borehole		6.07							
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	2.7 ▽	134.8

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-209

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 14 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		137.24				
0	Power Auger Stem Auger (210mm OD)	TOPSOIL		137.09				
		Loose to compact, brown SILTY SAND, trace to some gravel, with cobbles and boulders (GLACIAL TILL)		0.15	1	SS	355	8
1					2	SS	330	12
	Hollow	End of Borehole Auger Refusal		135.97 1.27				

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA
NATURAL REMOULDED
WATER CONTENT, %
W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Native backfill

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

RECORD OF BOREHOLE 22-210

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 14 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		135.67							
		TOPSOIL		0.10							
		Very loose, brown SILTY SAND, trace to some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	150	3			
1					2	SS	125	3			
2					3	SS	355	2			Native backfill
					4	SS	405	1			
3					5	SS	50	>50 for 100 mm			
				132.47							
		End of Borehole Auger Refusal		3.20							
4											
5											
6											
7											
8											
9											
10											

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-211

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 12 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		134.84							
	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		134.71							
		Very loose to very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		0.13	1	SS	125	2	●		Native backfill
				133.93	2	SS	100	>50 for 150 mm			
1		End of Borehole Auger Refusal		0.91							
2											
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m ●
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m ▲
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-212

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 11 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		136.57							
		TOPSOIL		0.08							
		Very loose, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	430	3	●		
				135.96							
		Dense, brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		0.61							
1					2	SS	535	34	●		Native backfill
					3	SS	510	45	●		
				134.61							
2		End of Borehole Auger Refusal		1.96							
3											
4											
5											
6											
7											
8											
9											
10											

10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-213

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 11 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		137.20							
		TOPSOIL		0.10							
		Loose to very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	305	8	●		Native backfill
1					2	SS	50	6	●		
					3	SS	330	>50 for 75 mm			
2				134.99							
		End of Borehole Auger Refusal		2.21							
3											
4											
5											
6											
7											
8											
9											
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS/ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-214

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

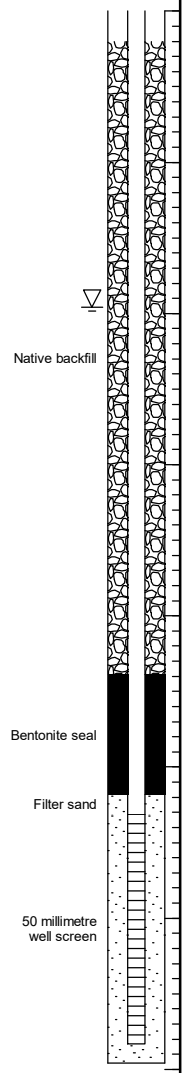
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 5 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface	137.92				
		TOPSOIL	0.08				
		Brown SILTY SAND		1	SS	480	8
			137.16				
1		Loose, grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	0.76	2	SS	305	7
				3	SS	430	9
2			135.63				
		Compact to very dense, grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	2.29	4	SS	455	29
3				5	SS	280	59
4				6	SS	535	68
				7	SS	180	>50 for 50 mm
			133.27				
	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, red to grey Precambrian BEDROCK	4.65	8	SS		TCR = 100%; SCR = 84%; RQD = 68%
5							
6				9	SS		TCR = 84%; SCR = 64%; RQD = 75%
			130.96				
7		End of Borehole	6.96				
8							
9							
10							

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	2.0 ▽	136.0

GEMTEC
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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-214A

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 6 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		137.80							
		TOPSOIL		0.08							
		Brown SILTY SAND			1	SS	150	-			
				137.04							
1		Grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		0.76	2	SS	455	-			Native backfill
2					3	SS	305	-			
				135.59							
		End of Borehole Auger Refusal		2.21							
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

RECORD OF BOREHOLE 22-214B

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 6 2022

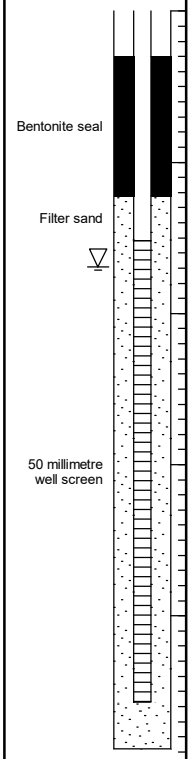
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface	137.80				
		TOPSOIL	0.08				
		Brown SILTY SAND	137.04				
1		Grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	0.76				
2			135.59				
		Grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	2.21	4	SS	355	-
3				5	SS	355	-
4				6	SS	405	-
				7	SS	305	-
5		End of Borehole Auger Refusal Soil stratigraphy from 0.00 to 2.21 metres was inferred from Borehole 22-214A	132.92 4.88				
6							
7							
8							
9							
10							

SOIL PROFILE | STRATA PLOT | SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	1.7 ▽	136.1

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-215

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 6 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface	135.25						
0	Power Auger Hollow Stem Auger (108mm OD)	TOPSOIL	0.05						
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)	134.64	1	SS	230	4		
		Very loose, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	0.61						
1				2	SS	405	3		
		Dense to very dense, some gravel, with cobbles and boulders (GLACIAL TILL)	133.88 1.37						
2				3	SS	455	35		
			132.81	4	SS	75	>50 for 150 mm		
		End of Borehole Auger Refusal	2.44						
3									
4									
5									
6									
7									
8									
9									
10									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

Native backfill

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-216

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 6 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface	134.58							
	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL	0.03							
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)	133.97	1	SS	405	3	●		
		Very loose, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	0.61 133.56	2	SS	50	1	●		
1	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, greenish grey to pink Precambrian BEDROCK	1.02	3	RC		TCR = 100%; SCR = 0%; RQD = 57%			Bentonite seal
2				4	RC		TCR = 94%; SCR = 69%; RQD = 74%			Filter sand
3				5	RC		TCR = 100%; SCR = 96%; RQD = 96%			
4										50 millimetre well screen
5				6	RC		TCR = 95%; SCR = 88%; RQD = 88%			
			128.79							
6		End of Borehole	5.79							
7										
8										
9										
10										

10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.7 ▽	133.9

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS/ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-218

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 5 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		135.96							
		TOPSOIL		0.05							
		Stiff to very stiff, grey brown SILTY CLAY, with roots (WEATHERED CRUST)			1	SS	205	6	●		Native backfill
				135.38							
		End of Borehole Auger Refusal		0.58							
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-219

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 5 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		136.84							
		TOPSOIL		0.08							
	Power Auger Hollow Stem Auger (210mm OD)	Loose to compact, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	180	5	●		Native backfill
1					2	SS	230	20	●		
				135.32							
		Compact to very dense, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		1.52	3	SS	280	19	●		
2					4	SS	455	65	●		
3					5	SS	405	84	●		
				133.31							
		End of Borehole Auger Refusal		3.53							
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-220

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 7 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		137.53							
	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.10							
		Loose, brown SILTY SAND, trace gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	455	9			
1					2	SS	480	9			Native backfill
				136.01							
		Loose to very dense, brown SILTY CLAYEY SAND, trace gravel, with cobbles and boulders (GLACIAL TILL)		1.52	3	SS	405	5		MH	
2					4	SS	100	>50 for 100 mm			
				134.96							
		End of Borehole Auger Refusal		2.57							
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS/ML
CHECKED: WAM

