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Geotechnical Investigation
Proposed Concrete Plant
2596 Carp Road
Ottawa, Ontario

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Submitted to:

Cavanagh Developments
9094 Cavanagh Road
Ashton, Ontario
K0A 1B0

Geotechnical Investigation
Proposed Concrete Plant
2596 Carp Road
Ottawa, Ontario

December 13, 2018
Project: 61318.20

experience • knowledge • integrity

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Ottawa, ON, Canada
K2K 2A9

December 13, 2018 File: 61318.20 –R02

Cavanagh Developments
9094 Cavanagh Road
Ashton, Ontario
K0A 1B0

Attention: Ben Houle, P.Eng. – Project Engineer, Land Development

Re: Geotechnical Investigation
Proposed Concrete Plant
2596 Carp Road
Ottawa, Ontario

Enclosed is our geotechnical investigation report for the above noted project, in accordance with our proposal dated July 5, 2018. This report was prepared by Gregory Davidson, B.Eng., E.I.T. and Brent Wiebe, P.Eng.

Greg Davidson, B.Eng., E.I.T.

Brent Wiebe P.Eng.
VP Operations - Ontario

GD/BW

Enclosures
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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed development of a new concrete plant to be located at 2596 Carp Road in Carp (Ottawa), Ontario (see Key Plan, Figure 1). The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of boreholes and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

This investigation was carried out in general accordance with our proposal dated July 5, 2018.

2.0 PROJECT DESCRIPTION AND SITE GEOLOGY

2.1 Project Description

It is understood that plans are being prepared to construct a new concrete batch plant on a relatively undeveloped parcel of land at 2596 Carp Road. The proposed structure(s) include a batching plant, office, aggregate storage bins and a wash plant. The area is surrounded by commercial properties to the south and west, residential properties at the far east property limits and wooded forest to the north. The area where the concrete plant is proposed appears to be relatively flat. A small slope is observed alongside a creek that crosses through the property.

Based on historical geological mapping, the overburden deposit within the vicinity of the new development generally consist of sand, silt and glacial till. Bedrock geology mapping indicates limestone and shale of the Verulam formation at depths ranging from about 5 to 10 metres.

3.0 METHODOLOGY

3.1 Geotechnical Investigation

The field work for this investigation was carried out on August 8, 2018. At that time, eleven (11) boreholes, numbered 18-1 to 18-11, inclusive, were advanced at the site by George Downing Estate Drilling Ltd. to depths ranging from about 1.5 to 2.9 metre below surface grade (elevations 107.4 to 113.2 metres, geodetic datum).

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

The field work was observed throughout by a member of our engineering staff who directed the drilling operations and logged the samples and boreholes.

Four (4) standpipe piezometers were installed and sealed in the overburden at borehole locations 18-1, 18-6, 18-7 and 18-11 to facilitate groundwater level measurements and hydraulic conductivity testing by others.

Following completion of the drilling, the soil samples were returned to our laboratory for examination by a geotechnical engineer. One (1) sample of the soil from borehole 18-8 and one (1) groundwater sample recovered from the monitoring well installed in borehole 18-7 was sent to Paracel Laboratories Ltd. for basic chemical testing relating to corrosion of buried concrete and steel.

The results of the boreholes are provided on the Record of Borehole sheets in Appendix A. The approximate locations of the boreholes are shown on the Borehole Location Plan, Figure 2. The laboratory testing results are provided on the Soils Grading charts in Appendix B. The results of the chemical analysis of a sample of soil relating to corrosion of buried concrete and steel are provided in Appendix C.

The borehole locations were selected by GEMTEC and positioned on site relative to existing features. The ground surface elevations at the location of the boreholes were determined using a Trimble R10 global positioning system. The coordinates of the boreholes are referenced to NAD83 (CSRS) Epoch 2010, vertical network CGVD2013 and are considered to be accurate within the tolerance of the instrument.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the soil and groundwater conditions identified in the boreholes are given on the Record of Borehole sheets in Appendix A. The logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of drilling, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at other than the test locations may vary from the conditions encountered in the boreholes. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil and bedrock involves judgement and GEMTEC does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

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

The following presents an overview of the subsurface conditions encountered in the boreholes advanced during this investigation. It should be noted borehole 18-11 was drilled to facilitate the installation of a standpipe piezometer. The soil conditions at this location were not logged.

4.2 Topsoil, Topsoil Fill

A surficial layer of topsoil or topsoil fill was encountered at all borehole locations. The thickness of the topsoil/ topsoil fill layer ranges from about 30 to 80 millimetres.

4.3 Fill Material

Fill material was encountered at borehole locations 18-2 to 18-5, inclusive, below the surficial topsoil fill layer. The fill material is variable across the site but can generally be described as grey to dark brown silty sand with varying amounts of gravel, clay, cobbles and boulders. It was noted that construction debris (reinforcing steel) was encountered in the fill material at borehole 18-3. Boreholes 18-2 to 18-5, inclusive, were terminated within the fill material at depths of about 1.5 metres below surface grade (elevations 112.4 to 113.2 metres, geodetic datum).

The results of grain size distribution testing on samples of the fill material is provided on the Soils Grading Charts in Appendix B and summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Testing (Fill Material)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt & Clay (%)
18-2	1	0.3 – 0.6	22	49	29
18-4	1	0.3 – 1.2	7	63	30

Moisture content testing carried out on samples of the fill material indicate moisture contents ranging from about 12 to 14 percent.

4.4 Sand

A deposit of brown sand with varying amounts of silt and gravel was encountered in boreholes 18-1 and 18-6 below the surficial topsoil layer and/or silty sand.

The results of grain size distribution testing on a sample of the native sand is provided on the Soils Grading Charts in Appendix B and summarized in Table 4.2.

Table 4.2 – Summary of Grain Size Distribution Testing (Sand)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt & Clay (%)
18-1	1	0.1 – 0.4	0	92	8

Moisture content testing carried out on a sample of the native sand indicates a moisture content of about 18 percent.

4.5 Silty Sand/Sandy Silt

Native deposits of silty sandy/sandy silt were encountered at borehole locations 18-1 and 18-6 to 18-10, inclusive, below the surficial topsoil layer and/or sand. The native deposits consist of grey to brown silty sand with varying amounts of gravel and clay to dark brown sandy silt. The thickness of the silty sand/sandy silt layer ranges from about 0.3 to 1.4 metres and extends to depths ranging from about 0.3 to 2.1 metres below surface grade. Boreholes 18-1 and 18-6 were terminated within the silty sand at a depth of about 2.1 metres below surface grade (elevation 110.7 and 108.7 metres, geodetic datum, respectively).

