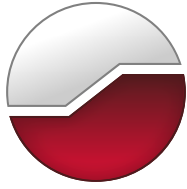




# GEMTEC

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**Geotechnical Investigation  
Proposed Industrial Development  
3160 Carp Road  
Ottawa, Ontario**



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Proposed Industrial Development  
3160 Carp Road  
Ottawa, Ontario**

February 26, 2025  
GEMTEC Project: 102151.001

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## 1.0 INTRODUCTION

This report presents the results of the preliminary subsurface investigation carried out for the proposed industrial development to be located at 3160 Carp Road, Ottawa, Ontario.

The purpose of the investigation was to identify the general subsurface and groundwater conditions at the site by means of a limited number of boreholes and monitoring wells and, based on the information obtained, to provide engineering guidelines and recommendations on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

This report is subject to the Conditions and Limitations of This Report, which follows the text of the report, and which are considered an integral part of the report.

## 2.0 BACKGROUND

### 2.1 Project Description

The site consists of an about 22 hectare land parcel located at 3160 Carp Road in Ottawa, Ontario. The site is currently undeveloped grassland with occasional small trees and alders; more mature trees can be found along the northern and eastern border of the site.

The proposed industrial development at the site will consist of 13 blocks, with 11 blocks for development, with sizes ranging from about 1.1 to 4.8 hectares in size. One of the proposed blocks (block 1, located on the west corner of the site) was severed since the carrying out the fieldwork.

Based on observations made on site during the fieldwork (in April 2023), a large stockpile of fill material was being placed on the site. The stockpile at the time of the fieldwork had a height of about 5 metres above the existing ground surface.

### 2.2 Previous Investigation

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) has completed a hydrogeological investigation for the proposed development. The results were provided in the following report:

- Report to Novatech Engineering Consultants Ltd., titled “Hydrogeological Investigation & Terrain Analysis, Proposed Industrial Subdivision, 3160 Carp Road, Ottawa, Ontario” dated July 10, 2020 (Report No. 64819.03).

As part of the hydrogeological investigation, 15 test pits, five boreholes with monitoring wells, and four test wells were advanced across the site. The following should be noted about the test holes advanced as part of the previous hydrogeological investigation:

- The test pit information was provided on Record of Borehole Sheets (in Appendix C of this report) and are referred to as test pits in this report and on the site plan.
- The test wells on the Well Records are labelled as Test Well 1 of 4, 2 of 4, 3 of 4, and 4 of 4 and correspond to TW-1, TW-2, TW-3, and TW-4, respectively, on the Site Plan, Figure 1.
- Boreholes 19-1 D and 19-1S, 19-3D and 19-3S, and 19-4S were advanced adjacent to test wells TW-1, TW-3, and TW-4, respectively. No boreholes were advanced adjacent to test well TW-2.

The subsurface conditions encountered in the previously advanced test pits and boreholes consisted of topsoil over native deposits of silty sand to sandy silt, over weathered silty clay crust, over glacial till. Some of the test pits and boreholes were advanced to practical refusal at depths ranging from about 1.8 to 9.2 metres. The refusal likely occurred on cobbles and/or boulders within the glacial till deposit or on the bedrock surface.

The depth to groundwater was measured on various dates at depths ranging from about 1.5 to 5.5 metres below the existing ground surface.

### **2.3 Site Geology**

Published geology maps indicate the subsurface conditions at the site are composed of silty sand and silty clay over glacial till. Bedrock geology maps indicate the bedrock in the area of the site consists of limestone and shale of the Verulam formation. Drift thickness mapping indicates that the bedrock is expected at depths ranging from about 3 to 15 metres, sloping down to the north.

The ground conditions encountered in the test holes during the previous investigation are generally consistent with the surficial geology mapping for the area of the site.

### **3.0 METHODOLOGY**

The fieldwork for the current investigation was carried out between April 18 and 20, 2023. At that time, 11 boreholes (numbered 23-01, 23-03, 23-04, 23-06, 23-07, 23-08, 23-10, 23-11, 23-13, 23-14, and 23-15) were advanced adjacent to the corresponding 18-series test pits, with the exception of borehole 23-14, at the approximate locations shown on the Site Plan, Figure 1.

The boreholes were advanced using a track mounted drill rig supplied and operated by CCC Geotechnical & Environmental Drilling Ltd. of Ottawa, Ontario. The boreholes were advanced to depths ranging from 2.6 to 9.0 metres below the existing ground surface.

Standard penetration tests were carried out in the boreholes and samples of the soils encountered were recovered using a 50 millimetre diameter split spoon sampling equipment. In situ vane testing was carried out, where possible, in the boreholes to measure the undrained shear strength of the silty clay.

A well screen was installed in the overburden in borehole 23-07 to measure the groundwater levels and for hydraulic conductivity testing. The groundwater level was measured on April 27, 2023.

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 samples were returned to our laboratory for examination by a geotechnical engineer. Selected samples of soil were tested for water content testing, Atterberg Limit testing, and grain size distribution testing. One soil sample was submitted to an accredited laboratory for chemical testing relating to corrosion of buried steel and concrete.

The borehole locations were selected and positioned at the site relative to existing site features by GEMTEC personnel. The locations and ground surface elevations of the boreholes were determined using high precision GPS survey instrumentation.

## **4.0 SUBSURFACE CONDITIONS**

### **4.1 General**

Descriptions of the subsurface conditions logged in the boreholes are provided on the Record of Borehole Sheets in Appendix A. The results of the soil classification testing are provided in Appendix B and on the Record of Borehole Sheets. The borehole records from the previous investigations are provided in Appendix C. A summary of the measured groundwater levels is provided in Appendix D. The results of chemical testing related to corrosion are provided in Appendix E.

The following presents an overview of the subsurface conditions encountered in the boreholes advanced during the current investigation. The results of the previous investigation are only referenced below with respect to refusal depths, bedrock and groundwater levels.

It should be noted that the deposits of grey silty clay that were encountered in the test pits were not encountered in the boreholes that were advanced adjacent to the respective test pits. The soil descriptions described herein supersede the descriptions in the test pits advanced adjacent to the current boreholes.

### **4.2 Fill Material Stockpile**

At the time of the investigation, a stockpile of fill material was observed at the site, as shown in Figure 1, with an approximate height of about 5 metres, based on the as surveyed top of stockpile at about elevation 119 metres and the base of the stockpile at about elevation 114 metres.

No test holes were advanced through the stockpile, however, based on the observations made on site during the fieldwork, the stockpile consists of rock fill.

### 4.3 Topsoil

A layer of topsoil was encountered at the ground surface at all borehole locations with thicknesses ranging from about 150 to 300 millimetres.

### 4.4 Silty Sand to Sandy Silt, and Sand

Native deposits of silty sand to sandy silt and sand with varying amounts of gravel and clay were encountered below the topsoil in all the boreholes, with the exception of borehole 23-10. These deposits are collectively referred to further in this report as silty sand. The silty sand to sandy silt extends to depths ranging from about 0.8 to 3.4 metres below the existing ground surface. The silty sand deposits also contain trace to some clay or silty clay seams at some locations.

Standard penetration tests carried out in the sandy deposits gave N values ranging from 1 to 21 blows per 0.3 metres of penetration, which reflect a very loose to compact relative density.

The results of a grain size distribution test carried out on one sample of the silty sand are provided in Appendix B and summarized in Table 4.1.

**Table 4.1 – Summary of Grain Size Distribution Testing (Silty Sand)**

Borehole ID	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
23-04	3	1.5 to 2.1	1	44	35	20

The measured water contents of eight samples of the silty sand to sandy silt ranged between about 21 and 35 percent.

### 4.5 Weathered Silty Clay Crust

Native deposits of silty clay were encountered below the silty sand in boreholes 23-01, 23-03, 23-08, 23-13, and 23-15. The full depth of the silty clay in the boreholes has been weathered to a grey brown crust. The weathered crust extends to depths ranging from about 1.5 to 3.8 metres below the existing surface grade.

Standard penetration tests carried out in the weathered silty clay gave SPT N values ranging from 2 to 8 blows per 0.3 metres of penetration, which reflect a stiff to very stiff consistency.

The results of grain size distribution testing carried out on one sample of the weathered silty clay crust are provided in Appendix B and are summarized in Table 4.2.

**Table 4.2 – Summary of Grain Size Distribution Testing (Weathered Crust)**

Borehole ID	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
23-08	2	0.7 to 1.4	0	1	48	51

The results of Atterberg Limit testing carried out on five samples of the weathered crust are provided on the Plasticity Charts in Appendix B and are summarized in Table 4.3.

**Table 4.3 – Summary of Atterberg Limit Testing (Weathered Crust)**

Borehole ID	Sample Number	Sample Depth (metres)	Water Content (%)	LL (%)	PL (%)	PI
23-01	2	0.7 to 1.4	27	33	15	18
23-03	3	1.5 to 2.1	27	30	15	15
23-08	3	1.5 to 2.1	56	30	16	14
23-13	3	1.5 to 2.1	30	27	14	13
23-15	5B	3.0 to 3.6	39	32	15	17

Based on the results of the Atterberg Limit testing, the samples of the weathered crust have a low plasticity.

The measured water contents of seven samples of the weathered silty clay crust range from about 27 to 56 percent.

A sample of the weathered crust was tested in our laboratory to determine the Shrinkage Limit of the silty clay at the site. The testing was performed in general accordance with ASTM D4943 (which was discontinued in 2017 by the ASTM Sponsoring Committee responsible for the standard). The modified plasticity index ( $PI_m$ ) was also calculated for samples of the clay using the following formula and the results of the Atterberg limits and grain size distribution testing described previously:

$$PI_m = PI \times (\% \text{ passing the 425 micrometre sieve} / 100).$$

A summary of the test and calculation results is provided in Table 4.4.

**Table 4.4 – Summary of Modified Plasticity Index**

Borehole ID / Sample No.	Shrinkage Limit (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Modified Plasticity Index (%)
23-01 / 2	-	15	33	18	18
23-03 / 3	-	15	30	16	16
23-08 / 2	18	-	-	-	-
23-08 / 3	-	16	30	14	14
23-13 / 3	-	14	27	13	13
23-15 / 5B	-	15	32	17	17

#### **4.6 Sand and Silt**

A native deposit of sand and silt was encountered below the weathered silty clay crust in borehole 23-08. The sand and silt has a thickness of about 0.8 metres and extends to a depth of about 2.9 metres below the existing ground surface.

One standard penetration test carried out in the sand and silt deposit gave an SPT N value of weight of hammer per 0.3 metres of penetration indicating a very loose relative density.

The measured water content of one sample of the sand and silt was about 33 percent.

#### **4.7 Glacial Till**

Native deposits of glacial till were encountered below the topsoil, silty clay, and/or sand and silt deposits, where encountered, in the boreholes. The glacial till was not fully penetrated in the boreholes, but was proven to depths ranging from about 2.5 to 9.0 metres below the existing ground surface.

Glacial till is a heterogeneous mixture of all grain sizes, and at this site, the glacial till can be described as silty sand to sandy silt, with varying amounts of clay and gravel to sandy silt and clay with trace gravel. Although not directly encountered in the boreholes, the glacial till deposit is known to contain cobbles and boulders.

Standard penetration tests carried out in the glacial till gave N values ranging from weight of hammer to greater than 50 blows per 0.3 metres of penetration, which reflect a very loose to very dense relative density. The higher blow counts likely represent the presence of cobbles and boulders or the surface of the bedrock rather than the relative density of the glacial till.

Two in-situ vane shear strength tests carried out in the silt and clay glacial till gave undrained shear strengths of about 18 and 69 kilopascals. The undrained shear strengths measured in the glacial till are not considered accurate, with the low shear strength likely taken through disturbed soil and the high shear strength likely influenced by the amount of sand and gravel in the deposit.

The results of a grain size distribution testing carried out on one sample of the glacial till are provided in Appendix B and summarized in Table 4.5.

**Table 4.5 – Summary of Grain Size Distribution Testing (Glacial Till)**

Borehole ID	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
23-06	10B	7.0 to 7.5	21	46	22	10
23-08	5	3.1 to 3.2	2	27	35	35

The water contents of 29 samples of the glacial till range between about 4 and 35 percent.

#### 4.8 Auger Refusal and Bedrock

Boreholes 23-06, 23-07, 23-08, 23-10, 23-14, and 23-15, from the current investigation encountered practical auger refusal at depths ranging from about 2.6 to 8.5 metres below the existing ground surface. Boreholes 19-1D, 19-3D, and 19-4S from the previous investigation encountered practical auger refusal at depths ranging from about 5.6 to 9.1 metres below the existing ground surface. Auger refusal may occur on cobbles and boulders within the glacial till or on the bedrock surface.

Practical refusal to excavating was encountered in test pits 18-2, 18-3, 18-6, 18-9, 18-10, 18-11, 18-12, 18-13, and 18-14 at depths ranging from about 1.8 to 3.1 metres below the existing ground surface.