RECORD OF BOREHOLE 22-221

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 12 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Stem Auger (210mm OD)	Ground Surface	134.63							
		TOPSOIL	134.50							
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)	0.13	1	SS	255	2	●		
1		Very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	134.02 0.61	2	SS	75	>50			
	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, medium to very strong, pinkish grey Precambrian BEDROCK	133.44 1.19	3	RC		TCR = 50%; SCR = 50%; RQD = 50%			Bentonite seal
2				4	RC		TCR = 97%; SCR = 85%; RQD = 88%			
3				5	RC		TCR = 100%; SCR = 93%; RQD = 35%			Filter sand
4										
5				6	RC		TCR = 100%; SCR = 95%; RQD = 91%			50 millimetre well screen
6			128.33	7	RC		TCR = 100%; SCR = 100%; RQD = 100%			
		End of Borehole	6.30							
7										
8										
9										
10										

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.5 ▽	134.2

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

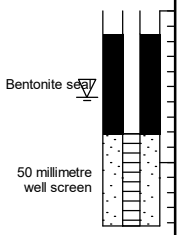
RECORD OF BOREHOLE 22-221A

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 12 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		134.72							
		TOPSOIL		134.59							
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		0.13 / 134.11							
1		Very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		0.61 / 133.30							
		End of Borehole Soil stratigraphy from 0.00 to 1.42 metres inferred from Borehole 22-221		1.42							
2											
3											
4											
5											
6											
7											
8											
9											
10											

10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.6 ▽	134.1

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-222

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 13 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface	135.63							
		TOPSOIL	0.10							
		Loose to very loose, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		1	SS	150	9			
1				2	SS	380	3			
			134.46							
	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, light grey to pinkish grey Precambrian BEDROCK	1.17	3	RC		TCR = 69%; SCR = 44%; RQD = 25%			
2				4	RC		TCR = 100%; SCR = 96%; RQD = 86%			
3										
			132.05	5	RC		TCR = 100%; SCR = 93%; RQD = 93%			
		Slightly weathered to fresh, fine grained, very strong, greyish pink to light pink Precambrian BEDROCK	3.58							
4										
5				6	RC		TCR = 98%; SCR = 51%; RQD = 71%			
				7	RC		TCR = 100%; SCR = 6%; RQD = 0%			
6			129.53							
		End of Borehole	6.10							
7										
8										
9										
10										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

Filter sand
Bentonite seal
Filter sand
50 millimetre well screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	1.1 ▽	134.5

GEMTEC
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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-222A

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 13 2022

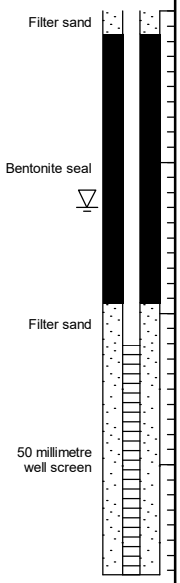
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)
0	Power Auger	Ground Surface	135.73
		TOPSOIL	0.10
	Hollow Stem Auger (210mm OD)	Loose to very loose, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	
1			134.56
	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, light grey to pinkish grey Precambrian BEDROCK	1.17
2			
3			132.15
		Slightly weathered to fresh, fine grained, very strong, greyish pink to light pink Precambrian BEDROCK	3.58
			3.73
4		End of Borehole Soil and bedrock stratigraphy from 0.00 to 3.73 metres inferred from Borehole 22-222	
5			
6			
7			
8			
9			
10			

SOIL PROFILE | STRATA PLOT | SAMPLES: NUMBER, TYPE, RECOVERY, mm, BLOWS/0.3m

● PENETRATION RESISTANCE (N), BLOWS/0.3m
▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	1.3 ▽	134.4

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-223

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 2
DATUM: CGVD28
BORING DATE: Jan 25 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		134.62							
		TOPSOIL		134.47							
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		0.15	1	SS	405	8			
1					2	SS	355	8			
				133.33	3	RC			TCR = 83%; SCR = 83%; RQD = 0%		
		Slightly weathered to fresh, fine grained, pink and grey Precambrian BEDROCK		1.29							
2	Diamond Rotary Core HQ (89mm OD)				4	RC			TCR = 100%; SCR = 100%; RQD = 100%		
3					5	RC			TCR = 100%; SCR = 93%; RQD = 90%		
4					6	RC			TCR = 97%; SCR = 97%; RQD = 97%		Bentonite seal
5					7	RC			TCR = 100%; SCR = 97%; RQD = 97%		
6					8	RC			TCR = 85%; SCR = 14%; RQD = 14%		
7					9	RC			TCR = 90%; SCR = 67%; RQD = 73%		
8				126.67							
		Fresh, fine grained, pink and greenish grey Precambrian BEDROCK		7.95	10	RC			TCR = 97%; SCR = 78%; RQD = 78%		
9					11	RC			TCR = 100%; SCR = 90%; RQD = 90%		50 millimetre well screen
10				124.62							

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-223

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 2 OF 2
DATUM: CGVD28
BORING DATE: Jan 25 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		Fresh, fine grained, pink and greenish grey Precambrian BEDROCK		10.00							50 millimetre well screen
11					12	RC		TCR = 97%; SCR = 86%; RQD = 80%			
12				122.53	13	RC		TCR = 100%; SCR = 22%; RQD = 0%			
		End of Borehole		12.09							
13											
14											
15											
16											
17											
18											
19											
20											

10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.3 ▽	134.3

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-224

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 5 2022

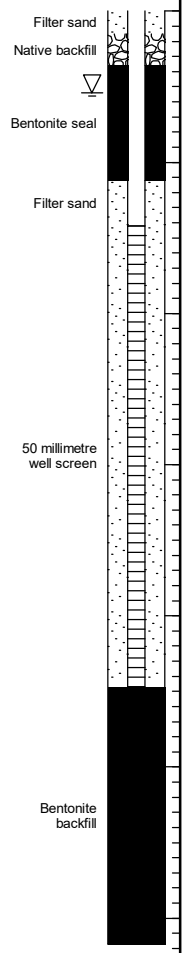
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0		Ground Surface		135.64				
	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.08				
		Very loose, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	255	4
1					2	SS	150	4
				134.12				
		Compact to very dense, grey brown to grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		1.52	3	SS	150	13
2					4	SS	405	22
3					5	SS	380	>50
4					6	SS	330	39
				131.19				
	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, pinkish grey Precambrian BEDROCK		4.45	7	RC		TCR = 43%; SCR = 43%; RQD = 0%
5					8	RC		TCR = 100%; SCR = 100%; RQD = 88%
6				129.47				
		End of Borehole		6.17				
7								
8								
9								
10								

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.5 ▽	135.1

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LOGGED: CS/ML
CHECKED: WAM

RECORD OF BOREHOLE 22-225

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 4 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Stem Auger (210mm OD)	Ground Surface	134.94							
		TOPSOIL	134.79							
		Loose, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)	0.15	1	SS	205	6	●		
1				2	SS	150	5	●		
	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, pinkish grey Precambrian BEDROCK	133.72 1.22	3	RC		TCR = 95%; SCR = 82%; RQD = 45%			
2				4	RC		TCR = 98%; SCR = 96%; RQD = 86%			
3				5	RC		TCR = 100%; SCR = 86%; RQD = 66%			
4										
5				6	RC		TCR = 98%; SCR = 85%; RQD = 66%			
6		End of Borehole	128.92 6.02							
7										
8										
9										
10										

SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

Bentonite seal
Filter sand
50 millimetre well screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.8 ▽	134.1

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

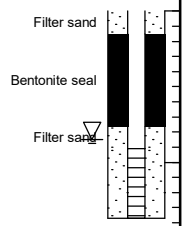
RECORD OF BOREHOLE 22-225A

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 4 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		134.97							
		TOPSOIL		134.82 / 0.15							
1		Loose, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		133.60 / 1.37							
		End of Borehole Auger Refusal Soil and bedrock stratigraphy from 0.00 to 1.37 metres inferred from Borehole 22-225									
2											
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	0.9 ▽	134.1

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-226

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 5 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		135.59							
	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.08							
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			1	SS	305	5	●		
1					2	SS	610	10	●		
2					3	SS	610	3	●		Native backfill
				133.30							
		Compact to very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		2.29	4	SS	25	21	●		
3					5	SS	75	>50 for 75 mm			
				132.24							
		End of Borehole Auger Refusal		3.35							
4											
5											
6											
7											
8											
9											
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-227

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 26 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		137.56							
	Power Auger / Hollow Stem Auger (210mm OD)	TOPSOIL		137.38							
		Compact to very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		0.18	1	SS	355	14	● at 14		Native backfill
					2	SS	150	>50 for 100 mm			
1		End of Borehole Auger Refusal		136.59 0.97							
2											
3											
4											
5											
6											
7											
8											
9											
10											

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-228

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 2
DATUM: CGVD28
BORING DATE: Jan 28 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		138.48							
	Power Auger	TOPSOIL		0.10							
	Auger (210mm OD)	Compact to very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)			1	SS	255	16	●		Native backfill
				137.54	2	SS	100	>50 for 75 mm			
1	Hollow Stem	Slightly weathered to fresh, fine grained, very strong, pinkish grey Precambrian BEDROCK		0.94	3	RC		TCR = 100%; SCR = 77%; RQD = 69%			
					4	RC		TCR = 100%; SCR = 19%; RQD = 0%			
					5	RC		TCR = 94%; SCR = 17%; RQD = 0%			
2					6	RC		TCR = 100%; SCR = 53%; RQD = 67%			
					7	RC		TCR = 92%; SCR = 61%; RQD = 61%			
3					8	RC		TCR = 100%; SCR = 74%; RQD = 54%			
					9	RC		TCR = 80%; SCR = 70%; RQD = 70%			
4					10	RC		TCR = 100%; SCR = 65%; RQD = 65%			Bentonite seal
					11	RC		TCR = 97%; SCR = 69%; RQD = 38%			
5					12	RC		TCR = 100%; SCR = 95%; RQD = 95%			
					13	RC		TCR = 100%; SCR = 68%; RQD = 65%			
6	Diamond Rotary Core				14	RC		TCR = 100%; SCR = 17%; RQD = 0%			
	HQ (89mm OD)				15	RC		TCR = 100%; SCR = 100%; RQD = 100%			
7					16	RC		TCR = 96%; SCR = 94%; RQD = 94%			
					17	RC		TCR = 97%; SCR = 43%; RQD = 37%			Filter sand
8					18	RC		TCR = 100%; SCR = 63%; RQD = 41%			
					19	RC		TCR = 100%; SCR = 0%; RQD = 0%			50 millimetre well screen
9											
10				128.48							

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-228

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 2 OF 2
DATUM: CGVD28
BORING DATE: Jan 28 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		Slightly weathered to fresh, fine grained, very strong, pinkish grey Precambrian BEDROCK		10.00	20	RC		TCR = 100%; SCR = 55%; RQD = 61%			50 millimetre well screen
11					21	RC		TCR = 100%; SCR = 57%; RQD = 33%			
					22	RC		TCR = 100%; SCR = 36%; RQD = 36%			
12					23	RC		TCR = 100%; SCR = 38%; RQD = 50%			
				126.14							
		End of Borehole		12.34							
13											
14											
15											
16											
17											
18											
19											
20											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	4.1 ▽	134.3

GEMTEC
Consulting Engineers and Scientists

LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-228A

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Feb 2 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger Auger (210mm OD)	Ground Surface		138.45				
		TOPSOIL		0.10				
		Compact to very dense, brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		137.51				
1	Hollow Stem Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, fine grained, very strong, pinkish grey Precambrian BEDROCK		0.94				
		End of Borehole Soil and bedrock stratigraphy from 0.00 to 7.65 metres inferred from Borehole 22-228		130.80 7.65				

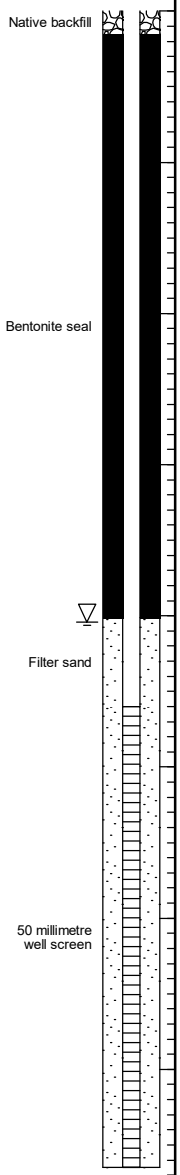
SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L

10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/02/09	4.0 ▽	134.4

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-229

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 4 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		135.59							
0	Power Auger Hollow Stem Auger (210mm OD)	TOPSOIL		0.05							
		Loose, brown silty sand, some gravel (FILL MATERIAL)			1	SS	50	6			
1					2	SS	405	5			Native backfill
					3	SS	355	>50 for 150 mm			
2				133.48							
		End of Borehole Auger Refusal		2.11							
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-230

CLIENT: Caivan Communities
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 4 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		134.95							
		TOPSOIL		0.08							
		Compact, brown silty sand, some gravel (FILL MATERIAL)		134.34	1	SS	230	18			
		Loose, dark brown silty sand, with organics (FILL MATERIAL)		0.61							
1		Loose, grey brown silty sand (FILL MATERIAL)		134.04							
				0.91	2	SS	455	5			
					3	SS	150	5			
2											Native backfill
		Loose to very dense, grey brown SILTY SAND, some clay, trace gravel, with cobbles and boulders (GLACIAL TILL)		132.66							
				2.29	4	SS	455	10		MH	
3					5	SS	610	16			
					6	SS	255	>50 for 150 mm			
4		End of Borehole Auger Refusal		130.91 4.04							
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: CS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_BOREHOLE LOGS.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-231

CLIENT: Caivan Communities
PROJECT: Geotechnical and Hydrological Investigation, Proposed Residential Development, Perth golf Course
JOB#: 100737.002
LOCATION: 141 Peter Street, Perth

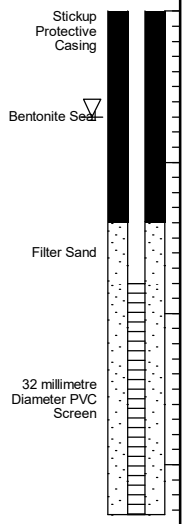
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Mar 15 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		136.54				
0	Portable Drill Rig, Open Borehole	Loose, black to dark brown fibrous PEAT		136.26	1	SS	430	3
		Stiff to very stiff, grey brown SILTY CLAY, trace sand (WEATHERED CRUST)		0.28	2	SS	610	6
1					3	SS	560	9
					4	SS	455	10
2				134.18	5	SS	355	41
		Dense, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		2.36	6	SS	0	>50 for 125mm
3					7	RC	5	DD
				133.19	8	RC	0	DD
		End of Borehole		3.35				
4								
5								
6								
7								
8								
9								
10								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/10/15	0.7 ▽	135.8