Penetration tests carried out within the silty sand/ sandy silt gave N values ranging from 3 to 9 blows per 0.3 metres of penetration, which reflects a very loose to loose relative density.

The results of grain size distribution testing on samples of the native silty sand/sandy silt are provided on the Soils Grading Charts in Appendix B and summarized in Table 4.3.

Table 4.3 – Summary of Grain Size Distribution Testing (Silty Sand/Sandy Silt)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt & Clay (%)
18-6	3	0.9 – 1.2	7	47	46
18-7	1B	0.1 – 0.6	4	70	26
18-10	2	0.8 – 1.4	0	35	65

Moisture content testing carried out on samples of the native silty sand/sandy silt indicate moisture contents ranging from about 14 to 36 percent.

4.6 Glacial Till

Native deposits of glacial till were encountered at borehole locations 18-7 to 18-10, inclusive, at depths ranging from about 0.8 to 1.5 metres below surface grade. Glacial till is a heterogeneous mixture of all grain sizes but at this site can generally be described as grey brown silty sand with trace to some gravel and probable cobbles and boulders. The thickness of the glacial till ranges from about 1.4 to 1.9 metres based on auger refusal at boreholes 18-7 to 18-10 inclusive.

Penetration tests carried out within the glacial till gave N values ranging from 18 blows per 0.3 metres of penetration to greater than 50 blows for 80 millimetres, which reflects a compact to very dense relative density. The relative density variability is likely due to the presence of cobbles and boulders within the glacial till.

The results of grain size distribution testing on a sample of the native glacial till is provided on the Soils Grading Charts in Appendix B and summarized in Table 4.4.

Table 4.4 – Summary of Grain Size Distribution Testing (Glacial Till)

Location	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
18-8	3	1.5 – 2.1	5	53	25	17

Moisture content testing carried out on samples of the native glacial till indicate moisture contents ranging from about 6 to 10 percent.

4.7 Auger Refusal

Practical auger refusal on inferred bedrock occurred at boreholes 18-7 to 18-11, inclusive, at depths ranging from about 2.7 to 2.9 metres below surface grade (elevations 107.4 to 109.8 metres, geodetic datum). Table 4.5 summarizes the depth of refusal and corresponding elevations at the borehole locations. It is noted that boreholes 18-1 to 18-6, inclusive, were advanced to pre-determined depths (1.5 to 2.1 metres below surface grade) to determine the conditions below the proposed access roadway and parking areas. As such, these boreholes were not taken to auger refusal.

Table 4.5 – Auger Refusal Summary

Borehole	Refusal Depth Below Existing Ground Surface (metres)	Elevation – Geodetic Datum (metres)
18-7	2.9	109.8
18-8	2.7	108.9
18-9	2.9	108.9
18-10	2.9	107.4
18-11	2.8	108.1

Auger refusal typically occurs on or within boulders or on the surface of the bedrock.

4.8 Groundwater

The groundwater conditions in the open boreholes were observed prior to backfilling. Groundwater seepage was observed in borehole 18-2 at about 1.4 metres below surface grade (elevation 112.8). It is noted that groundwater seepage may not be representative of the groundwater table. Standpipe piezometers were installed in boreholes 18-1, 18-6, 18-7 and 18-11, to measure stabilized groundwater conditions and facilitate hydraulic conductivity testing. The groundwater levels measured on August 17, 2018, are summarized in Table 4.6.

Table 4.6 – Groundwater Level Observations (August 17, 2018)

Borehole	Date	Depth Below Existing Ground Surface (metres)	Elevation – Geodetic Datum (metres)
18-1	August 17, 2018	0.7	112.2
18-6	August 17, 2018	1.3	109.6
18-7	August 17, 2018	1.5	111.2
18-11	August 17, 2018	1.5	109.4

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

4.9 Soil Chemistry Relating to Corrosion

The results of chemical testing of a soil sample from borehole 18-8 sample 2B are provided in Appendix D and summarized below:

- pH 7.89
- Sulphate Content <5 micrograms per gram
- Chloride Content <5 micrograms per gram
- Resistivity 121 Ohm metres

The results of chemical testing of a groundwater sample from borehole 18-7 sample 2B are also provided in Appendix D and summarized below:

- pH 7.7
- Sulphate Content 25 micrograms per gram
- Chloride Content 12 micrograms per gram
- Resistivity 18.1 Ohm metres

5.0 GEOTECHNICAL GUIDELINES AND RECOMMENDATIONS

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the boreholes advanced as part of this investigation and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from offsite sources are outside the terms of reference for this report and have not been investigated or addressed.

5.2 Proposed Buildings

5.2.1 Excavation

Based on the test pits advanced in the vicinity of the proposed buildings (18-7 to 18-10, inclusive) the excavations for the proposed batching plant, office, aggregate storage bins and wash plant will be carried out mostly through topsoil, sand, silt sand/sandy silt and glacial till. The sides of

the excavation in overburden 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 fill material at this site can be classified as Type 3 soil and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical, or flatter.

In the event that a granular pad is necessary below the foundations, the excavations should be sized to accommodate a pad of imported granular material which extends at least 0.3 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

Groundwater inflow, if any, from the overburden deposits should be relatively small and controlled by pumping from filtered sumps within the excavation. It is not expected that short term pumping during excavation will have a significant effect on nearby structures and services.

5.2.2 Footing Design

Based on the results of the current investigation, the proposed structures could be founded on conventional footings bearing on or within native, undisturbed sand, silty sand and/or glacial till however, based on the results pits 18-7 to 18-10, inclusive, it considered likely that the foundations will bear on the native glacial till.

In areas where subexcavation of disturbed material is required below proposed founding level, the grade could be raised with compacted granular material (engineered fill). The engineered fill should consist of granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II and should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. To provide adequate spread of load beneath the footings, the engineered fill should extend horizontally at least 0.3 metres beyond the footings and then down and out from this point at 1 horizontal to 1 vertical, or flatter.