Bedrock was encountered in the test wells at depths ranging from about 7.0 to 8.2 metres below the existing ground surface. The depth to bedrock at the test well locations was inferred from the drilling resistance and the drill cuttings.

A summary of the refusal depths and elevations from the current and previous investigation are summarized in Table 4.6.

**Table 4.6 – Summary of Auger Refusal and Bedrock Depths and Elevations**

Test hole ID	Ground Surface Elevation (metres)	Depth to Refusal (metres)	Refusal/Bedrock Elevation (metres)
BH 23-06	110.3	8.5 <sup>1</sup>	101.8 <sup>1</sup>
BH 23-07	112.8	3.3	109.6
BH 23-08	110.3	4.4	105.8
BH 23-10	114.1	4.2	109.9
BH 23-13	111.7	4.0 <sup>2</sup>	107.6 <sup>2</sup>
BH 23-14	116.3	2.6	113.8
BH 23-15	111.5	5.0	106.4
BH 19-1D	115.8	9.2	106.6
BH 19-3D	115.2	6.5	108.7
BH 19-4S	117.1	5.6	111.5
TW-1	115.8	7.9 <sup>3</sup>	107.9 <sup>3</sup>
TW-2	112.8	7.6 <sup>3</sup>	105.2 <sup>3</sup>
TW-3	115.3	7.0 <sup>3</sup>	108.3 <sup>3</sup>
TW-4	117.3	8.2 <sup>3</sup>	109.1 <sup>3</sup>
TP 18-2	114.7	2.9	111.8
TP 18-3	113.1	2.4	110.7
TP 18-6	114.5	2.9 <sup>4</sup>	111.6 <sup>4</sup>
TP 18-9	116.2	3.1 <sup>4</sup>	113.2 <sup>4</sup>
TP 18-10	114.1	3.1 <sup>4</sup>	111.0 <sup>4</sup>
TP 18-11	111.6	2.3 <sup>4</sup>	109.4 <sup>4</sup>
TP 18-12	116.3	2.9 <sup>4</sup>	113.4 <sup>4</sup>
TP 18-13	111.8	3.1 <sup>4</sup>	108.8 <sup>4</sup>
TP 18-14	115.5	1.8	113.6

Notes:

1. Practical auger refusal was encountered in borehole 23-06 at a depth of about 8.5 metres below the ground surface, however, an SPT advanced past auger refusal to a depth of about 9.0 metres below the existing ground surface.
2. Borehole 23-13 encountered SPT refusal (not auger refusal). SPT refusal likely represents cobbles and boulders, rather than the bedrock surface.
3. The depth to bedrock in the test wells is inferred from the drilling resistance and the drill cuttings.
4. Refusal to excavator advancement was encountered in test pits 18-6 and 18-9 to 18-13 on possible cobbles and boulders within the glacial till.

#### 4.9 Groundwater Levels

Monitoring wells were installed in borehole 23-07 from the current investigation and boreholes 19-1D, 19-1S, 19-3D, 19-3S, and 19-4S from the previous investigation to measure the groundwater levels. Four test wells were advanced at the site for pumping testing and groundwater level measurements during the previous investigation.

The measured groundwater levels in the monitoring wells and test wells installed in the boreholes are presented in Appendix D and the highest recorded groundwater levels in each monitoring well are summarized in Table 4.7. The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

**Table 4.7 – Summary of Groundwater Levels**

Borehole ID	Ground Surface Elevation (metres)	Groundwater Depth (metres below ground surface)	Groundwater Level Elevation (metres)	Date
BH 23-07	112.8	2.8	110.0	Apr 23, 2023
TW 19-1	115.8	4.2	111.6	Aug 8, 2019
TW 19-2	112.8	1.5	111.3	Aug 8, 2019
TW 19-3	115.3	3.0	112.3	Apr 23, 2023
TW 19-4	117.3	3.9	113.4	Apr 23, 2023
BH 19-1D	115.8	4.6	111.2	Aug 8, 2019
BH 19-1S	115.8	Dry	Dry	Aug 6, 2019
BH 19-3D	115.2	2.9	112.3	Apr 23, 2023
BH 19-3S	115.3	3.0	112.3	Apr 23, 2023
BH 19-4S	117.1	4.6	112.5	Apr 23, 2023

#### 4.10 Chemistry Relating to Corrosion

One sample of soil obtained from borehole 23-07 was sent to Paracel Laboratories for basic chemical testing relating to corrosion of buried concrete and steel. The results are provided in Appendix C and are summarized in Table 4.9.

**Table 4.9 – Summary of Corrosion Testing**

<b>Parameter</b>	<b>Borehole 23-07 Sample No. 5</b>
Chloride Content (µg/g)	<10
Resistivity (Ohm.m)	74.0
pH	7.74
Sulphate Content (µg/g)	68

## **5.0 RECOMMENDATIONS AND GUIDELINES**

### **5.1 General**

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions. The 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 offsite sources are outside the terms of reference for this report and have not been addressed.

### **5.2 Site Grade Raise Restrictions**

The soil conditions across the site generally consists of silty sand over discontinuous deposits of weathered silty clay crust over glacial till.

Based on the results of the subsurface investigation, the maximum thickness of any grade raise filling should be limited to 1.5 metres above the existing surface grade. Higher grade raises may be considered but should be reviewed by GEMTEC to confirm they are feasible.

### **5.3 Excavations**

The excavations for the foundations will extend through topsoil and into the native deposits of weathered silty clay crust, silty sand and/or glacial till. 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 above the groundwater level 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. The sandy and till overburden deposits below the groundwater level can be classified as Type 4 soils and allowance should be made for excavation side slopes of 3 horizontal to 1 vertical, or flatter.

## 5.4 Groundwater Pumping

The groundwater level in the monitoring wells installed during the current and previous investigations ranges from about 1.5 to 5.5 metres below ground surface (elevations ranging from about 110.0 to 113.4 metres).

Groundwater inflow from the overburden deposits into the excavations should be limited, provided that the excavations do not extend deeper than the groundwater levels. Excavations to limited depths below the groundwater levels will require more dewatering effort but it should be feasible to manage those inflows using typical construction dewatering methods.

If excavations below the groundwater level are required for the proposed buildings, an Environmental Activity and Sector Registry (EASR) in accordance with Environmental Protection Act Part II may be required, depending on the depth and size of the excavation. Further details could be provided as the design progresses.

It is noted that groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

It is not expected that short term pumping during excavation will have any significant affect on nearby structures and services.

## 5.5 Foundation Design

Based on the subsurface conditions which were encountered during the investigation, it is considered that the proposed buildings could be founded on spread footings bearing on or within the native overburden deposits. The topsoil and any fill material, if encountered, is not considered suitable for the support of the proposed structures. Therefore, any fill or deleterious material, if encountered, should be removed from the proposed building areas.

For exterior strip footings founded on or within the native, undisturbed deposits of the silty sand, weathered silty clay crust, glacial till, or on a pad of compacted engineered fill above the native, undisturbed soil should be sized using a geotechnical reaction at Serviceability Limit State (SLS) of 100 kilopascals and a factored geotechnical resistance at Ultimate Limit State (ULS) of 250 kilopascals.

In areas where the underside of footing level is above the level of the native soil or where subexcavation of soil is required, the grade below the proposed buildings could be raised with granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II. The granular material should be compacted in maximum 200 millimetre thick lifts to at least 98 percent of the material's standard Proctor maximum dry density value using suitably sized compaction equipment. To provide adequate spread of load below the footings, the granular material should extend at least 0.5 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

Provided that the subgrade surface and engineered fill are prepared as described in this report, the post construction total and differential settlement of the footings at SLS should be less than 25 and 15 millimetres, respectively.

For adjacent footings founded at different elevations, we recommend that the underside of the adjacent lower footing not encroach within a zone extending 0.5 metres horizontally beyond the underside of the upper footing and then down and out from this point at 1 horizontal to 1 vertical, or flatter.

Given the level of information on the proposed structures available at this time, the above recommendations should be considered to be preliminary. More detailed assessment of soil bearing capacity and potential foundation settlements can be provided once further details of the foundation design and structural configurations are known.

### **5.5.1 Seismic Site Class**

Based on the results of the investigation, it is anticipated that the proposed foundations will be supported on deposit of silty sand and/or glacial till or on a pad of engineered fill constructed on the weathered silty clay crust, the sandy deposits, and/or glacial till.

Based on Table 4.1.8.4.A. of the 2012 Ontario Building Code, the seismic site class can be determined based on the Average Standard Penetration Resistance or the Soil Undrained Shear Strength. Based on the results of the standard penetration carried out as part of this investigation, it is recommended that seismic Site Class D be used for the design of structures in the commercial development.

The overburden deposits at this site are not considered to be potentially liquefiable during the design seismic event.

### **5.6 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) footings that are located in areas that are to be cleared of snow should be provided with at least 1.8 metres of earth cover for frost protection purposes. 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, if needed.

### **5.7 Slab on Grade Support**

The topsoil is not considered suitable for support of the slab on grade. To prevent long term settlement of the floor slab, all organic material and any fill material, if encountered, should be removed from below the proposed slab to expose the native overburden deposits.

The grade within the proposed buildings could then be raised where necessary, with material meeting OPSS requirements for Granular A and Granular B Type I or II. The granular base for the proposed slab on grade should consist of at least 150 millimetres of OPSS Granular A.

OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular A. Since the source of recycled material cannot be determined, it is suggested that any granular materials used beneath the floor slab be composed of virgin material only for environmental reasons.

All imported granular materials placed below the proposed floor slab should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the material's standard Proctor maximum dry density value using suitable vibratory compaction equipment.

Underfloor drainage is not considered necessary provided that the floor slabs are above the finished exterior ground surface level. If any areas of the buildings are to remain unheated during the winter period, thermal protection of the slab on grade may be required. Further details on the insulation requirements could be provided, if necessary.

The floor slabs should be wet cured to minimize shrinkage cracking and slab curling. The slab should be saw cut to about 1/3 the thickness of the slab as soon as curing of the concrete permits, in order to minimize shrinkage cracks.

Proper moisture protection with a vapour retarder should be used for floor slabs where the floor will be covered by moisture sensitive flooring materials or where moisture sensitive equipment, products or environments will exist. The "Guide for Concrete Floor and Slab Construction", ACI 302.1R-04 should be considered for the design and construction of vapour retarders below the floor slabs.

## **5.8 Backfill and Drainage**

The native deposits at this site are frost susceptible and should not be used as backfill against foundations. To avoid frost adhesion and possible heaving, the foundations should be backfilled with imported, free-draining, non-frost susceptible granular material such as that meeting the requirements of OPSS Granular A, or Granular B Type I or II.

Where the backfill will ultimately support areas of hard surfacing (pavement, sidewalks or other similar surfaces), the backfill should be placed in maximum 200 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density value using suitable vibratory compaction equipment. Light walk behind compaction equipment should be used next to the foundation walls to avoid excessive compaction induced stress on the foundation walls.

Where future landscaped areas will exist next to the proposed structures and if some settlement of the backfill is acceptable, the backfill could be compacted to at least 90 percent of the material's

standard Proctor maximum dry density value using suitable vibratory compaction equipment. Where areas of hard surfacing (concrete, sidewalks, pavement, etc.) abut the proposed structures, a gradual transition should be provided between those areas of hard surfacing underlain by non-frost susceptible granular wall backfill and those areas underlain by existing frost susceptible fill material to reduce the effects of differential frost heaving. It is suggested that granular frost tapers be constructed from 1.5 metres below finished grade to the underside of the granular subbase material for the hard surfaced areas. The frost tapers should be sloped at 1 horizontal to 1 vertical, or flatter. Further, we recommend that downspouts outlet in such a way as to prevent saturation of soils below hard surfaced areas.

The frost susceptible native soils could be considered for foundation wall backfill purposes in soft landscaped areas provided that a suitable bond break is applied to the surface of the foundations to prevent frost jacking. A suitable bond break could consist of at least 2 layers of 6 MIL polyethylene sheeting or a proprietary plastic drainage system. It is also pointed out that the native soils at this site can be impacted by changes in moisture content and this could affect the ability to compact this material to the required density.

Perimeter foundation drainage is not considered necessary for a slab on grade structure provided that the floor slab level is above the finished exterior ground surface level.

## **5.9 Roadway Construction**

### **5.9.1 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 material's standard Proctor maximum dry density value using suitably sized 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.

Truck traffic should be avoided on the native soil subgrade within the roadways especially under wet conditions to prevent disturbance occurring.