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LOGGED: PS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_V01_2022-03-28.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-231A

CLIENT: Caivan Communities
PROJECT: Geotechnical and Hydrological Investigation, Proposed Residential Development, Perth golf Course
JOB#: 100737.002
LOCATION: 141 Peter Street, Perth

SHEET: 1 OF 2
DATUM: CGVD28
BORING DATE: Mar 16 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		136.03							
		Black to dark brown, fibrous PEAT		135.75							
		Grey to brown, SILTY CLAY, trace sand (WEATHERED CRUST)		0.28							
1											
2				133.67							
		Grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		2.36							
				133.18							
3	Wash Casing NQ (70mm OD)	Probable SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		2.85	1	RC	205	DD			Stickup Protective Casing
					2	RC	75	DD			
					3	RC	155	DD			
4					4	RC	0	DD			Native backfill
					5	RC	75	DD			
					6	SS	0	>50 for 25mm			
5					7	RC	815	DD			
6					8	RC	155	DD			
7				128.95	9	SS	0	>50 for 100mm			
		Slightly weathered to fresh, fine grained pink to grey Precambrian BEDROCK		7.08	10	RC		TCR 76%, SCR 35%, RQD 11%			Bentonite Seal
8	Diamond Rotary Core NQ (70mm OD)				11	RC		TCR 89%, SCR 44%, RQD 0%			
9				127.03							Filter Sand
		Slightly weathered to fresh, fine grained pink to grey Precambrian BEDROCK		9.00	12	RC	915	TCR 57%, SCR 16%, RQD 0%			
10											

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LOGGED: PS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_V01_2022-03-28.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-231A

CLIENT: Caivan Communities
PROJECT: Geotechnical and Hydrological Investigation, Proposed Residential Development, Perth golf Course
JOB#: 100737.002
LOCATION: 141 Peter Street, Perth

SHEET: 2 OF 2
DATUM: CGVD28
BORING DATE: Mar 16 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, mm	SAMPLES: BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10				125.62	13	RC	75	TCR 37%, SCR 25%, RQD 0%			Filter Sand 32 millimetre Diameter PVC Screen 32 millimetre Diameter PVC Screen
		End of Borehole		10.41							
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/10/15	0.8 ▽	135.3

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LOGGED: PS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_V01_2022-03-28.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-232

CLIENT: Caivan Communities
PROJECT: Geotechnical and Hydrological Investigation, Proposed Residential Development, Perth golf Course
JOB#: 100737.002
LOCATION: 141 Peter Street, Perth

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Mar 25 2022

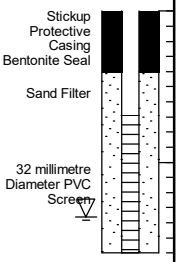
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		138.44				
0	Portable Drill Rig, Open Borehole	Black fibrous PEAT		0.07				
		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)			1	SS	280	3
					2	SS	460	9
1					3	SS	460	23
				136.84				
		End of Borehole Sampler Refusal		1.60				
2								
3								
4								
5								
6								
7								
8								
9								
10								

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA
NATURAL REMOULDED
WATER CONTENT, %
W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/10/17	1.4 ▽	137.1

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Consulting Engineers and Scientists

LOGGED: PS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_V01_2022-03-28.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-232A

CLIENT: Caivan Communities
PROJECT: Geotechnical and Hydrological Investigation, Proposed Residential Development, Perth golf Course
JOB#: 100737.002
LOCATION: 141 Peter Street, Perth

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Mar 23 2022

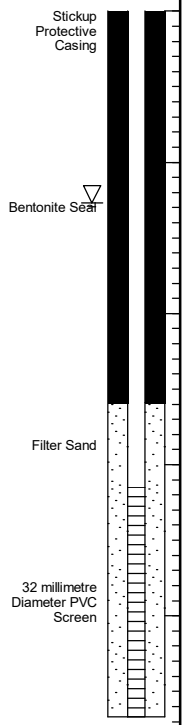
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
		Ground Surface		139.33				
0	Portable Drill Rig, Open Borehole	Black fibrous PEAT		138.77	1	SS	205	4
1	Portable Drill Rig, Open Borehole	Stiff to very stiff, grey to brown SILTY CLAY, some sand (WEATHERED CRUST)		137.71	2	SS	610	12
					3	SS	355	23
2	Diamond Rotary Core, NQ (70mm OD)	Slightly weathered to fresh, fine grained pink to grey Precambrian BEDROCK		1.62	4	RC		TCR 97%, SCR 92%, RQD 92%
					5	RC		TCR 97%, SCR 93%, RQD 93%
3					6	RC		TCR 100%, SCR 75%, RQD 67%
					7	RC		TCR 100%, SCR 97%, RQD 97%
					8	RC		TCR 100%, SCR 96%, RQD 75%
4					9	RC		TCR 98%, SCR 91%, RQD 84%
		End of Borehole		134.66 4.67				
5								
6								
7								
8								
9								
10								

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/10/17	1.3 ▽	138.1

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LOGGED: PS
CHECKED: WAM

GEO - BOREHOLE LOG 100737.002_GINT_V01_2022-03-28.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-233A

CLIENT: Caivan (Perth G.C.) Limited
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Oct 6 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, mm	SAMPLES: BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		134.85							
		Unsampled Overburden									Native backfill
3		End of Borehole, Auger Refusal		131.98 / 2.87							

10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: W.A.M.

GEO - BOREHOLE LOG 100737.002_GINT_2022-10-13.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-233B

CLIENT: Caivan (Perth G.C.) Limited
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Oct 6 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		134.94					10 20 30 40 50 60 70 80 90		Flush Mount
		Unsampled Overburden									Bentonite seal
1											Native backfill
2											Bentoniteseal
											Filter Sand
3											
4											
											50 mm diameter well screen
5											
				129.07							
6		End of Borehole, Auger Refusal		5.87							
7											
8											
9											
10											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/10/14	1.0 ▽	133.9

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: W.A.M.

GEO - BOREHOLE LOG 100737.002_GINT_2022-10-13.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-234

CLIENT: Caivan (Perth G.C.) Limited
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Oct 5 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (260mm OD)	Ground Surface		134.43				
		Unsampled Overburden						
2				132.14				
	Air Rotary, 98.4 mm diameter	Probable Bedrock		2.29				
7				127.57				
		End of Borehole		6.86				

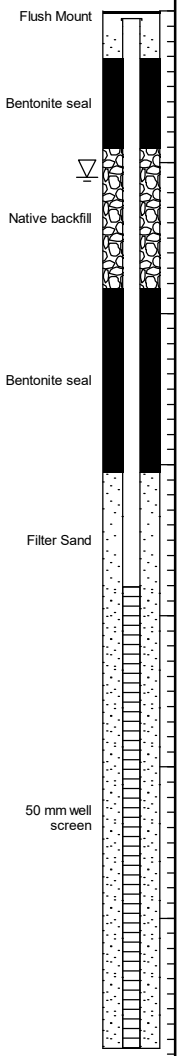
SOIL PROFILE | SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L

10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/10/14	1.1 ▽	133.3

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LOGGED: A.N.
CHECKED: W.A.M.