For design purposes, footings bearing on the native, undisturbed glacial till material, or on a pad of engineered fill above native, undisturbed glacial till should be sized using a geotechnical reaction at Serviceability Limit State (SLS) of 150 kilopascals and a factored geotechnical resistance at Ultimate Limit State (ULS) of 300 kilopascals. For footings bearing directly on the native, undisturbed sand, silty sand and/or sandy silt a geotechnical reaction at SLS of 90 kilopascals and a factored geotechnical resistance at ULS of 250 kilopascals could be used. The post construction total and differential settlement of the footings at SLS should be less than 25 millimetres, provided that all loose and/or disturbed soil is removed from the bearing surfaces.

To reduce the potential for cracking in the footings, foundation walls, and concrete slabs on grade where the footings transition between different subgrade materials, the foundation walls should be reinforced for a distance of 3 metres on both sides of the transition areas or as recommended by the structural engineer.

5.2.3 Seismic Design of Proposed Structures

Based on the results of the investigation, the proposed structures should be designed for seismic Site Class D.

There is no potential for liquefaction of the overburden deposits below typical level (i.e. soils deeper than about 1.5 metres below ground surface) at this site.

5.2.4 Frost Protection of the Foundations and Slab

All exterior footings in unheated portions of the proposed structures or slabs should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleaned of snow cover during the winter months should be provided with a minimum of 1.8 metres of earth cover. The required depth of frost protection can be reduced by the thickness of any engineered fill beneath the foundations. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. An insulation detail could be provided upon request.

5.2.5 Foundation Wall Backfill and Drainage

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 OPSS Granular B Type I or II requirements.

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 standard Proctor maximum dry density value using suitable vibratory compaction equipment. Light, walk behind compaction equipment should be used next to 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 standard Proctor maximum dry density value.

Where areas of hard surfacing (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 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.

Perimeter foundation drainage is not considered necessary for slab on grade structures at this site, provided that the floor slab level is above the finished exterior ground surface level.

5.2.6 Slab on Grade Support

Based on the results of the investigation, the area in the vicinity of the buildings is generally underlain by topsoil and native overburden deposits. The existing topsoil should be removed from the slab on grade areas.

The grade below the concrete slabs on grade could be raised, where necessary, with granular material meeting OPSS requirements for Granular B Type I or II. The use of Granular B Type II material is preferred under wet conditions. The granular base for the proposed slab on grade should consist of at least 150 millimetres of OPSS Granular A.

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 standard Proctor maximum dry density value.

Underfloor drainage is not considered necessary provided that the floor slab level is above the finished exterior ground surface level.

Thermal protection of the concrete slab on grade is required in areas that will remain unheated during the winter period. An insulation detail is provided on Figure D1 in Appendix D. The type of insulation used below the slabs will depend on the stresses imposed on the insulation. The stress on the insulation should not exceed about 35 percent of the insulation's quoted compressive strength due to the time dependant creep characteristics of this material. Further comments could be provided as the design progresses. The allowable stress levels for several strengths of insulation are provided in Table 5.1.

Table 5.1 – Allowable Stress Levels

Insulation Type	Maximum Allowable Stress (kilopascals)
Dow SM (or equivalent)	70
Dow Highload 40 (or equivalent)	100
Dow Highload 60 (or equivalent)	150

If required, a modulus of subgrade reaction for the design of the concrete slabs on grade could be provided as the design progresses.

5.2.7 Corrosion of Buried Concrete and Steel

The measured sulphate concentrations in the soil sample and groundwater sample recovered from borehole 18-8 and the well screen in borehole 18-7 are <5 micrograms per gram and 25 milligrams per litre, respectively. According to Canadian Standards Association (CSA) "Concrete Materials and Methods of Concrete Construction", the concentration of sulphate can be classified as low. Therefore any concrete in contact with the groundwater could be batched with General Use (GU) cement.

Based on the resistivity and pH of the soil sample, the soil in this area can be classified as non-aggressive towards unprotected steel.

5.3 Roadway

5.3.1 Subgrade Preparation

In preparation for roadway construction at this site, all surficial topsoil and any soft, wet or deleterious materials should be removed from the proposed roadway areas.

Prior to placing granular material for the internal roads, the exposed subgrade should be inspected and approved by geotechnical personnel. Any soft areas should be subexcavated and replaced with suitable (dry) earth borrow or well shattered and graded rock fill material that is frost compatible with the materials exposed on the sides of the area of subexcavation.

Similarly, should it be necessary to raise the roadway grades at this site, material which meets OPSS specifications for Select Subgrade Material, Earth Borrow or well shattered and graded rock fill material may be used.

The Select Subgrade material or Earth Borrow should be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment. Rock fill should be placed in maximum 500 millimetres lifts and suitably compacted either with a large drum roller, the haulage and spreading equipment, or a combination of both.

5.3.2 Pavement Structure

For the parking areas to be used by light vehicles (cars, etc.) the following minimum pavement structure is recommended:

- 50 millimetres of hot mix asphaltic (Superpave 12.5);
- 150 millimetres of OPSS Granular A base; over
- 300 millimetres of OPSS Granular B Type II subbase.

For parking areas and access roadways to be used by heavy truck traffic the suggested minimum pavement structure is:

- 100 millimetres of hot mix asphaltic concrete (40 millimetres of Superpave 12.5 (Traffic Level B) over 60 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 and parking lot 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 thickness 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 thickness 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. An allowance could be made for the following:

- Increase the Granular B, Type II subbase thickness to 600 millimetres and,
- Install a non-woven geotextile separator meeting OPSS 1860 Class II requirements, between the subgrade surface and granular roadway subbase material.

5.3.3 Asphalt Cement Type

Performance grade PG 58-34 asphalt cement should be specified for Superpave asphaltic concrete mixes.

5.3.4 Pavement Transitions

As part of the roadway construction, the new pavement will abut the existing pavement at Carp Road. The following is suggested to improve the performance of the joint between the new and the existing pavements:

- Neatly saw cut the existing asphaltic concrete;
- Remove the asphaltic concrete and slope the bottom of the excavation within the existing granular base and subbase at 1 horizontal to 1 vertical, or flatter, to avoid undermining the existing asphaltic concrete.
- To avoid cracking of the asphaltic concrete due to an abrupt change in the thickness of the roadway granular materials where new pavement areas join with the existing

pavements, the granular depths should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the existing pavement structure.

- Remove (mill off) 40 to 50 millimetres of the existing asphaltic concrete to a distance of 300 millimetres at the joint and tack coat the asphaltic concrete at the joint in accordance with the requirements in OPSS 310.