## 5.9.2 Pavement Design

If the roadway is to be used by light vehicles (cars, etc.), the following pavement structure is recommended:

- 90 millimetres of hot mix asphaltic concrete (40 millimetres of Superpave 12.5 over 50 millimetres of Superpave 12.5 Traffic Level B), over
- 150 millimetres of OPSS Granular A base, over
- 300 millimetres of OPSS Granular B, Type II subbase

If the roadway is to be used by heavy truck traffic, the following minimum pavement structure is recommended:

- 120 millimetres of hot mix asphaltic concrete (50 millimetres of Superpave 12.5 over 70 millimetres of Superpave 19.0 Traffic Level B), over
- 150 millimetres of OPSS Granular A base, over
- 450 millimetres of OPSS Granular B, Type II subbase

The above pavement structure assumes that the access roadway subgrade surfaces are prepared as described in this report. If the subgrade surfaces become disturbed or wetted due to construction operations or precipitation, the granular subbase thicknesses given above may not be adequate and it may be necessary to increase the thickness of the subbase and/or to incorporate a woven geotextile separator between the subgrade surfaces and the granular subbase material. The adequacy of the design pavement thicknesses should be assessed by geotechnical personnel at the time of construction.

If the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the granular subbase layer, 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.

The required thickness of the subbase materials will depend on a number of factors, including contractor workmanship and schedule, contractor methodology, soil types and weather conditions, and should be assessed by geotechnical personnel at the time of construction. In our opinion, the preferred approach from a geotechnical point of view is to:

- Proof roll the subgrade conditions at the time of construction under the supervision of experienced geotechnical personnel.
- Adjust the thickness of the subbase material and include a woven geotextile separator, as required. Unit rate allowances should be made in the contract for subexcavation and replacement with OPSS Granular B Type II.

### **5.9.3 Granular Material Placement**

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

### **5.9.4 Asphaltic Cement**

Performance graded PG 58-34 asphaltic cement is recommended for local roadways while performance graded PG 64-34 asphalt is recommended heavy truck traffic, fire access, and garbage collection, etc.

### **5.9.5 Transition Treatments**

In areas where the new pavement structure will abut existing pavements (e.g., Carp Road), 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.

### **5.9.6 Pavement Drainage**

Adequate drainage of the pavement granular materials and subgrade is important for the long-term performance of the pavement at this site. Where feasible, catch basins should be provided with minimum 3-metre-long perforated stub drains which extend in at least two directions from each catch basin at the pavement subgrade level. In addition, where catch basins are not feasible, we recommend that swales or ditches be implemented to promote drainage around the road surface areas. The granular base and subbase materials should be crowned and extend horizontally to the ditches or swales. Where possible, the bottom of the swales/ditches should be at least about 0.3 metres below the bottom of the Granular B Type II.

## **5.10 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 borehole BH 23-07 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 building 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.

## **5.11 Sensitive Marine Clay – Effects of Trees**

The site is underlain by a discontinuous deposit of silty clay, a material which is known to be susceptible to shrinkage with a change/reduction in moisture content. Research by the Institute

for Research in Construction (formerly the Division of Building Research) of the National Research Council of Canada has shown that trees can cause a reduction of moisture content in the silty clays in the Ottawa area, which can result in significant settlement/damage to nearby buildings supported on shallow foundations, or hard surfaced areas. Therefore, deciduous tree planting should be carried in accordance with the guidelines identified in the City of Ottawa document titled: “Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines”.

The City of Ottawa Tree Planting Guidelines indicates that sensitive marine clay soils with a modified plasticity index of less than 40 percent are considered to have a low/medium potential for soil volume change. Clay soils with a modified plasticity index that exceeds 40 percent are considered to have a high potential for soil volume change.

The modified plasticity index of the samples of weathered silty clay crust, provided in Table 4.4, ranges from about 13 to 18 percent. As such, the potential for soil volume change, as defined by the City of Ottawa, is low/medium.

In accordance with the City of Ottawa Tree Planting Guidelines, tree planting restrictions apply where clay soils with low/medium potential for volume change are present between the underside of footing and a depth of 3.5 metres below finished grade (refer to the City of Ottawa document titled: “Tree Planting in Sensitive Marine Soils - 2017 Guidelines”) – as is likely the case at this site.

According to the City of Ottawa 2017 Tree Planting Guidelines, the tree to foundation setbacks within the development can be reduced to 4.5 metres for small to medium sized trees (i.e., trees with a mature height of less than 14 metres) with further information and recommendations on planting trees near foundations provided in the City of Ottawa Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines.

## **6.0 ADDITIONAL CONSIDERATIONS**

### **6.1 Effects of Construction Induced Vibration**

Some of the construction operations (such as granular material compaction, excavation, 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. The magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition.

### **6.2 Monitoring Well Abandonment**

Monitoring well installed as part of this investigation should be decommissioned by a licensed well technician. The well abandonment could be carried out in advance of or during construction.

### 6.3 Winter Construction

If construction is required during freezing temperatures, the native soil subgrade below the footings should be protected immediately from freezing using straw, propane heaters and insulated tarpaulins, or other suitable means. The frost susceptibility potential of the bedrock should be assessed by geotechnical personnel to determine if frost protection is required for bedrock subgrades.

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.

### 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



Bill Cavers, P.Eng.  
Principal Geotechnical Engineer

## GEOTECHNICAL REPORT CONDITIONS & LIMITATIONS

**STANDARD OF CARE:** GEMTEC has prepared this report in a manner consistent with generally accepted engineering or environmental consulting practice in the jurisdiction in which the services are provided at the time of the report. No other warranty, expressed or implied is made.

**COPYRIGHT:** The contents of this report are subject to copyright owned by GEMTEC, save to the extent that copyright has been legally assigned by us to another party or is used by GEMTEC under license. To the extent that GEMTEC owns the copyright in this report, it may not be copied without our prior written agreement for any purpose other than the purpose indicated in this report. The methodology (if any) contained in this report is provided to the Client in confidence and must not be disclosed or copied to third parties without the prior written agreement of GEMTEC. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests.

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

**BASIS OF REPORT:** This Report has been prepared for the specific site, development, design objectives and purposes that were described to GEMTEC by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this report expressly addresses the proposed development, design objectives and purposes. Any change of site conditions, purpose or development plans may alter the validity of the report and GEMTEC cannot be responsible for use of this report, or portions thereof, unless GEMTEC is requested to review any changes and, if necessary, revise the report.

**TIME DEPENDENCE:** If the proposed project is not undertaken by the Client within 18 months following the issuance of this report, or within the timeframe understood by GEMTEC to be contemplated by the Client, the guidance and recommendations within the report should not be considered valid unless reviewed and amended or validated by GEMTEC in writing.

**USE OF THIS REPORT:** The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without GEMTEC's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, GEMTEC may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

**NO LEGAL REPRESENTATIONS:** GEMTEC makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

**DECREASE IN PROPERTY VALUE:** GEMTEC shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.

**RELIANCE ON PROVIDED INFORMATION:** The evaluation and conclusions contained in this report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

**INVESTIGATION LIMITATIONS:** Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions but even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions.

The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. Accordingly, GEMTEC does not warrant or guarantee the exactness of the subsurface descriptions.

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

In addition, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

**SAMPLE DISPOSAL:** GEMTEC will dispose of all uncontaminated soil and/or rock samples 60 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

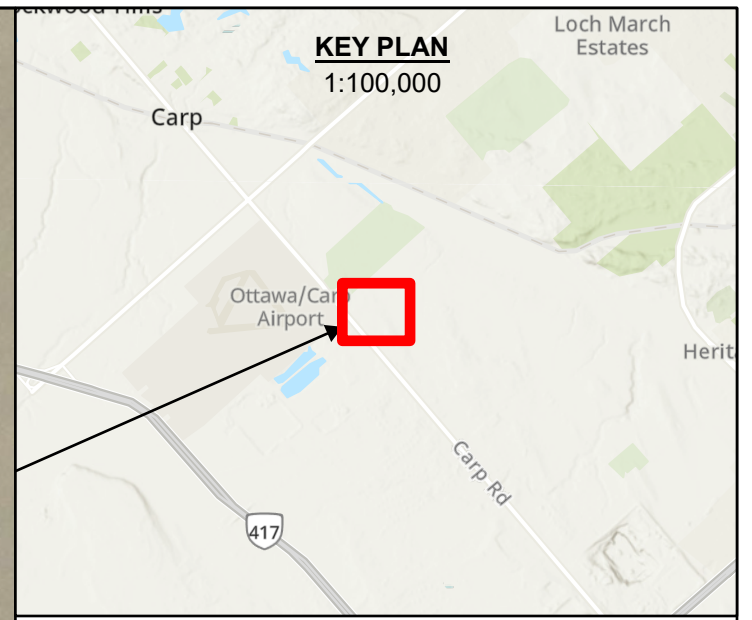
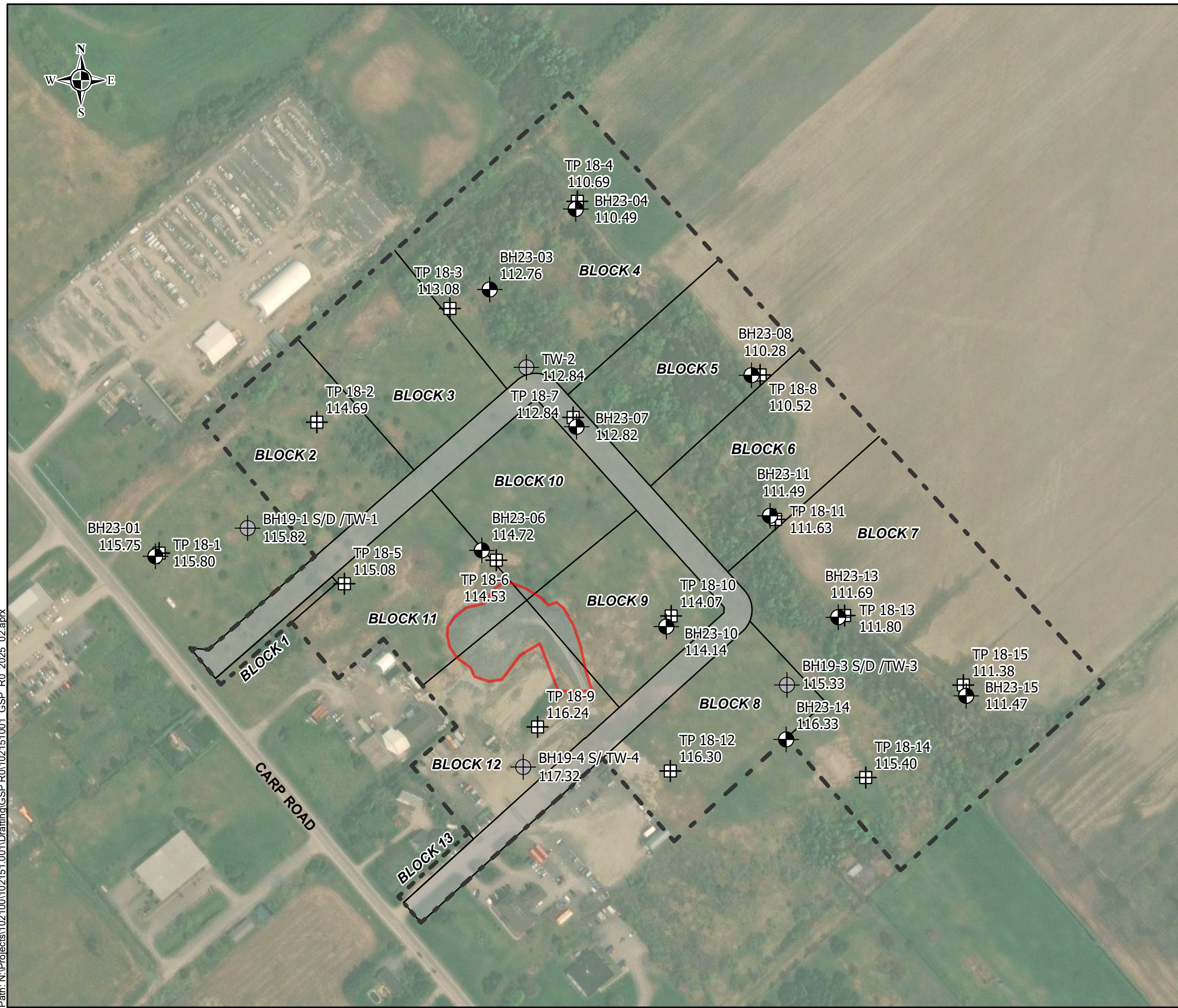
**FOLLOW-UP AND CONSTRUCTION SERVICES:** All details of the design were not known at the time of submission of GEMTEC's report. GEMTEC should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of GEMTEC's report.