GEO - BOREHOLE LOG 100737.002_GINT_2022-10-13.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-235

CLIENT: Caivan (Perth G.C.) Limited
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Oct 6 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		134.25				
		Unsampled Overburden						
1				132.93				
	Air Rotary 98.4 mm diameter	Probable Bedrock		1.32				
2								
3								
4								
5								
6				128.15				
		End of Borehole		6.10				
7								
8								
9								
10								

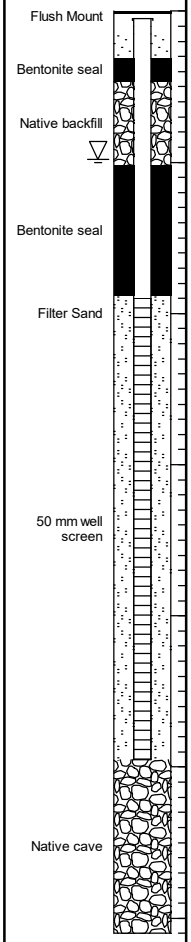
SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L

10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
22/10/14	1.0 ▽	133.3

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: W.A.M.

GEO - BOREHOLE LOG 100737.002_GINT_2022-10-13.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-106

CLIENT: Caivan (Perth G.C.) Limited
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Oct 5 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		136.50							
		Unsampled Overburden		136.14							Native backfill
1		End of Borehole, Auger Refusal		0.36							
2											
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: A.N.
CHECKED: W.A.M.

GEO - BOREHOLE LOG 100737.002_GINT_2022-10-13.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-107

CLIENT: Caivan (Perth G.C.) Limited
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Oct 5 2022

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, mm	SAMPLES: BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger / Hollow Stem Auger (210mm OD)	Ground Surface		135.38					10 20 30 40 50 60 70 80 90		
		Unsampled Overburden									Native backfill
1											
2				132.71							
		End of Borehole, Auger Refusal		2.67							
3											
4											
5											
6											
7											
8											
9											
10											

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LOGGED: A.N.
CHECKED: W.A.M.

GEO - BOREHOLE LOG 100737.002_GINT_2022-10-13.GPJ GEMTEC 2018.GDT 12/14/22

RECORD OF BOREHOLE 22-108

CLIENT: Caivan (Perth G.C.) Limited
PROJECT: Proposed Residential Development, Perth Golf, 141 Peter Street, Perth, Ontario
JOB#: 100737.002
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Oct 5 2022

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		137.40					10 20 30 40 50 60 70 80 90		
		Unsampled Overburden									Native backfill
3				134.22							
		End of Borehole, Auger Refusal		3.18							
10											

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LOGGED: A.N.
CHECKED: W.A.M.

GEO - BOREHOLE LOG 100737.002_GINT_2022-10-13.GPJ GEMTEC 2018.GDT 12/14/22

APPENDIX B

Laboratory Test Results
Grain Size Distribution Testing

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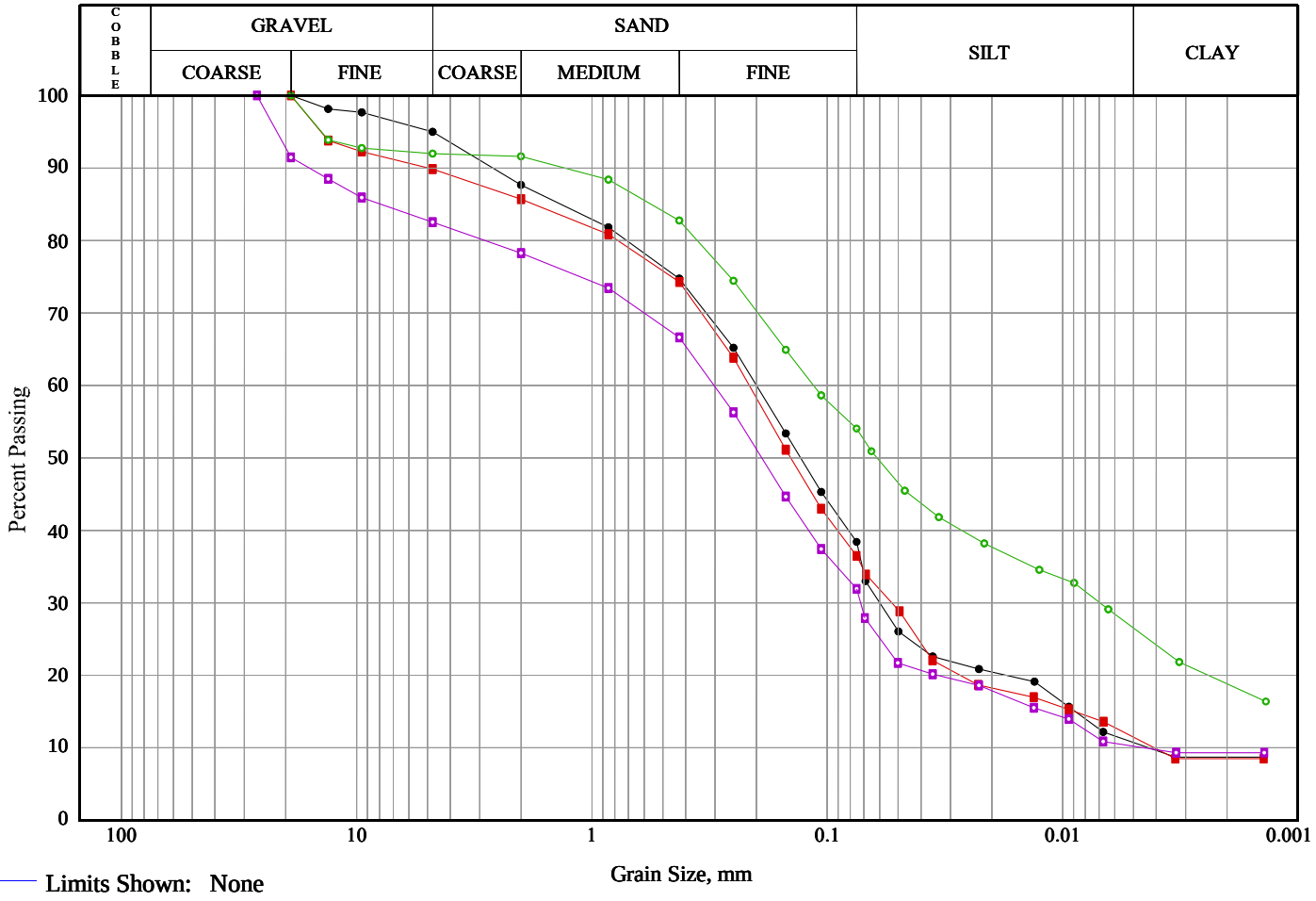
Client:	Caivan Communities
Project:	Geotechnical and Hydrogeological Investigation, Propose
Project #:	100737002

Soils Grading Chart (T88)



Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●	GLACIAL TILL	22-202	SS 5	3.05-3.48	5.0	56.6	27.7	10.7
■	GLACIAL TILL	22-207	SS 3	1.52-2.13	10.2	53.4	25.0	11.5
○	GLACIAL TILL	22-220	SS 3	1.52-2.13	8.0	38.0	27.5	26.5
□	GLACIAL TILL	22-224	SS 4	2.29-2.90	17.5	50.6	21.7	10.2