5.3.5 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long term performance of the pavement at this site. The subgrade surfaces should be crowned and shaped to drain to the ditches to promote drainage of the pavement granular materials.

5.3.6 Granular Material Compaction

The granular base and subbase materials should be compacted in maximum 300 millimetre thick lifts to at least 98 percent of the standard Proctor maximum dry density value.

5.4 Existing Slope

As indicated above, a slope exists adjacent to a creek that crosses through the property. Plans provided to us indicate a “Meander Belt” setback for this creek. The proposed development is outside of this setback.

In order to assess the slope, available topographic information in the vicinity of the slope was reviewed and a site visit was carried out by a member of our engineering staff who assessed several sections of the slope in the vicinity of the development. Based on our review and observations, the slope height is generally less than about 2 metres. We have no concerns with impacts from the proposed development on the global stability of this slope. Furthermore, it is noted that the meander belt setback will result in a considerable separation distance between the development and the creek.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Effects of Construction Induced Vibration

Some of the construction operations (such as excavation and granular material compaction, 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. Assuming that any excavating is carried out in accordance with the guidelines in this report, the magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition, but may any felt at the nearby structures. We recommend that preconstruction surveys be carried out on the adjacent structures and that vibration monitoring be carried out during the construction to ensure that vibrations are below typical threshold values and so that any damage claims can be addressed in a fair manner.

6.2 Winter Construction

In the event that construction is required during freezing temperatures, the subgrade should be protected immediately from freezing using straw, propane heaters and insulated tarpaulins, or other suitable means.

6.3 Excess Soil Management Plan

This report does not constitute an excess soil management plan. The disposal requirements for excess soil from the site have not been assessed.

6.4 Design Review

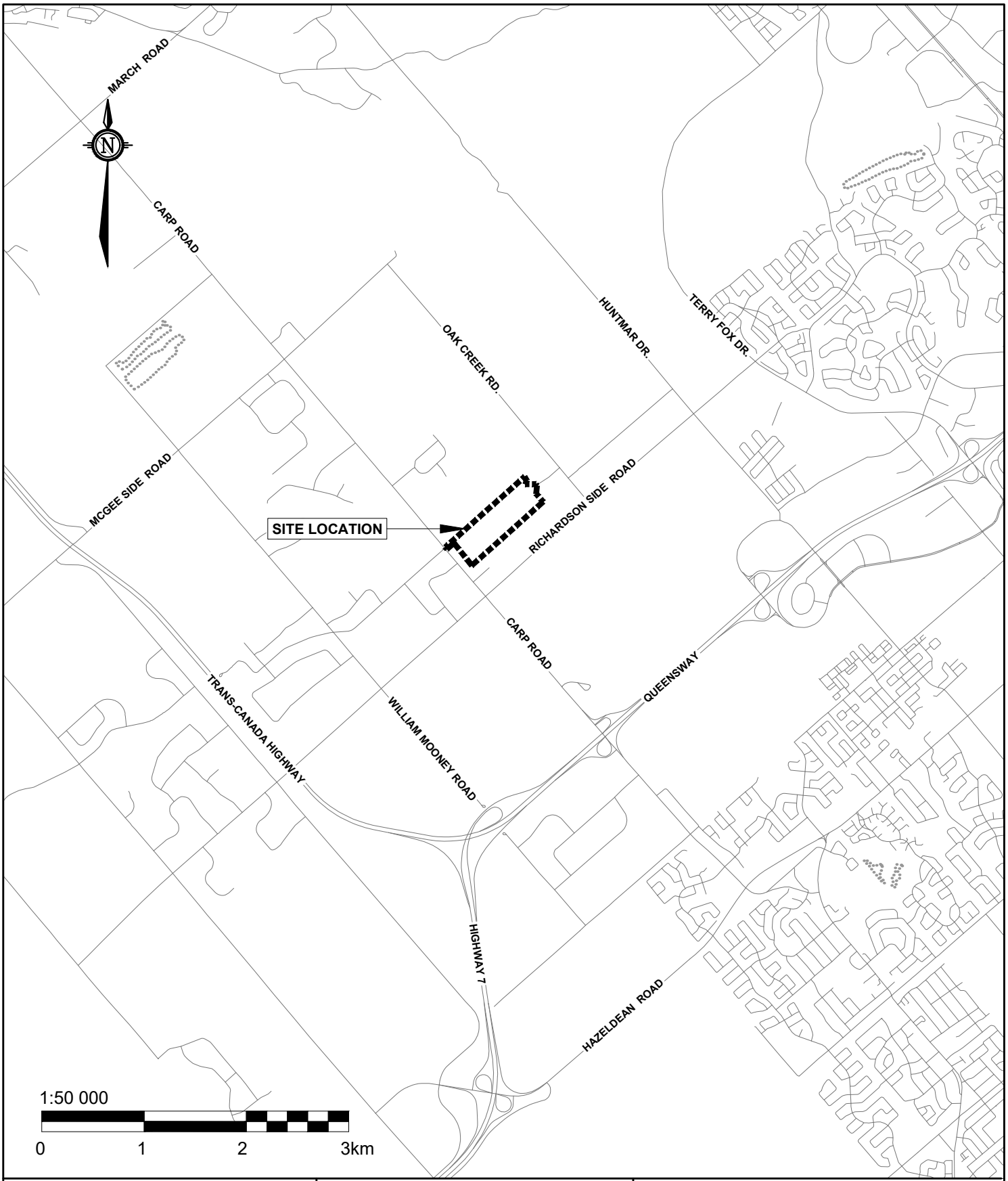
It is recommended that the final design drawings be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the proposed development should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

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.

Greg Davidson, B.Eng., E.I.T.