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

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

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

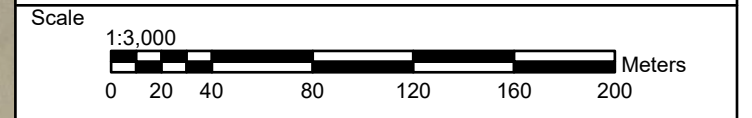
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**LEGEND**

- BH/MW # — BOREHOLE / MONITORING WELL ID
- XX.XX — GROUND SURFACE ELEVATION, IN METERS  
GEODETTIC DATUM
- ⊙ BOREHOLE LOCATION  
(current investigation)
- ⊕ TEST PIT LOCATION  
(previous investigation by GEMTEC, No. 64819.03)
- ⊙ BOREHOLE/ TEST WELL LOCATION  
(previous investigation by GEMTEC, No. 64819.03)
- APPROXIMATE PROPERTY BOUNDARY
- ▬ PROPOSED ROAD
- ▭ APPROXIMATE OUTLINE OF ROCKFILL

Service Layer Credits: World Imagery: Maxar, Microsoft  
World Topographic Map: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community  
World Hillshade: Esri, NASA, NGA, USGS, FEMA



Drawing	SITE PLAN	
Client:	TLC HOLDINGS LTD.	
Project	GEOTECHNICAL INVESTIGATION PROPOSED COMMERCIAL DEVELOPMENT 3160 CARP ROAD OTTAWA, ONTARIO	
Drwn By:	E.P./S.L.	Chkd By: W.A.M.
Project No.	102151.001	Revision No. 0
Date	FEBRUARY 2025	<b>FIGURE: 1</b>

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## **APPENDIX A**

Records of Borehole Logs – Current Investigation  
List of Abbreviations and Symbols  
Borehole 23-01, 23-03, 23-04, 23-06, 23-07, 23-08, 23-10,  
23-11, 23-13, 23-14, and 23-15

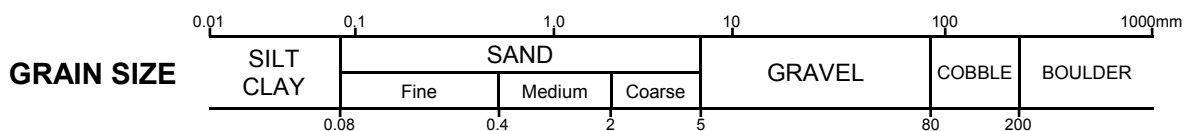
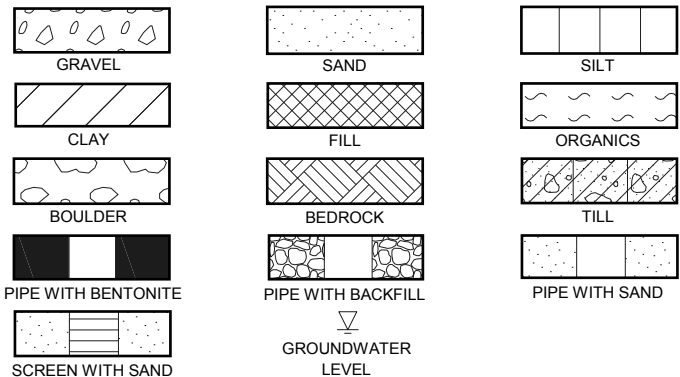
# ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, $w_p$	Plastic limit
LL, $w_L$	Liquid limit
C	Consolidation (oedometer) test
$D_R$	Relative density
DS	Direct shear test
$G_s$	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
$\gamma$	Unit weight

PENETRATION RESISTANCE	
<p><b>Standard Penetration Resistance, N</b> The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.</p>	
<p><b>Dynamic Penetration Resistance</b> The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).</p>	
WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	Description	$C_u$ , kPa	Description
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard



## DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)

TRACE	SOME	ADJECTIVE	noun > 35% and main fraction
trace clay, etc	some gravel, etc.	silty, etc.	sand and gravel, etc.

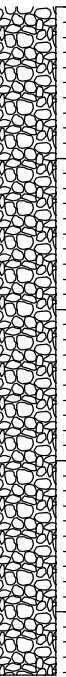
# RECORD OF BOREHOLE 23-01

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	● PENETRATION RESISTANCE (N), BLOWS/0.3m	⊕ NATURAL ⊕ REMOULDED	WATER CONTENT, %			
												W <sub>p</sub> — W — W <sub>L</sub>			
												10 20 30 40 50 60 70 80 90			
0		Ground Surface TOPSOIL		115.75											
		Loose, brown SILTY SAND, with rootlets		115.50 0.25	1	SS	405	7	●						
		Grey brown SILTY SAND, trace to some clay		114.99 0.76 114.79 0.96	2	SS	535	7	●	— ○ —					
		Stiff to very stiff, grey brown SILTY CLAY, with sand seams (WEATHERED CRUST)		114.23 1.52											
		Compact to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		114.23 1.52	3	SS	155	27		●					
	Power Auger Hollow Stem Auger (210mm OD)				4	SS	430	26		○	●				
					5	SS	155	87	○		●				
		Dense, grey SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		111.94 3.81	6	SS	405	46		●					
		End of Borehole		111.33 4.42											
5															
6															
7															
8															
9															
10															

Auger Cuttings



GEO - BOREHOLE LOG, 102151.001, BH, LOGS, 2023-04-24, GPJ, GEMTEC, 2018, GDT, 8/17/23

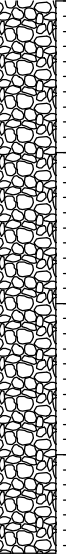
# RECORD OF BOREHOLE 23-03

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		WATER CONTENT, %			
0		Ground Surface		112.76										
		TOPSOIL		112.61										
		Very loose, grey brown SILTY SAND, trace to some clay		0.15	1	SS	380	WH						
				112.00										
1		Compact, grey brown SILTY SAND, some clay		0.76	2	SS	585	21						
				111.24										
2	Power Auger	Stiff to very stiff, grey brown SILTY CLAY, trace sand (WEATHERED CRUST)		1.52	3	SS	610	8	●	○				
				110.48										
	Hollow Stem Auger (210mm OD)	Loose to compact, grey brown SILTY SAND to SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)		2.28	4	SS	380	8	●					
3														
4		End of Borehole		3.65	5	SS	535	20	○	●				
5														
6														
7														
8														
9														
10														

Auger Cuttings



GEO - BOREHOLE LOG, 102151.001, BH LOGS, 2023-04-24, GPJ, GEMTEC, 2018, GDT, 8/17/23

# RECORD OF BOREHOLE 23-04

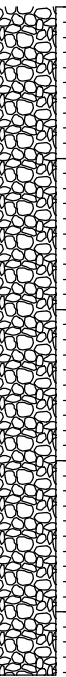
CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	●	▲	+	⊕			
				WATER CONTENT, %											
				10	20	30	40	50	60	70	80	90			
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		110.49											
		TOPSOIL		110.29											
		Loose, grey brown SILTY SAND, with rootlets		0.20	1	SS	510	4	●						
1		Loose to compact, grey brown SAND, some silt, with silty clay seams		0.76	2	SS	510	9	●	○					
2					3	SS	460	12	●	○					
3		Dense to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		2.28	4	SS	405	51	○		●				
4				5	SS	430	57			●					
4				6	SS	205	49	○		●					
5	End of Borehole			106.07											
4.42															
5															
6															
7															
8															
9															
10															

MH

Auger Cuttings



GEO - BOREHOLE LOG, 102151.001, BH LOGS, 2023-04-24, GPJ, GEMTEC, 2018, GDT, 8/17/23

# RECORD OF BOREHOLE 23-06

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 20 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	● PENETRATION RESISTANCE (N), BLOWS/0.3m	+ NATURAL ⊕ REMOULDED		
0		Ground Surface TOPSOIL		110.29									
		Grey brown SILTY SAND, trace clay, with rootlets		109.99 0.30	1	SS	355	5	●				
		Loose to very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		109.53 0.76	2	SS	560	6	● ○				
1													
2					3	SS	305	46		●			
3					4	SS	610	41	○	●			
4					5	SS	305	50		●			
5					6	SS	405	>50	○				
6					7	SS	510	72			●		
7					8	SS	305	62	○		●		
8					9	SS	480	36	○	●			
9					10	SS	480	82	○			●	
10					11	SS	330	77	○			●	
11					12	SS	330	59	○		●		
12													
13		End of Borehole Note: Auger refusal occurred at 8.53 metres depth		101.30 8.99									

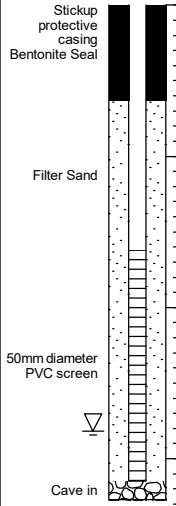
GEO - BOREHOLE LOG - 102151.001 - BH LOGS - 2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

# RECORD OF BOREHOLE 23-07

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 20 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	●	WATER CONTENT, % Wp — W — Wl	+ NATURAL			⊕ REMOULDED
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface TOPSOIL		112.82											
		Brown SILTY SAND, with rootlets		112.52 0.30	1	SS	355	1	●						
1		Loose, grey brown SILTY SAND, some gravel, trace clay		112.06 0.76	2	SS	405	7	●						
2		Dense, grey brown SILTY SAND, trace to some gravel, with cobbles and boulders (GLACIAL TILL)		111.30 1.52	3	SS	460	43	●	○					
					4	SS	330	>50							
3				5	SS	50	>50								
3		End of Borehole Auger Refusal		109.55 3.27											
4															
5															
6															
7															
8															
9															
10															



GROUNDWATER OBSERVATIONS		
DATE	DEPTH (m)	ELEV. (m)
23/04/27	2.8	110.0

GEO - BOREHOLE LOG\_102151.001\_BH\_LOGS\_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23



LOGGED: CC  
 CHECKED: TM

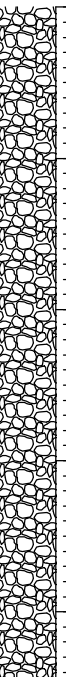
# RECORD OF BOREHOLE 23-08

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	●	▲	+	⊕			
WATER CONTENT, %															
								10 20 30 40 50 60 70 80 90		Wp   W   Wl					
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		110.28											
		TOPSOIL		110.08											
		Brown SILTY SAND, trace clay, with rootlets		0.20	1	SS	430	7	●						
1		Stiff to very stiff, grey brown SILTY CLAY (WEATHERED CRUST)		0.76	2	SS	610	5	●			⊕		MH	
2		Very loose, grey SILT and SAND		2.13	3	SS	610	3	●			⊕			
3		Very loose, grey sandy SILT and CLAY, with cobbles and boulders (GLACIAL TILL)		2.89	4	SS	175	WH							
				107.39	5	SS	380	WH						MH	
4		End of Borehole Auger Refusal		105.84											
5				4.44											
6															
7															
8															
9															
10															

Auger Cuttings



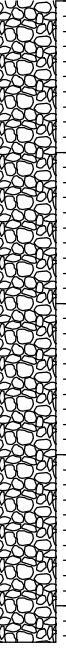
GEO - BOREHOLE LOG 102151.001\_BH\_LOGS\_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

# RECORD OF BOREHOLE 23-10

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 19 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	●	⊕ NATURAL	⊖ REMOULDED			
				WATER CONTENT, %											
				10	20	30	40	50	60	70	80	90			
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		114.14											
		TOPSOIL		113.99											
		Grey SAND and GRAVEL, with cobbles and boulders (GLACIAL TILL)		0.15	1	SS	205	17		●					
1		Loose, grey brown, SILTY SAND, trace gravel (GLACIAL TILL)		113.38	2	SS	405	4	●	○					
		Very dense, grey brown, SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		112.62	3	SS	75	>50							
2				1.52	4	SS	180	>50	○						
3					5	SS	0	>50							
4				6	SS	355	>50	○							
4.24		End of Borehole Auger Refusal		109.90											
5															
6															
7															
8															
9															
10															



GEO - BOREHOLE LOG 102151.001\_BH\_LOGS\_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23

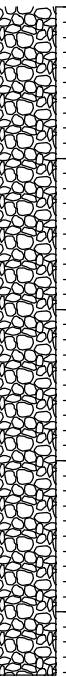
# RECORD OF BOREHOLE 23-11

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 18 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		WATER CONTENT, %				
10	20			30					40	50	60	70	80	90	
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		111.49											
		TOPSOIL		111.29											
		Loose to compact, grey brown SILTY SAND, trace to some clay		0.20	1	SS	510	11	●						
1						2	SS	510	11	●					
2						3	SS	610	5	●					
			Dense to very dense, grey brown SILTY SAND and GRAVEL, with cobbles and boulders (GLACIAL TILL)		109.21 2.28	4	SS	205	32	○	●				
3					5	SS	510	72	○		●				
4					6	SS	305	102	○					→	
4.42		End of Borehole		107.07											

Auger Cuttings



GEO - BOREHOLE LOG 102151.001 BH LOGS 2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23