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Silty sand , some clay , trace gravel	N/A	0.00	0.01	0.06	0.13	0.20	1.36	27.7
■	Silty sand , some gravel, some clay	N/A	0.00	0.01	0.05	0.14	0.21	1.77	25.0
○	Silty clayey sand , trace gravel	N/A	---	---	0.01	0.06	0.11	0.56	27.5
□	Silty sand , some gravel, some clay	N/A	0.00	0.01	0.07	0.19	0.30	7.89	21.7

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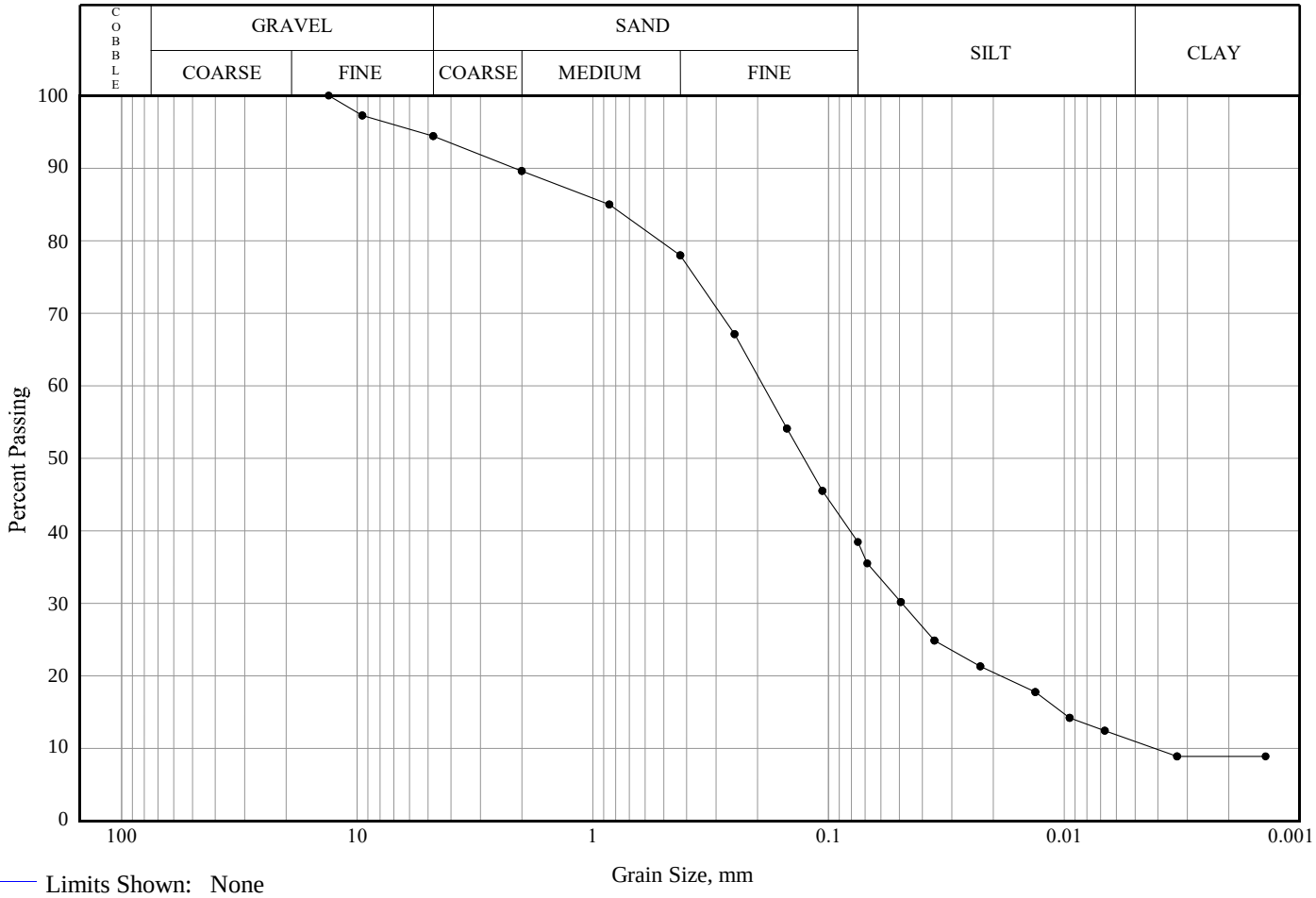
Client:	Caivan Communities
Project:	Geotechnical and Hydrogeological Investigation, Propose
Project #:	100737002

Soils Grading Chart (T88)



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
—●—	GLACIAL TILL	22-230	SS 4	2.29-2.90	5.6	56.0	27.5	10.9

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
—●—	Silty sand , some clay , trace gravel	N/A	0.00	0.01	0.05	0.13	0.19	0.85	27.5

APPENDIX C

Bedrock Core Photographs
Figures C1 to C12
Unconfined Compressive Strength Results

BOREHOLE 22-201
BORING DATE: JANUARY 19, 2022
DEPTH: 6.43 **to** 7.47 **mbgs**

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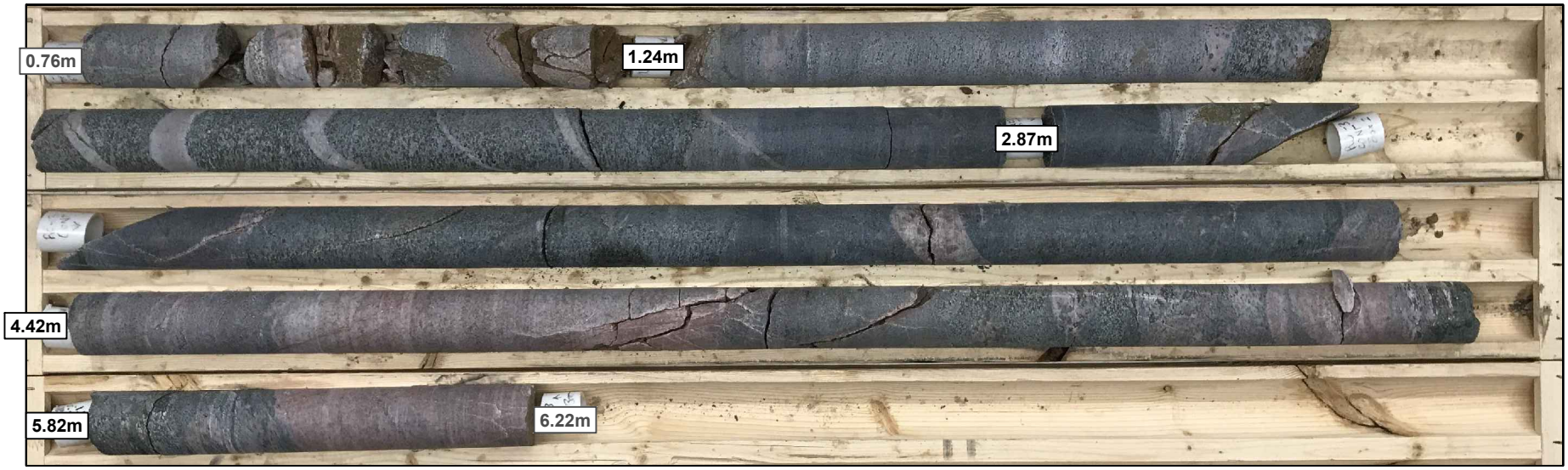
Project
PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C1