Brent Wiebe, P.Eng.
VP Operations - Ontario



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Project
GEOTECHNICAL INVESTIGATION
2596 CARP ROAD
OTTAWA, ONTARIO

Drawing
KEY PLAN

Drwn By	Chkd By	Date	Project No.	Revision No.	
P.C.	K.H.	SEPT. 2018	61318.20	0	**FIGURE 1**

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LEGEND

BOREHOLE LOCATION IN PLAN
(current investigation by GEMTEC)

BH 18-1 ← BOREHOLE ID
113.72 ← GROUND SURFACE ELEVATION IN METRES GEODETIC DATUM

Scale 1:2500

0 50 100 150m

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Ottawa, ON K2K 2A9
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Client	Project
1384341 ONTARIO LTD.	61318.20

Location: 2596 CARP ROAD, OTTAWA, ON

Drwn by	Chkd by	
P.C.	K.H.	BOREHOLE LOCATION PLAN

Date	Rev.	
SEPT. 2018	0	**FIGURE 2**

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APPENDIX A

List of Abbreviations and Terminology
Record of Borehole Sheets

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
γ	Unit weight

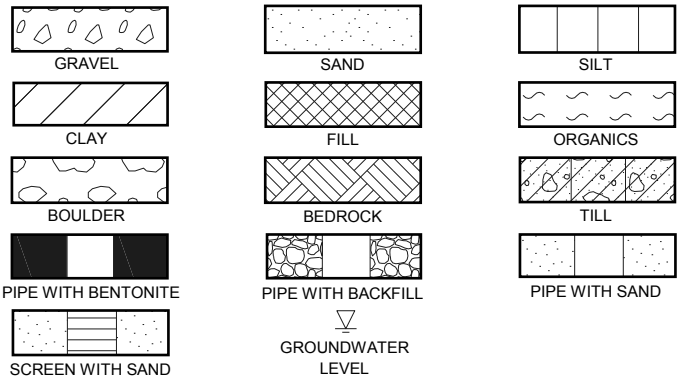
PENETRATION RESISTANCE

Standard Penetration Resistance, N
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.

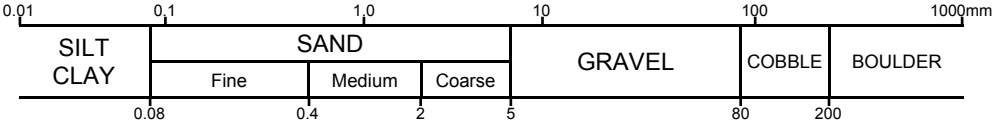
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

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**	**Cu, 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

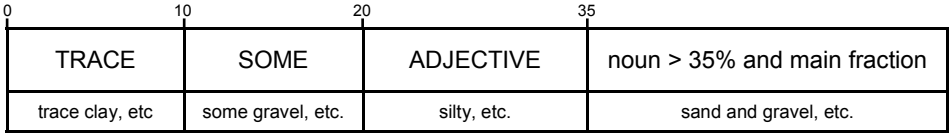


GRAIN SIZE



DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)



RECORD OF BOREHOLE 18-1

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		112.90						
		TOPSOIL		0.05						
		Brown SAND, trace silt		112.49	1	GS			M	
		Grey SILTY SAND, trace clay		0.41	2	GS				
2				110.77						
		End of borehole		2.13						
3										
4										
5										

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

Bentonite seal
Filter sand
51 mm diametre, 1.52 m long well screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/08/17	0.69 ▽	112.21

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-2

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		114.17					10 20 30 40 50 60 70 80 90		
		TOPSOIL FILL		0.03							
		Dark brown sandy silt, some clay, trace gravel (FILL MATERIAL)			1	GS			○	M	Backfilled with soil cuttings
1					2	GS					Groundwater seepage oberved in open borehole
				112.65							
		End of borehole		1.52							
2											
3											
4											
5											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/08/08	1.35 ▽	112.82

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-3

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		114.76							
		TOPSOIL FILL		114.71 / 0.05	1	GS					
		Brown sandy silt, trace gravel and clay, with debris (rebar) (FILL MATERIAL)			2	GS					Backfilled with soil cuttings
1											
				113.24							No groundwater seepage observed upon completion of borehole
		End of borehole		1.52							
2											
3											
4											
5											

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

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-4

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		113.88							
		TOPSOIL FILL		0.05							
		Brown sandy silt, trace gravel and clay, with possible cobbles and boulders (FILL MATERIAL)			1	GS			○	M	Backfilled with soil cuttings
1											
		End of borehole		112.36 1.52							No groundwater seepage observed upon completion of borehole
2											
3											
4											
5											

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

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Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-5

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		113.91							
		TOPSOIL FILL		0.03							
		Grey to brown sandy silt, some clay, trace gravel (FILL MATERIAL)			1	GS					Backfilled with soil cuttings
1					2	GS					
		End of borehole		112.39 / 1.52							No groundwater seepage observed upon completion of borehole
2											
3											
4											
5											

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

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Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-6

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m ● / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m ▲	SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED / WATER CONTENT, % W_P W W_L	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		110.86								
		TOPSOIL		0.05								
		Dark brown SILTY SAND		110.56	1	GS						
		Brown SAND, trace silt and gravel		0.30 / 110.35	2	GS						
1		Grey brown SILTY SAND		0.51	3	GS					M	
2				108.73								
		End of borehole		2.13								
3												
4												
5												

10 20 30 40 50 60 70 80 90

Bentonite seal
Filter sand
51 mm diametre, 1.52 m long well screen

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/08/17	1.25 ▽	109.61

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

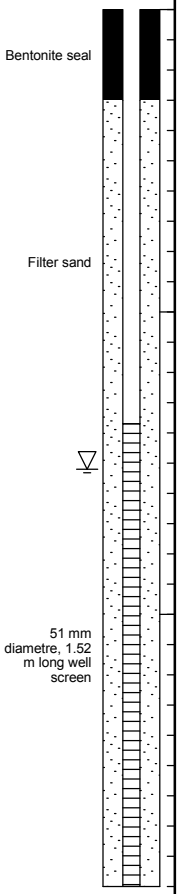
RECORD OF BOREHOLE 18-7

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		112.68						
		TOPSOIL		0.05						
		Loose, brown SILTY SAND, trace gravel			1 1B	SS SS	430	7	M	
1		very dense, grey brown silty sand, trace to some gravel with possible cobbles and boulders (GLACIAL TILL)		111.61 1.07	2	SS	480	10		
2					3	SS	610	54		
					4	SS	410	>50 for 150 mm		
3		End of borehole Auger refusal on inferred bedrock		109.78 2.90						
4										
5										

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



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/08/17	1.52 ▽	111.16

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LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-8