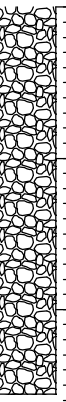
# RECORD OF BOREHOLE 23-14

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 19 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		WATER CONTENT, %				
												W <sub>p</sub>	W <sub>L</sub>		
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface TOPSOIL		116.33											
		Loose, grey brown SILTY SAND		116.05 0.28	1	SS	50	6	●						
1						2	SS	380	7	●					
		Very dense, grey brown SILTY SAND, some gravel, with cobbles and boulders (GLACIAL TILL)		114.96 1.37	3	SS	25	>50	○						
2						4	SS	180	>50						
3		End of Borehole Auger Refusal		113.77 2.56											
4															
5															
6															
7															
8															
9															
10															

Auger Cuttings



GEO - BOREHOLE LOG - 102151.001 - BH - LOGS - 2023-04-24.GPJ - GEMTEC - 2018.GDT - 8/17/23

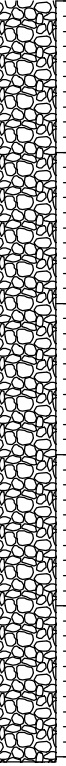
# RECORD OF BOREHOLE 23-15

CLIENT: TLC Holdings Ltd.  
 PROJECT: Geotechnical Investigation, Proposed Plan of Subdivision, 3160 Carp Road, Ottawa, Ontario  
 JOB#: 102151.001  
 LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Apr 19 2023

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		WATER CONTENT, %				
												W <sub>p</sub>	W <sub>L</sub>		
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		111.47											
		TOPSOIL		111.27											
		Loose, brown SILTY SAND, with rootlets		0.20	1	SS	330	7	●						
1		Compact, grey brown SILTY SAND, trace clay		0.76	2	SS	460	11	●	○					
2		Compact, brown SILTY SAND		1.52	3	SS	355	17	●						
3		Very loose, grey SANDY SILT		2.28	4	SS	560	1	●	○					
		Grey brown SAND, some silt		3.05											
	Grey brown SILTY CLAY with sand seams (WEATHERED CRUST)		3.35	5	SS	430	20	●	○						
4		Dense to very dense, grey brown SILTY SAND and GRAVEL, trace clay, with cobbles and boulders (GLACIAL TILL)		3.81	6	SS	330	38	●						
5					7	SS	230	>50	○						
5		End of Borehole Auger Refusal		5.03											
6															
7															
8															
9															
10															

Auger Cuttings



GEO - BOREHOLE LOG 102151.001\_BH\_LOGS\_2023-04-24.GPJ GEMTEC 2018.GDT 8/17/23



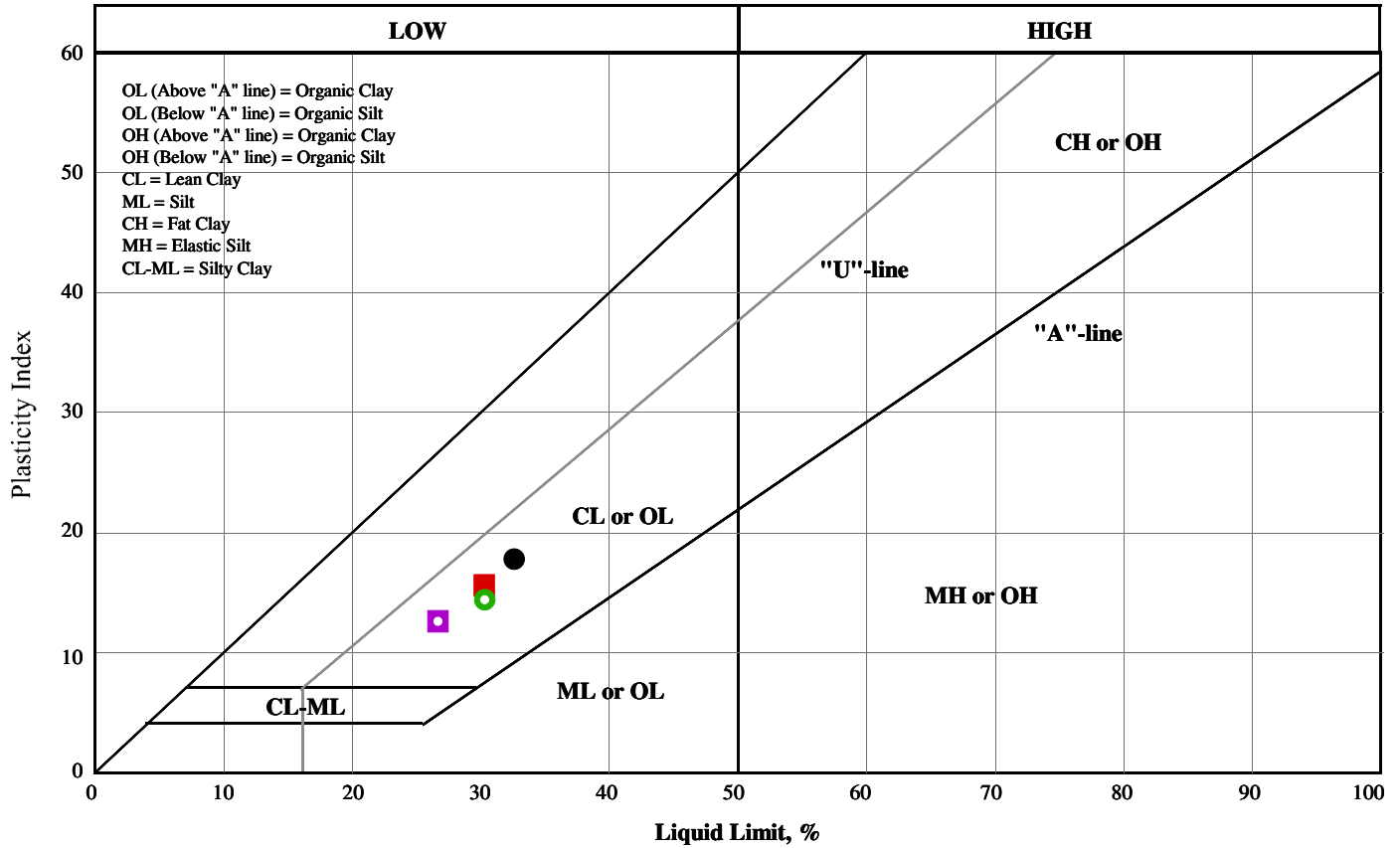
## **APPENDIX B**

### Laboratory Test Results

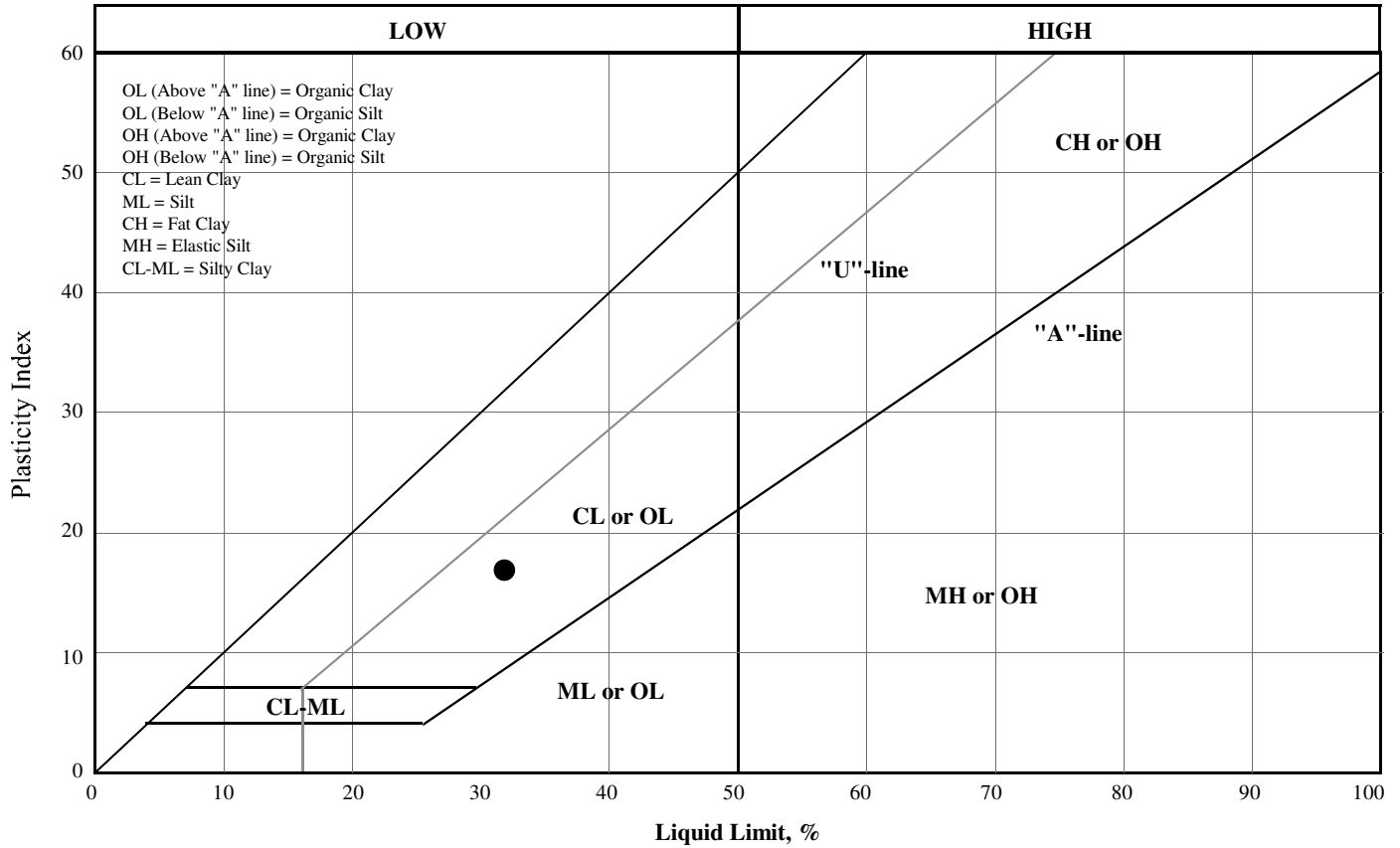








Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	23-01	02	0.76-1.37	32.6	14.8	17.8	<input type="checkbox"/>	27.07
■	23-03	03	1.52-2.13	30.3	14.7	15.6	<input type="checkbox"/>	27.04
○	23-08	03	1.52-2.13	30.3	15.9	14.4	<input type="checkbox"/>	55.94
■	23-13	03	1.52-2.13	26.7	14.1	12.6	<input type="checkbox"/>	29.50



Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	23-15	05B	3.05-3.66	31.8	15.0	16.9	□	39.07



Volume of Shrinkage Dish	
Mass of Glass Plate (g):	37.33
Mass of Shrinkage Dish (g) (m):	20.70
Mass of Shrinkage Dish, Plate, Grease and Water (g):	75.40
Mass of Water (g):	17.37
Volume of Shrinkage Dish:	17.0

Test Specimen	
<b>Specimen No:</b>	<b>1</b>
Mass of Shrinkage Dish, m (g):	20.83
Mass of Shrinkage Dish and Wet Soil, $m_w$ (g):	50.1
Mass of Shrinkage Dish and Dry Soil, $m_d$ (g):	40.42
Mass of Wax-Coated Soil in Air, $m_{sxa}$ (g):	20.09
Mass of Wax-Coated Soil in Water, $m_{sxw}$ (g):	8.8

Calculated Shrinkage Limit	
<b>Specimen No:</b>	<b>1</b>
Mass of Dry Soil, $m_s$ (g):	19.59
Water Content of Soil when Placed in Dish, w (%):	49.41
Mass of Water Displaced by Wax-Coated Soil, $m_{wsx}$ (g):	11.29
Volume of Dry Soil and Wax, $V_{dx}$ (cm <sup>3</sup> ):	11.29
Mass of Wax, $m_x$ (g):	0.50
Volume of Wax, $V_x$ (cm <sup>3</sup> ):	0.56
Volume of Dry Soil, $V_d$ (cm <sup>3</sup> ):	10.73
Shrinkage Limit, SL	17.43

Specific Gravity of Wax = 0.908 at 15.5°C

Specific Gravity of Wax = 0.900 at 20°C

Density of Water (g/cm<sup>3</sup>) = 1.000 (g/cm<sup>3</sup>)

<b>Project No.: 102151.001</b>	<b>Tested By: KN</b>
<b>Project Name:</b>	<b>Checked By:</b>
<b>Date Tested: May 15, 2023</b>	<b>Sample No: BH23-08 SA2</b>
<b>Sample Date:</b>	<b>Source:</b>
<b>Remarks:</b>	<b>Depth: 2'6"-4'6"</b>