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-201

BOREHOLE 22-203A
BORING DATE: JANUARY 20, 2022
DEPTH: 0.76 **to** 6.22 **mbgs**



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PERTH, ONTARIO

FIGURE C2

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-203A

BOREHOLE 22-206
BORING DATE: JANUARY 25, 2022
DEPTH: 3.81 **to** 7.59 **mbgs**

Note:
The material in the core box from 3.81 to 7.59 metres depth is gravel and cobbles from within the glacial till

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PERTH, ONTARIO

FIGURE C3

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-206

BOREHOLE 22-208
BORING DATE: JANUARY 13, 2022
DEPTH: 0.30 **to** 6.07 **mbgs**

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PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C4

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-208

BOREHOLE 22-214
BORING DATE: JANUARY 6, 2022
DEPTH: 4.65 **to** 6.96 **mbgs**

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PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C5

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-214

BOREHOLE 22-216
BORING DATE: JANUARY 10, 2022
DEPTH: 1.02 **to** 5.79 **mbgs**

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PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C6

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-216

BOREHOLE 22-221
BORING DATE: JANUARY 12, 2022
DEPTH: 1.19 **to** 6.30 **mbgs**

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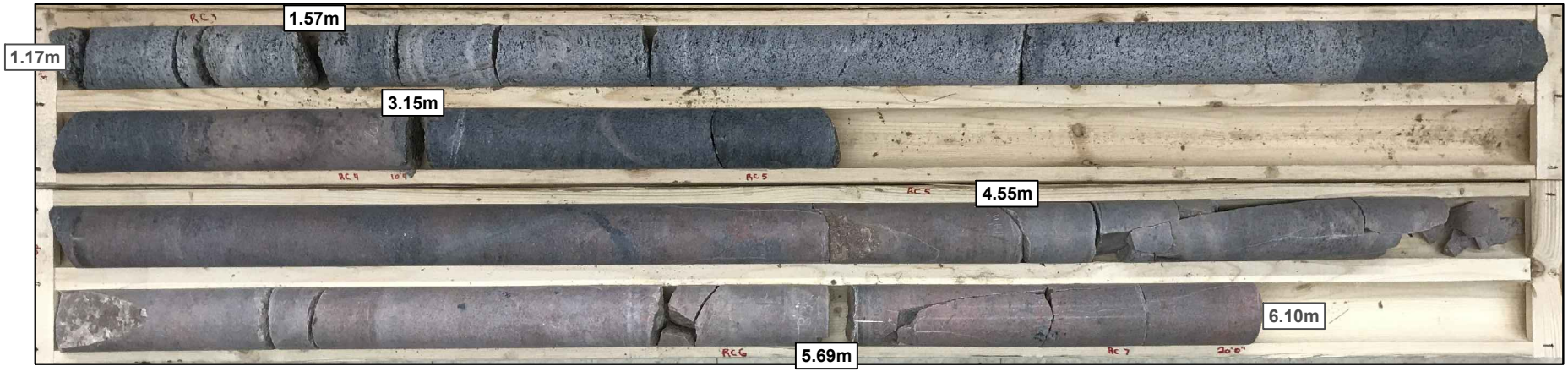
PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C7

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-221

BOREHOLE 22-222
BORING DATE: JANUARY 13, 2022
DEPTH: 1.17 **to** 6.10 **mbgs**



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Project
PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C8

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-222

BOREHOLE 22-223
BORING DATE: JANUARY 27, 2022
DEPTH: 1.29 **to** 12.09 **mbgs**

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Project
PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C9

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-223

BOREHOLE 22-224
BORING DATE: JANUARY 5, 2022
DEPTH: 4.45 **to** 6.17 **mbgs**

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PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C10

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-224

BOREHOLE 22-225
BORING DATE: JANUARY 4, 2022
DEPTH: 1.22 **to** 6.02 **mbgs**

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Project
PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C11

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-225

BOREHOLE 22-228
BORING DATE: JANUARY 28, 2022
DEPTH: 0.94 **to** 12.34 **mbgs**

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Project
PROPOSED DEVELOPMENT
PERTH GOLF, 151 PETER STREET
PERTH, ONTARIO

FIGURE C12

File No.
100737.002

ROCKCORE PHOTOGRAPH
BH22-228

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Ottawa, ON
K2K 2A9
Tel.: 613-836-1422
Fax.:613-836-9731

COMPRESSIVE STRENGTH of ROCK CORE

CLIENT: Caivan **PROJECT No.:** 100737.002

Project: Perth Golf Course **REPORT NO:**

Date Received: 28-Jan-22 **Date Tested:** 31-Jan-22

Lab no.						
Cylinder ID	BH 22-201	BH 22-203	BH 22-208	BH 22-216	BH 22-221	BH 22-222
Depth (m)	6.55-6.75	2.44-2.73	0.81-1.04	3.02-3.43	2.97-3.28	5.18-5.51
Cut length (mm)						
Ground length (mm)	125.21	126.08	126.03	125.91	125.27	125.01
Diameter (mm)	63.24	63.37	63.23	63.17	63.35	63.25
Ground Mass (kg)	1097.00	1089.00	1078.00	1.07	1.13	1035.00
Length:Diameter ratio	1.98	1.99	1.99	1.99	1.98	1.98
Correction factor	1.00	1.00	1.00	1.00	1.00	1.00
Failure load (kN)	103.63	510.74	468.84	511.48	131.17	724.21
Uncorrected Strength (MPa)	33.00	161.90	149.30	163.20	41.60	230.50
Corrected Strength (MPa)	**33.00**	**161.90**	**149.30**	**163.20**	**41.60**	**230.50**

Remarks The Core from BH22-201 had cracking before being broken.

Checked by: Krystle Smith, Laboratory Manager

Reviewed by: Steve Goodman, Ph.D., P.Eng.

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Fax.:613-836-9731

COMPRESSIVE STRENGTH of ROCK CORE

CLIENT: Caivan **PROJECT No.:** 100737.002

Project: Perth Golf Course **REPORT NO:**

Date Received: Jan 28,2022 **Date Tested:** 31-Jan-22

Lab no.						
Cylinder ID	BH 22-223	BH 22-224	BH 22-225			
Depth (m)	4.39-4.80	4.67-5.05	5.31-5.54			
Cut length (mm)						
Ground length (mm)	125.82	125.92	125.97			
Diameter (mm)	63.18	63.14	63.16			
Ground Mass (kg)	1069.00	1079.00	1088.00			
Length:Diameter ratio	1.99	1.99	1.99			
Correction factor	1.00	1.00	1.00			
Failure load (kN)	362.71	408.55	442.73			
Uncorrected Strength (MPa)	115.70	130.50	141.30			
Corrected Strength (MPa)	**115.70**	**130.50**	**141.30**			

Remarks

Checked by: Krystle Smith, Laboratory Manager

Reviewed by: Steve Goodman, Ph.D., P.Eng.

APPENDIX D

Borehole Records – Previous Investigation
Boreholes 21-01 to 21-04, Probeholes 21-101 to 21-104,
and Hand Augerholes 21-201 and 21-202

RECORD OF PROBEHOLE 21-101

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 3 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		135.31							
	Power Auger Hollow Stem Auger (210mm OD)	Soil statigraphy not logged									Native backfill
1											
				133.33							
2		End of Probehole Auger Refusal		1.98							
3											
4											
5											
6											
7											
8											
9											
10											

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

RECORD OF PROBEHOLE 21-102

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 3 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		135.25							
	Power Auger Hollow Stem Auger (210mm OD)	Soil statigraphy not logged									Native backfill
2				133.19							
		End of Probehole Auger Refusal		2.06							
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

RECORD OF PROBEHOLE 21-103

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 3 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	SHEAR STRENGTH (Cu), kPA (NATURAL / REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger (210mm OD) Hollow Stem Auger	Ground Surface		134.85								
		Soil statigraphy not logged										Native backfill
				134.24								
1		End of Probehole Auger Refusal		0.61								
2												
3												
4												
5												
6												
7												
8												
9												
10												

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

RECORD OF PROBEHOLE 21-104

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 4 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger (Hollow Stem Auger (210mm OD))	Ground Surface		134.88							
		Soil statigraphy not logged		134.73							
		End of Probhole Auger Refusal		0.15							Native backfill
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

RECORD OF BOREHOLE 21-01

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 4 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		135.07								
		Grey brown silty sand and gravel (BASE MATERIAL)		134.97 0.10								
		Loose, brown silty sand, trace gravel (FILL MATERIAL)			1	SS	405	6				
				134.31								
1		Loose to compact, grey brown SILTY SAND, some gravel, with cobbles and gravel (GLACIAL TILL)		0.76	2	SS	455	10				
					3	SS	455	6				
2				132.63								
		Very dense, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		2.44	4	RC	250					
3												Native backfill
4	Wash Casing HW (114mm OD)				5	RC	305					
5					6	SS	255	>50 for 51 mm				
6					7	RC						
				128.39								
		End of Borehole		6.68								
7												
8												
9												
10												

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

Gravel
Native backfill

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Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 21/5/21

RECORD OF BOREHOLE 21-02

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 4 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		136.30						
0	Power Auger Hollow Stem Auger (210mm OD)	Grey brown silty sand and gravel (BASE MATERIAL)		136.10						Gravel
		Loose to very loose, dark brown silty sand, with organics (FILL MATERIAL)		0.20	1	SS	255	5		
1					2	SS	255	2		
		Compact, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		134.93 1.37	3	SS	455	28	MH	
2					4	SS	305	34		Bentonite
3					5	SS	205	>50 for 75 mm		
	Diamond Rotary Core HQ (89mm OD)	Slightly weathered to fresh, grey and pink, fine grained, strong Precambrian BEDROCK		132.97 3.33	6	RC		TCR = 100%, SCR = 100%, RQD = 100%		
4					7	RC		TCR = 95%, SCR = 92%, RQD = 75%	UCS	
5		End of Borehole		131.19 5.11						
6										
7										
8										
9										
10										

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA
+ NATURAL ⊕ REMOULDED
WATER CONTENT, %
W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

RECORD OF BOREHOLE 21-03

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 4 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		138.51							Gravel
		Grey brown silty sand and gravel (BASE MATERIAL)		138.43 0.08							
		Grey brown, SILTY SAND and gravel (GLACIAL TILL)		138.10 0.41							
1	Diamond Rotary Core HQ (89mm OD)	Highly fractured pink, fine grained Precambrian BEDROCK			1	RC		TCR = 100%, SCR = 20%, RQD = 20%			
				136.78							Bentonite
2		Slightly weathered to fresh, pink, fine grained, strong Precambrian BEDROCK		1.73	2	RC		TCR = 100%, SCR = 90%, RQD = 50%			
3					3	RC		TCR = 100%, SCR = 87%, RQD = 87%			
				135.18							
		End of Borehole		3.33							
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, % W_P W W_L
10 20 30 40 50 60 70 80 90

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

RECORD OF BOREHOLE 21-04

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 3 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		134.66							
	Power Auger (210mm OD)	Grey brown silty sand and gravel (BASE MATERIAL)		134.51 / 0.15							
		Loose, brown SILTY SAND, trace gravel (GLACIAL TILL)			1	SS	305	6	●		Gravel
1					2	SS	355	45	●		
	Hollow Stem Auger	Weathered Bedrock		133.59 / 1.07							
		Slightly weathered to fresh, dark grey, fine grained, strong Precambrian BEDROCK		133.22 / 1.44	3	RC		TCR = 56%, SCR = 56%, RQD = 80%			Bentonite
2	Diamond Rotary Core HQ (89mm OD)									UCS	
3					4	RC		TCR = 100%, SCR = 83%, RQD = 83%			
		End of Borehole		131.18 / 3.48							
4											
5											
6											
7											
8											
9											
10											

10 20 30 40 50 60 70 80 90

SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L

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LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

RECORD OF HAND AUGERHOLE 21-201

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 5 2021

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Hand Auger Open hole	Ground Surface		134.70							
		TOPSOIL		134.55							
		Brown SILTY CLAY (WEATHERED CRUST)		0.15	1	AS					Native backfill
1		Brown SILTY SAND, some gravel (GLACIAL TILL)		133.73 133.58	2	AS					
		End of Hand Auger hole Hand Auger Refusal		1.12							
2											
3											
4											
5											
6											
7											
8											
9											
10											

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Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 21/5/21

RECORD OF HAND AUGERHOLE 21-202

CLIENT: Caivan Communities
PROJECT: Preliminary Geotechnical Investigation, Perth Golf Course, Perth, Ontario
JOB#: 100737.001
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: May 5 2021

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		135.35							
	Hand Auger Open hole	TOPSOIL		135.20							
		Brown SILTY SAND, trace gravel (GLACIAL TILL)		0.15	1	AS					Native backfill
				134.44							
1		End of Hand Auger hole Hand Auger Refusal		0.91							
2											
3											
4											
5											
6											
7											
8											
9											
10											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GEMTEC
Consulting Engineers and Scientists

LOGGED: ML
CHECKED: WAM

GEO - BOREHOLE LOG 100737.001 GINT LOGS.GPJ GEMTEC 2018.GDT 5-18-21

APPENDIX E

Chemical Analysis of Soil Samples
Samples Relating to Corrosion
(Paracel Laboratories Ltd. Order No. 2205579)

Certificate of Analysis

Report Date: 03-Feb-2022

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 28-Jan-2022

Client PO:

Project Description: 100737.002

	Client ID:	22-226 SS-3	22-212 SS-3	-	-
	Sample Date:	28-Jan-22 12:10	28-Jan-22 13:15	-	-
	Sample ID:	2205579-01	2205579-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	67.7	94.7	-	-
General Inorganics					
Conductivity	5 uS/cm	201	104	-	-
pH	0.05 pH Units	7.53	7.26	-	-
Resistivity	0.10 Ohm.m	49.7	96.4	-	-
Anions					
Chloride	5 ug/g dry	<5	<5	-	-
Sulphate	5 ug/g dry	16	<5	-	-

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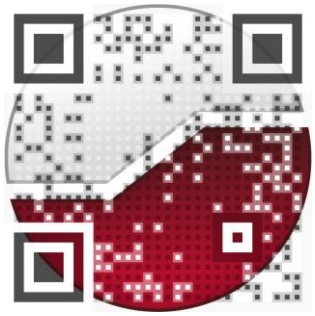

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

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