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		111.57							
		TOPSOIL		0.05							
	Power Auger / Hollow Stem Auger (210mm OD)	Very loose, brown SILTY SAND, trace gravel			1A 1B	SS SS	480	4			Soil moist at about 0.8 metres below ground surface
				110.81							
1		Compact to very dense, grey brown silty sand, trace to some gravel with possible cobbles and boulders (GLACIAL TILL)		0.76	2	SS	460	21			Backfilled with soil cuttings
					3	SS	510	54		MH	
2					4	SS	510	>50 for 100 mm			
				108.88							
		End of borehole Auger refusal on inferred bedrock		2.69							
3											
4											
5											

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-9

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0		Ground Surface		111.79				
		TOPSOIL		0.05				
	Power Auger Hollow Stem Auger (210mm OD)	Loose to compact, brown SILTY SAND, trace gravel			1	SS	305	7
1		Compact to very dense, grey brown silty sand, trace to some gravel with possible cobbles and boulders (GLACIAL TILL)		110.72 1.07	2	SS	560	15
					3	SS	560	58
2					4	SS	530	>50 for 130 mm
				108.92 2.87				
3		End of borehole Auger refusal on inferred bedrock						
4								
5								

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

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Soil moist at about 0.8 metres below ground surface

Backfilled with soil cuttings

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-10

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		110.28						
		TOPSOIL		110.20 / 0.08						
		Very loose to loose dark brown to brown SANDY SILT, trace clay			1	SS	510	3		
1					2	SS	585	9	M	Soil moist at about 0.8 metres below ground surface
				108.76 / 1.52						Backfilled with soil cuttings
2		Compact to very dense, grey brown silty sand, trace to some gravel with possible cobbles and boulders (GLACIAL TILL)			3	SS	560	18		
					4	SS	280	>50 for 80 mm		
3		End of Borehole Auger refusal on inferred bedrock		107.38 / 2.90						
4										
5										

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

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

RECORD OF BOREHOLE 18-11

CLIENT: Cavanagh Developments
PROJECT: 2596 Carp Road
JOB#: 61318.20
LOCATION: See Borehole Location Plan, Figure 2

SHEET: 1 OF 1
DATUM: CGVD2013
BORING DATE: Aug 8 2018

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE (N), BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (+ NATURAL, ⊕ REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		110.87							
		Soil conditions not logged									Bentonite seal
1											Filter sand
2											51 mm diametre, 1.52 m long well screen
				108.08							
3		End of Borehole Auger refusal on inferred bedrock		2.79							
4											
5											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
18/08/18	1.47 ▽	109.40

GEMTEC
Consulting Engineers and Scientists

LOGGED: K.H.
CHECKED: B.W.

GEO - BOREHOLE LOG 61318.20_GINT_V01_2018-08-08.GPJ GEMTEC 2018.GDT 30/8/18

APPENDIX B

Laboratory Testing Results
Soils Grading Charts

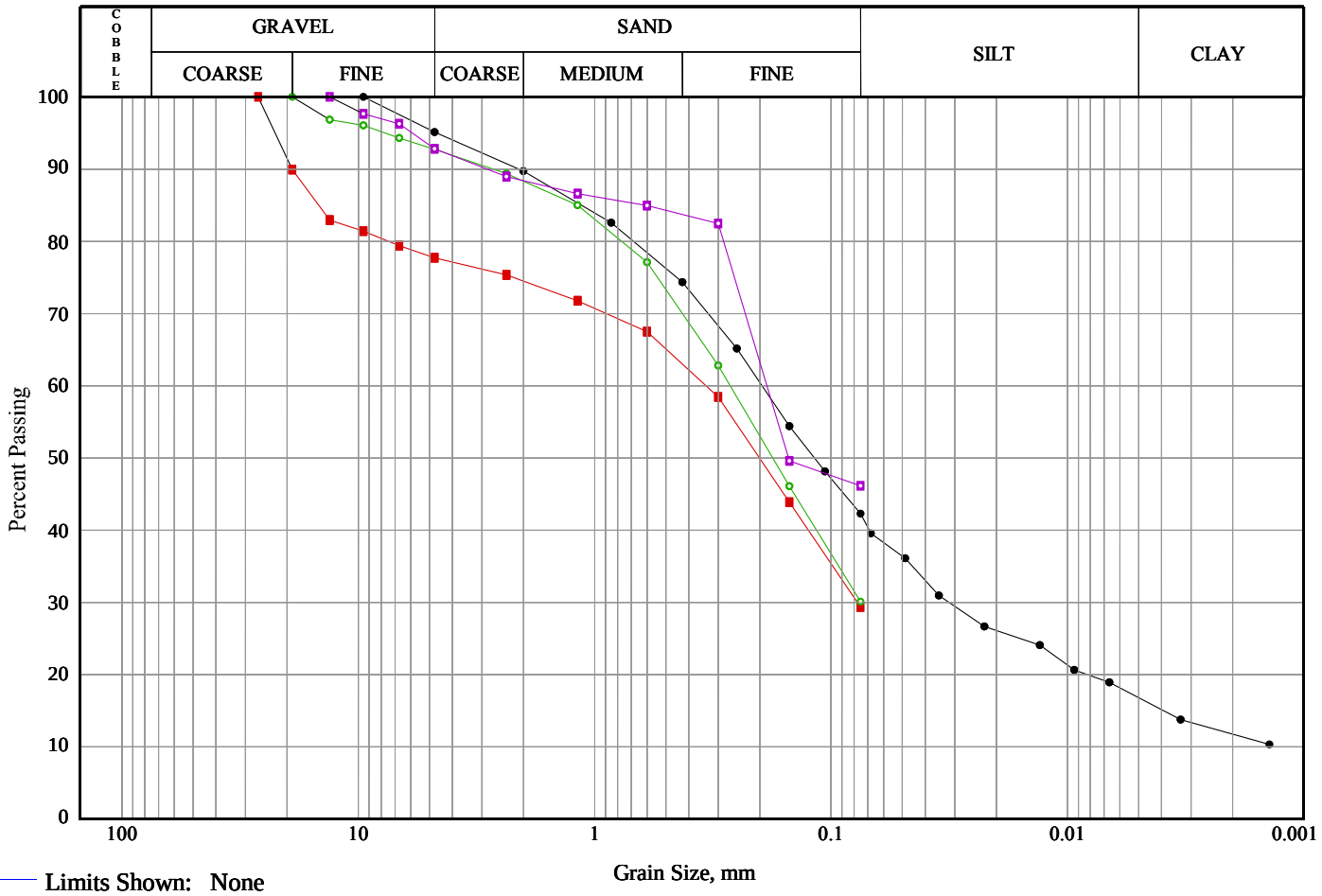
GEMTEC
Consulting Engineers and Scientists