## **APPENDIX C**

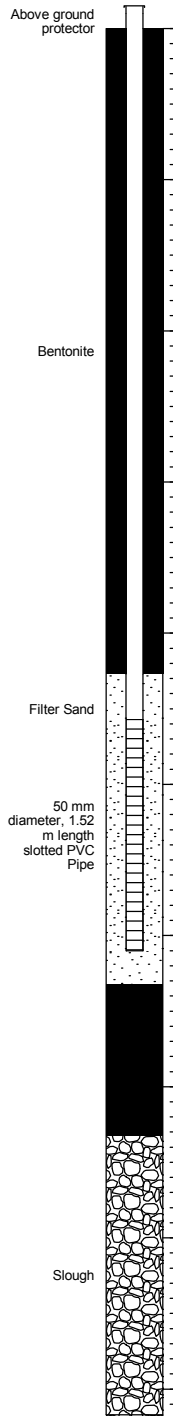
Record of Test hole Logs – Previous Investigation  
Boreholes 19-1 to 19-4, Test Pits 18-1 to 18-15,  
and Test Wells TW-1 to TW-4

# RECORD OF BOREHOLE 19-1D

CLIENT: Novatech  
 PROJECT: Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Jul 9 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION							
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	●	▲	+ NATURAL ⊕ REMOULDED	WATER CONTENT, %									
													$W_p$	$W_L$							
													10	20	30	40	50	60	70	80	90
0		Ground Surface																			
		Dark brown silty sand, with organic material (TOPSOIL)		0.20	1	SS	533	5	●												
		Brown SILTY SAND		0.31																	
		Grey brown SILTY CLAY, some sand																			
		Brown SILTY SAND, trace clay		0.61																	
1		Grey brown SILTY CLAY		0.91	2	SS	610	11	●												
		Brown SILTY SAND, trace clay		1.04																	
		Grey brown SILTY CLAY with silty sand seams		1.22																	
		Grey brown silty sand, some gravel, trace to some clay (GLACIAL TILL)		1.65	3	SS	610	10	●												
				1.83																	
2		Grey sandy silt / silty sand, some gravel, cobbles, and boulders (GLACIAL TILL)			4	SS	610	26		●											
					5	SS	610	33			●										
3					6	SS	406	89													
					7	SS	200	65				●									
4					8	SS	100	68					●								
5					9	SS	279	59													
					10	SS	483	43													
6					11	SS	381	50													
					12	SS	76	50													
7					13	SS	51	50													
					14	SS	127	50													
8					15	SS	203	90													
9		Auger refusal on inferred bedrock End of borehole		9.17																	
10																					



GEO - BOREHOLE LOG 64819.03, BOREHOLE LOGS, GNT\_V01\_2019-07-10.GPJ, GEMTEC 2018, GDT, 21/8/19

# RECORD OF BOREHOLE 19-1S

CLIENT: Novatech  
 PROJECT: Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Jul 9 2019


DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				TESTING									
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m	SHEAR STRENGTH (Cu), kPA	WATER CONTENT, %		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION				
										$W_p$ — $W$ — $W_L$								
										10 20 30 40 50 60 70 80 90								
0		Ground Surface															Above ground protector	
1	Power Auger Hollow Stem Auger (210mm OD)	Soil conditions not logged															Bentonite	
2																		Filter Sand
3				3.05													50 mm diameter, 1.52 m length slotted PVC Pipe	
4																		
5																		
6																		
7																		
8																		
9																		
10																		

GEO - BOREHOLE LOG 64819.03, BOREHOLE LOGS, GNT\_V01\_2019-07-10.GPJ, GEMTEC 2018, GDT, 21/8/19

# RECORD OF BOREHOLE 19-3D

CLIENT: Novatech  
 PROJECT: Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Jul 10 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	WATER CONTENT, %	+ NATURAL	⊕ REMOULDED				
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		0.13												
		Dark brown silty sand, with organic material (TOPSOIL)			1	SS	330	16								
		Grey brown sandy silt / silty sand, some gravel cobbles boulders (GLACIAL TILL)			2	SS	178	103								
1																
2																
3																
4																
5																
6																
7		Auger refusal on inferred bedrock End of borehole		6.53												
8																
9																
10																

GEO - BOREHOLE LOG 64819.03, BOREHOLE LOGS, GNT\_V01\_2019-07-10.GPJ, GEMTEC 2018.GDT, 21/8/19

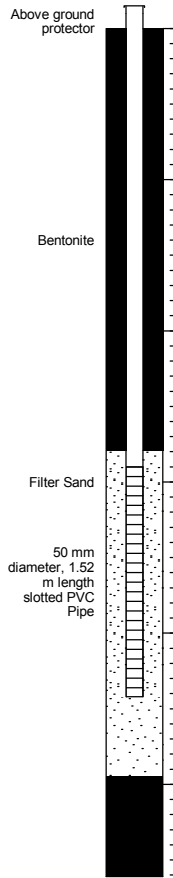


# RECORD OF BOREHOLE 19-4S

CLIENT: Novatech  
 PROJECT: Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Jul 10 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	WATER CONTENT, %	+ NATURAL	⊕ REMOULDED			
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface													
		Dark brown silty sand, with organic material (TOPSOIL)		0.20	1	SS	406	9	●						
		Reddish brown SILTY SAND, trace gravel		0.41											
1		Grey brown silty sand, some gravel, cobbles and boulders (GLACIAL TILL)			2	SS	254	8	●						
					3	SS	330	43							
2					4	SS	559	77							
					5	SS	610	76							
3					6	SS	381	92							
				3.10	7	SS	406	83							
4					8	SS	356	36							
5															
6		Auger refusal on boulders End of borehole		5.61											
7															
8															
9															
10															



GEO - BOREHOLE LOG 64819.03, BOREHOLE LOGS, GNT\_V01\_2019-07-10.GPJ, GEMTEC 2018.GDT, 21/8/19

# RECORD OF BOREHOLE 18-1

CLIENT: Novatech  
 PROJECT: Industrial Subdivision Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	●	▲	+ NATURAL ⊕ REMOULDED	WATER CONTENT, %			
0	Excavator CASE CX135 sr	Ground Surface													
		Dark brown silty sand, with organic material (TOPSOIL)			1	GS									Test pit backfilled with excavated material
		Brown, fine to medium grained SAND, trace to some silt		0.23	2	GS									
1		Grey brown, fine to coarse grained SAND, trace silt, trace to some gravel, cobbles and boulders, some sandy silt pockets with depth (GLACIAL TILL)		0.91	3	GS									
2				4	GS										
3		End of Test Pit		3.05										No groundwater observed upon completion of test pit	
4															
5															

GEO - BOREHOLE LOG\_64819.03\_TEST PIT LOGS\_GNT\_V01\_2018-11-26.GPJ\_GEMTEC 2018.GDT\_10/12/18



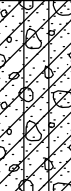





# RECORD OF BOREHOLE 18-4

CLIENT: Novatech  
 PROJECT: Industrial Subdivision Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPa		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	▲ DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m	● PENETRATION RESISTANCE (N), BLOWS/0.3m	+ NATURAL ⊕ REMOULDED	WATER CONTENT, %			
0	Excavator CASE CX135 sr	Ground Surface													
		Dark brown silty sand, with organic material (TOPSOIL)													
		Grey brown SILTY CLAY (WEATHERED CRUST)		0.18	1	GS									
		Grey brown silty sand, trace clay, some gravel, cobbles and boulders (GLACIAL TILL)		0.53	2	GS									
		Grey brown silty sand, trace clay, some gravel, cobbles and boulders, with pockets of grey SILTY CLAY on one side of test pit (GLACIAL TILL)		1.17											
3				3	GS										
				4	GS										
3.05		End of Test Pit													
3.05														Groundwater seepage at 0.91 m below ground surface	
4															
5															

GEO - BOREHOLE LOG 64819.03 TEST PIT LOGS\_GNT\_V01\_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18



# RECORD OF BOREHOLE 18-6

CLIENT: Novatech  
 PROJECT: Industrial Subdivision Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				PENETRATION RESISTANCE (N), BLOWS/0.3m		SHEAR STRENGTH (Cu), kPA		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	▲ DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m	● PENETRATION RESISTANCE (N), BLOWS/0.3m	+ NATURAL ⊕ REMOULDED	WATER CONTENT, % W <sub>p</sub> — W — W <sub>L</sub>		
0	Excavator CASE CX135 sr	Ground Surface	[Symbol]										Test pit backfilled with excavated material	[Diagram]
		Dark brown silty sand, with organic material (TOPSOIL)	[Symbol]											
		Brown SILTY SAND	[Symbol]	0.36	1	GS								
		Grey brown SILTY CLAY (WEATHERED CRUST)	[Symbol]	0.61	2	GS								
1		Grey silty sand, some gravel, cobbles and boulders (GLACIAL TILL)	[Symbol]	1.02	3	GS							No groundwater observed upon completion of test pit	[Diagram]
2														
3		Practical shovel refusal within Glacial Till End of Test Pit	[Symbol]	2.90										
4														
5														

GEO - BOREHOLE LOG 64819.03 TEST PIT LOGS\_GNT\_V01\_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

# RECORD OF BOREHOLE 18-7

CLIENT: Novatech  
 PROJECT: Industrial Subdivision Hydrogeological Investigation  
 JOB#: 64819.03  
 LOCATION: See Test Pit Location Plan, Figure 2

SHEET: 1 OF 1  
 DATUM: CGVD28  
 BORING DATE: Nov 22 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES				● PENETRATION RESISTANCE (N), BLOWS/0.3m      SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED ▲ DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m      WATER CONTENT, % $W_p$ — $W$ — $W_L$										ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	10 20 30 40 50 60 70 80 90											
									(Vertical scale for blow counts)											
0	Excavator CASE CX135 sr	Ground Surface																	Test pit backfilled with excavated material	
		Dark brown silty sand, with organic material (TOPSOIL)																		
		Brown SILTY SAND																		
		Grey silty sand, some gravel, cobbles and boulders (GLACIAL TILL)																		
1				0.20																
2				0.76																
3				3.05																
		End of Test Pit																	No groundwater observed upon completion of test pit	
4																				
5																				

GEO - BOREHOLE LOG 64819.03 TEST PIT LOGS\_GNT\_V01\_2018-11-26.GPJ GEMTEC 2018.GDT 10/12/18

















# CERTIFICATE OF WELL COMPLIANCE



I ( Jeremy Hanna ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of the water well on the property of :

OWNER: ALAN GALE AGENCIES LIMITED

Location: # 3160 CARP ROAD, CARP

Part 11  
LOT: 4/12 CON: 2 PLAN# RP-SR-7272 S/L# Parts 1 & 3

Ottawa-Carleton / Geographical Township of West Carleton

I CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

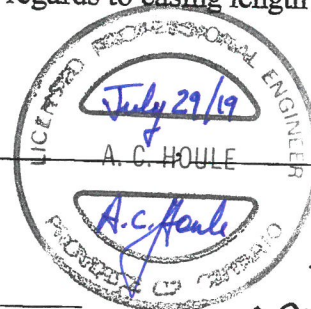
Signed this 18<sup>TH</sup> Day of JUNE, 2019

Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. (C-7681)

The Engineer on behalf of the Landowner set out above, Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg 903, this report ~~and the Hydrogeological Report~~ with regards to casing length and grouting requirements.