Client: 1384341 Ontario Ltd (Cavanagh)

Project: Geotechnical Investigation - Proposed Concrete Plant

Project #: 61318.20

Soils Grading Chart



Limits Shown: None

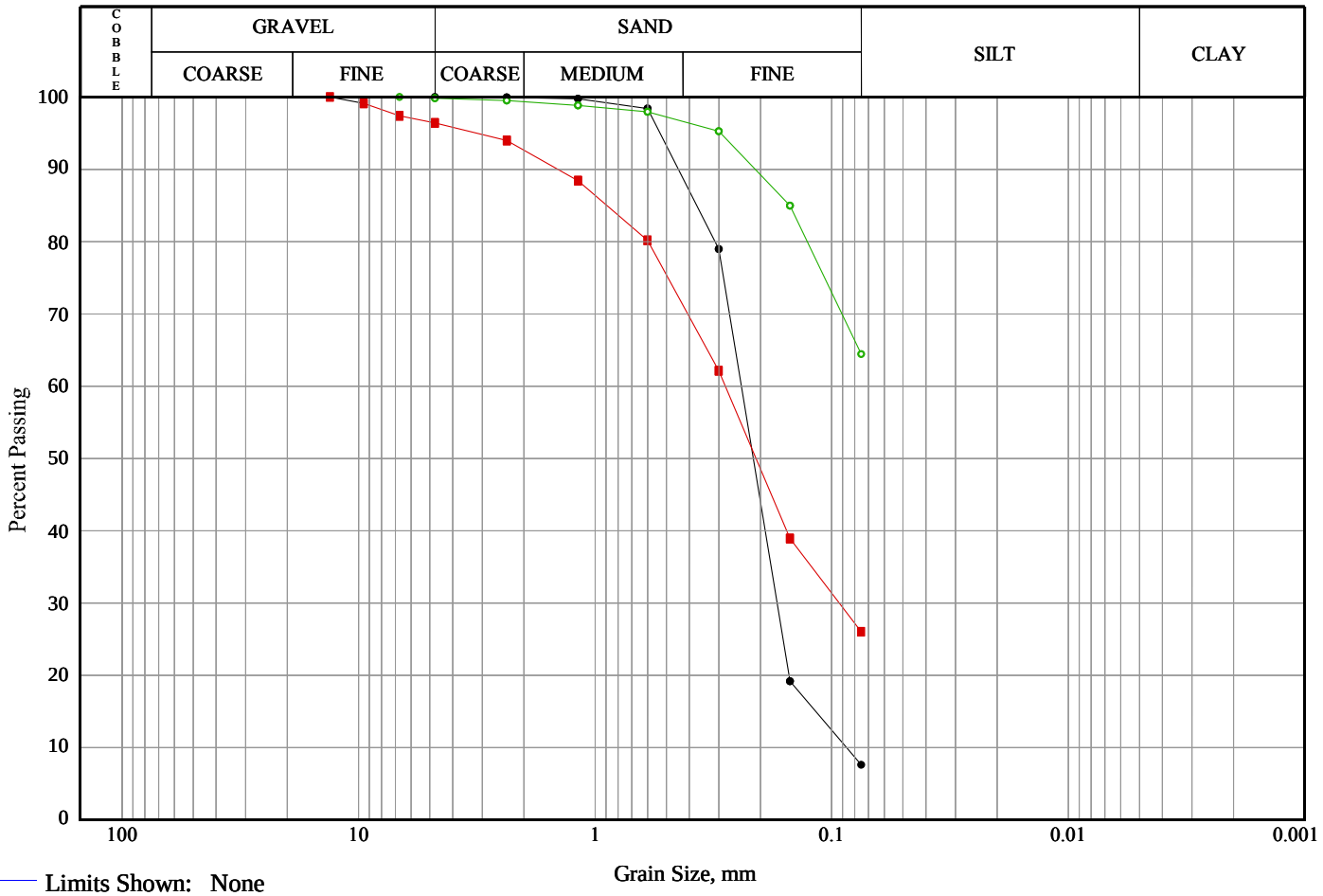
Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
	Glacial Till	18-8	3	1.5-2.1	4.9	52.8	25.5	16.8
	Fill Material	18-2	1	0.3-0.6	22.3	48.4	29.3	
	Fill Material	18-4	1	0.3-1.2	7.3	62.6	30.1	
	Silty Sand	18-6	3	0.9-1.2	7.2	46.7	46.1	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Silty sand , some clay , trace gravel		---	0.00	0.03	0.12	0.20	1.14	25.5
	Gravelly silty sand		---	---	0.08	0.20	0.34	14.70	---
	Silty sand , trace gravel		---	---	---	0.18	0.27	85.00	---
	Sand and silt , trace gravel		---	---	---	0.15	0.19	0.61	---

GEMTEC
Consulting Engineers and Scientists

Client:	1384341 Ontario Ltd (Cavanagh)
Project:	Geotechnical Investigation - Proposed Concrete Plant
Project #:	61318.20

Soils Grading Chart



Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
	Sand	18-1	1	0.05-0.4	0.0	92.4	7.6	
	Silty Sand	18-7	1B	0.05-0.6	3.6	70.4	26.0	
	Sandy Silt	18-10	2	0.8-1.4	0.2	35.4	64.4	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
	Sand , trace silt	N/A	0.09	0.12	0.17	0.21	0.24	0.37	---
	Silty sand , trace gravel		---	---	0.09	0.21	0.28	0.89	---
	Silt and sand , trace gravel	N/A	---	---	---	---	---	0.15	---

APPENDIX C

Chemical Analysis of Soil and Groundwater Samples
Relating to Corrosion
(Paracel Laboratories Ltd. Order No. 1833415 and 1834104)

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO: 61318.20

Report Date: 20-Aug-2018

Order Date: 15-Aug-2018

Project Description: 61318.20

	Client ID:	BH-18-8 SA 2B	-	-	-
	Sample Date:	08/08/2018 09:00	-	-	-
	Sample ID:	1833415-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	91.2	-	-	-
General Inorganics					
pH	0.05 pH Units	7.89	-	-	-
Resistivity	0.10 Ohm.m	121	-	-	-
Anions					
Chloride	5 ug/g dry	<5	-	-	-
Sulphate	5 ug/g dry	<5	-	-	-