Signed this 29 day of July 2019



A.C. Houle, P. Eng.  
(Engineer)  
Gemtec

2019342  
TW# 1054

A260857



Measurements recorded in:  Metric  Imperial

Page \_\_\_\_\_ of \_\_\_\_\_

Well Owner's Information

First Name \_\_\_\_\_ Last Name / Organization **Alan Gale Agencies Limited** E-mail Address \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name) **1870 Sixth Line Road RR1** Municipality **Dunrobin** Province **ON** Postal Code **K0A 1T0** Telephone No. (inc. area code) \_\_\_\_\_

Well Location

Address of Well Location (Street Number/Name) **3160 Carp Road** Township **West Carleton** Lot **P/L 11-13-2** Concession \_\_\_\_\_

County/District/Municipality **Ottawa Carleton** City/Town/Village **Carp** Province **Ontario** Postal Code \_\_\_\_\_

UTM Coordinates Zone Easting Northing Municipal Plan and Sublot Number Other  
NAD 83 **18 421243 5019125** **RP-5R-7272** **Parts 1 & 3**

Overburden and Bedrock Materials/Abandonment/Sealing Record (See instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)
	Clay			0' 8'
	Gravel		(Packed)	8' 26'
Grey	Limestone			26' 137'
Grey	Sandstone	w/ Grey Limestone	Mix	137' 190'
Grey	Sandstone	w/ Grey Limestone	Mix	190' 200'

TEST WELL # 1 OF 4

Annular Space

Depth Set at (m/ft) From To	Type of Sealant Used (Material and Type)	Volume Placed (m <sup>3</sup> /ft <sup>3</sup> )
42' 32'	Neat cement	10.9
32' 0'	Bentonite slurry	12.6

Method of Construction Well Use

Cable Tool  Diamond  Public  Commercial  Not used

Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering

Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring

Boring  Digging  Irrigation  Cooling & Air Conditioning

Air percussion  Industrial  Other, specify \_\_\_\_\_

Other, specify **Hydrofracked**

Construction Record - Casing Status of Well

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 1/4"	Steel	.188"	+2'	42'	<input checked="" type="checkbox"/> Water Supply
5 15/16"	Open Hole		42'	200'	<input type="checkbox"/> Replacement Well

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details Hole Diameter

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Depth (m/ft)		Diameter (cm/in)
		From	To	
190'				9 3/4"
		0'	42'	5 15/16"

Well Contractor and Well Technician Information

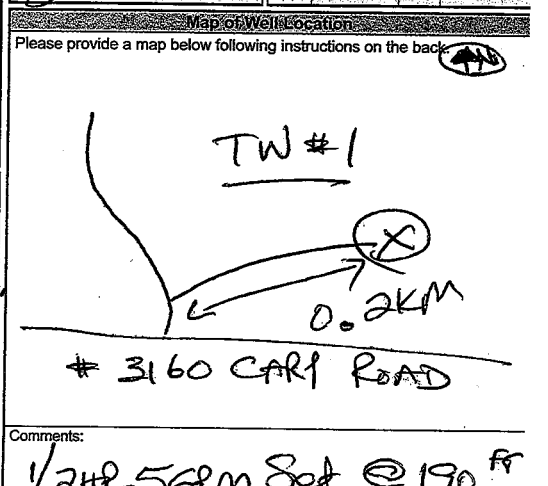
Business Name of Well Contractor **Air Rock Drilling Co. Ltd.** Well Contractor's Licence No. **C7881**

Business Address (Street Number/Name) **6055 Franktown Road** Municipality **Richmond**

Province **ON** Postal Code **K0A 2Z0** Business E-mail Address **air-rock@sympatico.ca**

Results of Well Yield Testing

After test of well yield, water was: <input type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify: <b>Not tested</b>	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason:  Pump intake set at (m/ft) <b>190'</b> Pumping rate (l/min / GPM) <b>3</b> Duration of pumping <b>1 hrs + 0 min</b> Final water level end of pumping (m/ft) <b>21.2'</b> If flowing give rate (l/min / GPM) <b>X</b>	Static Level	<b>13.8'</b>		<b>21.2'</b>
	1	<b>16'</b>	1	<b>17'</b>
	2	<b>17.1'</b>	2	<b>15.8'</b>
	3	<b>18'</b>	3	<b>15.4'</b>
	4	<b>18.8'</b>	4	<b>15.1'</b>
	5	<b>19.2'</b>	5	<b>14.8'</b>
10	<b>20.5'</b>	10	<b>14.2'</b>	
15	<b>20.9'</b>	15	<b>14'</b>	
20	<b>21'</b>	20	<b>13.9'</b>	
25	<b>21.1'</b>	25	<b>13.9'</b>	
30	<b>21.1'</b>	30	<b>13.8'</b>	
40	<b>21.1'</b>	40	<b>13.8'</b>	
50	<b>21.2'</b>	50	<b>13.8'</b>	
60	<b>21.2'</b>	60	<b>13.8'</b>	



Bus. Telephone No. (inc. area code) **813382170** Name of Well Technician (Last Name, First Name) **Hanna, Jeremy**

Well Technician's Licence No. **13632** Signature of Technician and/or Contractor \_\_\_\_\_ Date Submitted **2019 06 19**

Well owner's information package delivered  Yes  No

Date Package Delivered **2019 06 19** Date Work Completed **2019 06 19**

Ministry Use Only  
Audi No: **2302284**

# CERTIFICATE OF WELL COMPLIANCE



I ( Jeremy Hanna ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have

supervised the drilling of the water well on the property of :

OWNER: ALAN GALE AGENCIES LIMITED

Location: # 3160 CARP ROAD, CARP

Part  
LOT: 4 11 CON: 2 PLAN # RPSR-7272 S/L # Parts 1 & 3

Ottawa-Carleton / Geographical Township of West Carleton

I CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

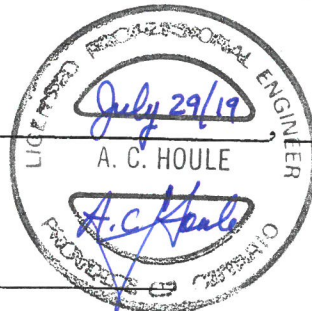
Signed this 17<sup>TH</sup> Day of JUNE, 2019

Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. ( C-7681 )

The Engineer on behalf of the Landowner set out above, Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg 903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

Signed this 29 day of July 2019



A.C. Houle, P.Eng.  
(Engineer)  
Gentec

2019343  
TW#2 OF 4  
A26858





Measurements recorded in:  Metric  Imperial

Page of

Well Owner's Information

First Name: \_\_\_\_\_ Last Name / Organization: **Alan Gale Agencies Limited** E-mail Address: \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name): **1870 Sixth Line Road RR1** Municipality: **Dunrobin** Province: **ON** Postal Code: **K0A 1T0** Telephone No. (inc. area code): \_\_\_\_\_

Well Location

Address of Well Location (Street Number/Name): **3160 Carp Road** Township: **West Carleton** Lot: **P/L 11-12-2** Concession: \_\_\_\_\_

County/District/Municipality: **Ottawa Carleton** City/Town/Village: **Carp** Province: **Ontario** Postal Code: \_\_\_\_\_

UTM Coordinates: Zone: **18** Easting: **421451** Northing: **5019245** Municipal Plan and Sublot Number: **RP-5R-7272** Other: **Parts 1 & 3**

Overburden and Bedrock Materials/Abandonment/Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)
				From To
	Clay			0' 7'
	Gravel		(Packed)	7' 25'
Grey	Limestone			25' 53'
Grey	Limestone			53' 170'
Grey	Limestone			170' 175'
Grey	Sandstone	W / Grey Limestone		175' 200'
<b>TEST WELL # 2 OF 4</b>				

Annular Space

Depth Set at (m/ft)	Type of Sealant Used (Material and Type)	Volume Placed (m <sup>3</sup> /ft <sup>3</sup> )
From To		
40' / 30'	Neat cement	10.9
30' / 0'	Bentonite slurry	12.6

Method of Construction:  Cable Tool  Rotary (Conventional)  Rotary (Reverse)  Percussion  Other, specify: **HYDRO PACKED**

Well Use:  Public  Domestic  Livestock  Irrigation  Industrial  Commercial  Municipal  Test Hole  Cooling & Air Conditioning  Not used  Dewatering  Monitoring

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 1/4"	Steel	.188"	+2'	40'	<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify <input type="checkbox"/> Other, specify
5 1/8"	Open Hole		40'	200'	

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

Water Details

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify	Hole Diameter (cm/in)
		Depth (m/ft) From To
53 (m/ft)	<input checked="" type="checkbox"/> Untested	0' 40' 9 3/4"
170 (m/ft)	<input checked="" type="checkbox"/> Untested	40' 200' 5 1/8"

Well Contractor and Well Technician Information

Business Name of Well Contractor: **Air Rock Drilling Co. Ltd.** Well Contractor's Licence No.: **7881**

Business Address (Street Number/Name): **6659 Franktown Road** Municipality: **Richmond**

Province: **ON** Postal Code: **K0A 2Z0** Business E-mail Address: **air-rock@sympatico.ca**

Bus. Telephone No. (inc. area code): **613-882-170** Name of Well Technician (Last Name, First Name): **Hanna, Jeremy**

Well Technician's Licence No.: **T3632** Signature of Technician and/or Contractor: \_\_\_\_\_ Date Submitted: **2019 07 31**

Results of Well Yield Testing

After test of well yield, water was: <input type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify: <b>Not tested</b>	Draw-Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason: <b>None</b>	Static Level	4.6'		26.4'
	1	8.3	1	19
	2	10.9	2	18.5
	3	12.5	3	14.7
	4	14	4	13
	5	15.3	5	11.7
Final water level end of pumping (m/ft): <b>26.4'</b>	10	19.8	10	7.6
If flowing give rate (l/min / GPM): <b>5</b>	15	21.9	15	6
Recommended pump depth (m/ft): <b>190'</b>	20	23.3	20	4.8
Recommended pump rate (l/min / GPM): <b>5</b>	25	24.2	25	4.6
Well production (l/min / GPM): <b>5</b>	30	24.8	30	4.6
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	40	25.5	40	4.6
	50	26	50	4.6
	60	26.4	60	4.6

Map of Well Location

Please provide a map below following instructions on the back. **(4)**

Comments: **Y2H-56PM Sat @ 190' FT**

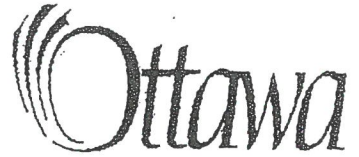
Well owner's information package delivered:  Yes  No

Date Package Delivered: **Y 2019 M 07 D 14**

Date Work Completed: **2019 06 19**

Ministry Use Only: Audit No: **7302285**

# CERTIFICATE OF WELL COMPLIANCE



I ( Jeremy Hanna ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of the water well on the property of :

OWNER: ALAN GALE AGENCIES LIMITED

Location: # 3160 CARP ROAD, Carp

Part 11  
LOT: 412 CON: 2 PLAN # RP-5R-7272 S/L # Parts 1 & 3

Ottawa-Carleton / Geographical Township of West Carleton

I CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

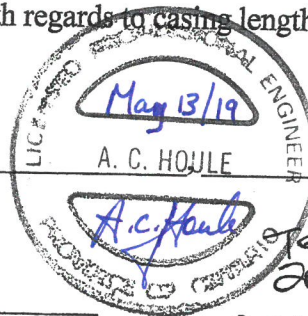
Signed this 7<sup>th</sup> Day of MARCH, 2019

Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. (# 1119)

The Engineer on behalf of the Landowner set out above, Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg 903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

Signed this 13 day of May, 2019



A.C. Houle, P.Eng.  
(Engineer) Gemtec

Test well # 3/4  
209070  
A260960

Shaping our future together  
Ensemble, formons notre avenir

City of Ottawa  
Client Service Centre  
8782 Victoria Street

Ville d'Ottawa  
Centre de service  
8782 rue Victoria





Measurements recorded in:  Metric  Imperial

A260960

Page \_\_\_ of \_\_\_

Well Owner's Information

First Name \_\_\_\_\_ Last Name / Organization **Alan Gale Agencies Limited** E-mail Address \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name) **1870 Sixth Line Road.RR1** Municipality **Dunrobin** Province **ON** Postal Code **K0A 1T0** Telephone No. (inc. area code) \_\_\_\_\_

Well Location

Address of Well Location (Street Number/Name) **3160 Carp Road** Township **West Carleton** Lot **P/L 11-12** Concession **2**

County/District/Municipality **Ottawa-Carleton** City/Town/Village **Carp** Province **Ontario** Postal Code \_\_\_\_\_

UTM Coordinates Zone Easting Northing Municipal Plan and Sublot Number Other  
**NAD 83 18 421648 5019008 RP-5R-7272 Parts 1 & 3**

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From To
	Sand	Gravel	Boulders	0' 23'
Grey	Limestone			23' 185'
Grey	Limestone			185' 200'

TEST WELL # 3 OF 4

**Annular Space**

Depth Set at (m/ft) From To	Type of Sealant Used (Material and Type)	Volume Placed (m <sup>3</sup> /ft <sup>3</sup> )
38' 28'	Neat cement	9.36
28' 0'	Bentonite slurry	8.4

**Method of Construction**

Cable Tool  Diamond  Public  Commercial  Not used  
 Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering  
 Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring  
 Boring  Digging  Irrigation  Cooling & Air Conditioning

Air percussion  Industrial  Other, specify **Hydrofracked**

**Construction Record - Casing**

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		Status of Well
			From	To	
6 1/4"	Steel	.188"	+2'	38'	<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply <input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, specify <input type="checkbox"/> Other, specify
6 1/8"	Open Hole		38'	200'	

**Construction Record - Screen**

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)	
			From	To

**Water Details**

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify	Depth (m/ft) From To	Diameter (cm/in)
185'		0' 38'	9 1/4"
		38' 200'	6 1/8"

**Well Contractor and Well Technician Information**

Business Name of Well Contractor **Air Rock Drilling Co. Ltd** Well Contractor's Licence No. **1119**

Business Address (Street Number/Name) **6055 Franktown Road, RR#1** Municipality **Richmond**

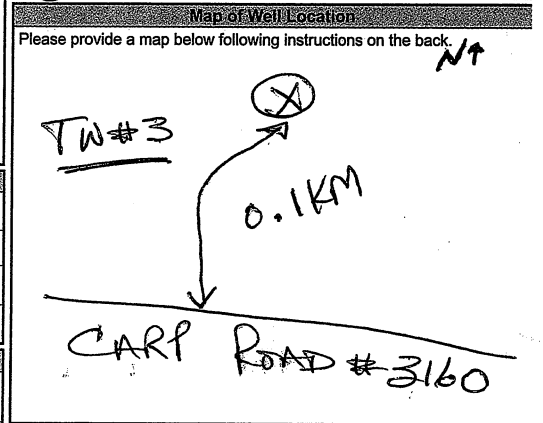
Province **ON** Postal Code **K0A 2Z0** Business E-mail Address **air-rock@sympatico.ca**

Bus. Telephone No. (inc. area code) **6138382170** Name of Well Technician (Last Name, First Name) **Purcell, Shannon**

Well Technician's Licence No. **T14053** Signature of Technician and/or Contractor *[Signature]* Date **2019 03 07**

**Results of Well Yield Testing**

After test of well yield, water was: <input type="checkbox"/> Clear and sand free <input type="checkbox"/> Other, specify <b>Not tested</b>	Draw Down		Recovery	
	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
If pumping discontinued, give reason: <b>∞</b>	Static Level	9'5"	20'8"	
	1	16.5	1	23.6
	2	18	2	21.4
	3	19.1	3	20.4
	4	20.1	4	19.4
	5	20.9	5	18.7
Pump intake set at (m/ft) <b>190</b>				
Pumping rate (l/min / GPM) <b>5</b>				
Duration of pumping <b>1 hrs + 0 min</b>				
Final water level end of pumping (m/ft) <b>29.8'</b>	10	23.8	10	16.5
If flowing give rate (l/min / GPM) <b>X</b>	15	25.4	15	15.3
	20	26.5	20	14.5
Recommended pump depth (m/ft) <b>190'</b>	25	27.3	25	14
Recommended pump rate (l/min / GPM) <b>5</b>	30	27.9	30	13.7
Well production (l/min / GPM) <b>5</b>	40	28.7	40	13.1
Disinfected? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	50	29.3	50	12.5
	60	29.8'	60	12'



Comments: **1/2 HP - 7 GPM SET @ 190 FEET**

Well owner's information package delivered  Yes  No

Date Package Delivered **2019 03 07**

Date Work Completed **2019 03 07**

Ministry Use Only  
 Audit No. **Z302436**  
 Received \_\_\_\_\_

# CERTIFICATE OF WELL COMPLIANCE



I ( **Jeremy Hanna** ) AIR ROCK DRILLING CO. LTD. - DO HEREBY CERTIFY

that I am licensed to drill water wells in the Province of Ontario, and that I have supervised the drilling of the water well on the property of :

OWNER: ALAN GALE AGENCIES LIMITED

Location: #3160 CARP ROAD, Carp

Part 11

LOT: 412 CON: 2 PLAN# RP-5R-7272 S/L# Parts 1+3

Ottawa-Carleton / Geographical Township of West Carleton

I CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

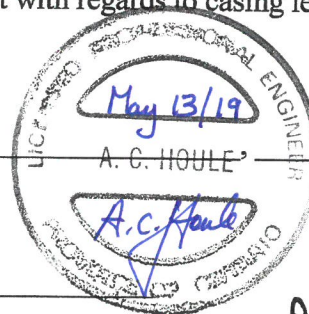
Signed this 6<sup>TH</sup> Day of MARCH, 2019

Jeremy Hanna (T3632)

Air Rock Drilling Co. Ltd. (# 1119)

The Engineer on behalf of the Landowner set out above, Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg 903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

Signed this 13 day of May, 2019



(Engineer)

A.C. Houle, P.Eng.  
Gemtec

Test well # 4/4  
2019069

A260961





Measurements recorded in:  Metric  Imperial

A260961

Page of

**Well Owner's Information**

First Name: \_\_\_\_\_ Last Name / Organization: **Alan Gale Agencies Limited** E-mail Address: \_\_\_\_\_  Well Constructed by Well Owner

Mailing Address (Street Number/Name): **1870 Sixth Line Road RR1** Municipality: **Dunrobin** Province: **ON** Postal Code: **K0A 1T0** Telephone No. (inc. area code): \_\_\_\_\_

**Well Location**

Address of Well Location (Street Number/Name): **3160 Carp Road** Township: **West Carleton** Lot: **P/L 11-1-2 2** Concession: \_\_\_\_\_

County/District/Municipality: **Ottawa-Carleton** City/Town/Village: **Carp** Province: **Ontario** Postal Code: \_\_\_\_\_

UTM Coordinates Zone: **NAD 83** Easting: **18 421446** Northing: **5018944** Municipal Plan and Sublot Number: **RP-5R-7272** Other: **Parts 1 & 3**

**Overburden and Bedrock Materials/Abandonment Sealing Record** (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
	Sand	Stones		0'	15'
	Sand	Gravel		15'	27'
Grey	Limestone			27'	187'
Grey	Sandstone	W/Grey Limestone	Mix	187'	200'
<b>TEST WELL # 4 OF # 4</b>					

**Annular Space**

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
42'	32'	Neat cement	10.92
32'	0'	Bentonite slurry	16.8

**Method of Construction**

Cable Tool  Diamond  Public  Commercial  Not used

Rotary (Conventional)  Jetting  Domestic  Municipal  Dewatering

Rotary (Reverse)  Driving  Livestock  Test Hole  Monitoring

Boring  Digging  Irrigation  Industrial  Cooling & Air Conditioning

Air percussion  Other, specify: **HYDROCRACKED**

**Construction Record - Casing**

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6 1/4"	Steel	.188"	+2'	42'
6 1/8"	Open Hole		42'	200'

**Status of Well:**

Water Supply  Replacement Well  Test Hole  Recharge Well  Dewatering Well  Observation and/or Monitoring Hole  Alteration (Construction)  Abandoned, Insufficient Supply  Abandoned, Poor Water Quality  Abandoned, other, specify \_\_\_\_\_  Other, specify \_\_\_\_\_

**Construction Record - Screen**

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To

**Water Details**

Water found at Depth (m/ft)	Kind of Water: <input type="checkbox"/> Fresh <input checked="" type="checkbox"/> Untested <input type="checkbox"/> Gas <input type="checkbox"/> Other, specify _____	Depth (m/ft) From	To	Hole Diameter (cm/in)
193		0'	42'	9 3/4"
		42'	200'	6 1/8"

**Well Contractor and Well Technician Information**

Business Name of Well Contractor: **Air Rock Drilling Co. Ltd.** Well Contractor's Licence No.: **1119**

Business Address (Street Number/Name): **6659 Franktown Road, RR#1** Municipality: **Richmond**

Province: **ON** Postal Code: **K0A 2Z0** Business E-mail Address: **air-rock@sympatico.ca**

**Results of Well Yield Testing**

After test of well yield, water was:  Clear and sand free  Other, specify: **Not tested**

If pumping discontinued, give reason: \_\_\_\_\_

Pump intake set at (m/ft): **190**

Pumping rate (l/min / GPM): **3**

Duration of pumping: **3** hrs + **0** min

Final water level end of pumping (m/ft): **63.2'**

If flowing give rate (l/min / GPM): \_\_\_\_\_

Recommended pump depth (m/ft): **190'**

Recommended pump rate (l/min / GPM): **3**

Well production (l/min / GPM): **3**

Disinfected?  Yes  No

Draw Down	Recovery		
Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
Static Level	13.5'	63.2'	
1	20.3	1	52.3
2	23	2	50.6
3	25.2	3	48.4
4	27.1	4	46.3
5	28.5	5	44.4
10	36.6	10	35.7
15	42.7	15	30.6
20	40.4	20	25.1
25	49.8	25	21.3
30	54.5	30	17.5
40	57.8	40	13.5
50	60.7	50	13.5
60	63.2'	60	13.5'

**Map of Well Location**

Please provide a map below following instructions on the back:

Comments: **1/2 HP - 5 GPM SET @ 190 FEET**

Bus. Telephone No. (inc. area code): **6138382170** Name of Well Technician (Last Name, First Name): **Purcell, Shannon**

Well Technician's Licence No.: **T4033** Signature of Technician and/or Contractor: \_\_\_\_\_ Date Submitted: **2019 04 30**

Well owner's information package delivered:  Yes  No

Date Package Delivered: **2019 04 28** Date Work Completed: **2019 03 06**

Ministry Use Only: **AUDITING Z302437**



## **APPENDIX D**

### Groundwater Level Measurements

Borehole ID	Ground Surface Elevation (metres)	Groundwater Depth (metres below ground surface)	Groundwater Level Elevation (metres)	Date
BH 23-07	112.8	2.8	110.0	Apr 23, 2023
TW 19-1	115.8	4.3	111.5	Aug 6, 2019
		4.3	111.6	Aug 7, 2019
		4.2	111.6	Aug 8, 2019
		4.4	111.4	Aug 22, 2019
		4.4	111.5	Jan 10, 2020
		3.1	112.7	Apr 23, 2023
TW 19-2	112.8	1.5	111.3	Aug 6, 2019
		1.5	111.3	Aug 7, 2019
		1.5	111.4	Aug 8, 2019
		1.6	111.3	Aug 12, 2019
		1.7	111.2	Aug 22, 2019
		1.6	111.3	Jan 10, 2020
TW 19-3	115.3	3.9	111.3	Aug 6, 2019
		3.8	111.4	Aug 7, 2019
		3.9	111.4	Aug 8, 2019
		4.1	111.2	Aug 22, 2019
		3.9	111.4	Jan 10, 2020
		3.0	112.3	Apr 23, 2023
TW 19-4	117.3	5.3	112.01	Aug 6, 2019
		5.3	112.0	Aug 7, 2019
		5.2	112.1	Aug 8, 2019
		5.5	111.8	Aug 22, 2019
		5.4	111.9	Jan 10, 2020
		3.9	113.4	Apr 23, 2023
BH 19-1D	115.8	4.7	111.2	Aug 7, 2019
		4.6	111.2	Aug 8, 2019
		4.8	111.0	Aug 22, 2019
		4.6	111.2	Jan 10, 2020
		3.6	112.3	Apr 23, 2023

Borehole ID	Ground Surface Elevation (metres)	Groundwater Depth (metres below ground surface)	Groundwater Level Elevation (metres)	Date
BH 19-1S	115.8	Dry	Dry	Aug 6, 2019
		Dry	Dry	Aug 7, 2019
		Dry	Dry	Aug 8, 2019
		Dry	Dry	Aug 12, 2019
		Dry	Dry	Aug 22, 2019
		Dry	Dry	Jan 10, 2020
		2.4	113.4	Apr 23, 2023
BH 19-3D	115.2	4.0	111.2	Aug 7, 2019
		4.0	111.2	Aug 8, 2019
		4.2	111.1	Aug 22, 2019
		4.0	111.3	Jan 10, 2020
		2.9	112.3	Apr 23, 2023
BH 19-3S	115.3	4.1	111.2	Aug 7, 2019
		4.1	111.2	Aug 8, 2019
		4.3	111.1	Aug 22, 2019
		4.1	111.3	Jan 10, 2020
		3.0	112.3	Apr 23, 2023
BH 19-4S	117.1	Dry	Dry	Aug 7, 2019
		Dry	Dry	Aug 8, 2019
		Dry	Dry	Aug 12, 2019
		Dry	Dry	Aug 22, 2019
		Dry	Dry	Jan 10, 2020
		Dry	Dry	Apr 23, 2023



## **APPENDIX E**

Chemical Analysis of Soil Samples  
Samples Relating to Corrosion  
(Paracel Laboratories Ltd. Order No. 2319294)

Certificate of Analysis

Report Date: 16-May-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 10-May-2023

Client PO:

Project Description: 102151.001

<b>Client ID:</b>	BH23-07 SA5 10'0"-10'6"	-	-	-
<b>Sample Date:</b>	20-Apr-23 14:00	-	-	-
<b>Sample ID:</b>	2319294-01	-	-	-
<b>MDL/Units</b>	Soil	-	-	-

**Physical Characteristics**

% Solids	0.1 % by Wt.	83.6	-	-	-
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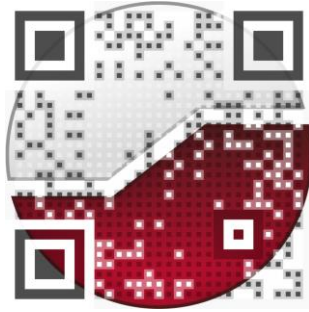
**General Inorganics**

Conductivity	5 uS/cm	179	-	-	-
pH	0.05 pH Units	7.74	-	-	-
Resistivity	0.1 Ohm.m	74.0	-	-	-

**Anions**

Chloride	10 ug/g dry	<10	-	-	-
Sulphate	10 ug/g dry	68	-	-	-

experience • knowledge • integrity



civil	civil
geotechnical	géotechnique
environmental	environnement
structural	structures
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité