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 24-Aug-2018

Order Date: 20-Aug-2018

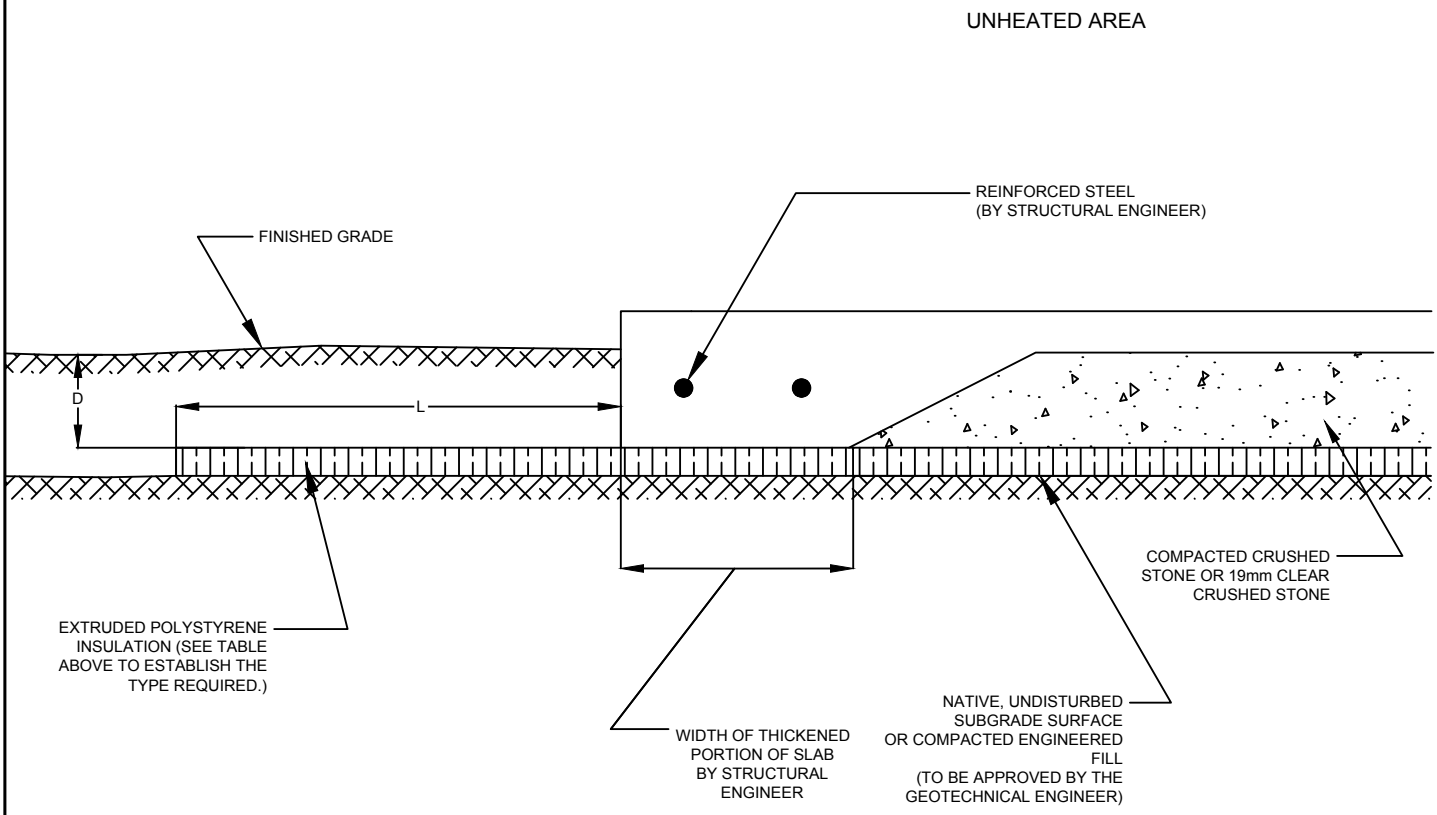
Project Description: 61318.20

	Client ID:	BH18-702	-	-	-
	Sample Date:	08/17/2018 12:00	-	-	-
	Sample ID:	1834104-01	-	-	-
	MDL/Units	Water	-	-	-
General Inorganics					
pH	0.1 pH Units	7.7	-	-	-
Resistivity	0.01 Ohm.m	18.1	-	-	-
Anions					
Chloride	1 mg/L	12	-	-	-
Sulphate	1 mg/L	25	-	-	-

APPENDIX D

Concrete Slab Insulation Detail
Figure D1

APPLIED BEARING PRESSURE	TYPE OF INSULATION
<70 kPa	DOW SM
<100 kPa	DOW HI 40
<150 kPa	DOW HI 60



NOT TO SCALE

NOTES:

1. INSULATION JOINTS TO BE TIGHTLY BUTT JOINED OR LAPPED.
2. ANY GRANULAR MATERIAL PLACED BENEATH THE FLOOR SLAB TO BE COMPACTED TO AT LEAST 95 PERCENT OF THE STANDARD PROCTOR DRY DENSITY VALUE.
3. SUBGRADE TO BE INSPECTED AND APPROVED BY THE GEOTECHNICAL ENGINEER BEFORE PLACING THE GRANULAR MATERIAL.
4. FOR ADEQUATE FROST PROTECTION, D + L $\geq$ 1.8 METRES.
5. FURTHER COMMENTS COULD BE PROVIDED AS THE DESIGN PROGRESSES.

GEMTEC
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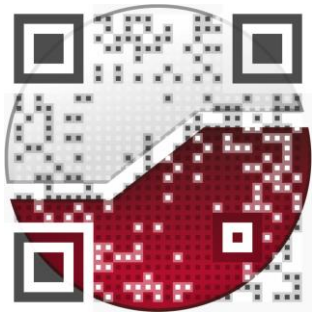
Project	Drawing
GEOTECHNICAL INVESTIGATION PROPOSED CONCRETE PLANT 2596 CARP ROAD OTTAWA, ONTARIO	CONCRETE SLAB INSULATION DETAIL

Drwn By	Chkd By	Date	Project No.	Revision No.	
G.D.	B.W.	DECEMBER 2018	61318.20	0	**FIGURE D1**

experience • knowledge • integrity



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

expérience • connaissance • intégrité