# GEOTECHNICAL REPORT
# OFFICE COMPLEX AT 1037 CARP ROAD

Project No.: CP-19-125

Prepared for:

Jim Bell Architectural Design Inc.
26 Bert G. Argue Dr,
Stittsville, ON K2S 1X9

Prepared by:

McIntosh Perry
104-215 Menten Place
Ottawa, ON K2H 9C1

Revised based on Recent Site Plans
March 2023

McINTOSH PERRY

## TABLE OF CONTENTS

**1.0 INTRODUCTION ..... 1**
**2.0 SITE DESCRIPTION ..... 1**
**3.0 PROJECT UNDERSTANDING ..... 1**
**4.0 FIELD PROCEDURES ..... 2**
**5.0 IDENTIFICATION AND TEST PROCEDURES ..... 2**
**6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS ..... 3**
*6.1 Site Geology ..... 3*
*6.2 Subsurface Conditions ..... 3*
6.2.1 Topsoil ..... 3
6.2.2 Sand ..... 3
6.2.3 Till: Silty Sand, Some Gravel and Clay ..... 4
*6.3 Groundwater ..... 4*
*6.4 Chemical Analysis ..... 5*
**7.0 DISCUSSIONS AND RECOMMENDATIONS ..... 5**
*7.1 General ..... 5*
*7.2 Overview ..... 6*
*7.3 Foundations ..... 7*
7.3.1 Foundation Excavation ..... 7
7.3.2 Shallow Foundations ..... 8
*7.4 Seismic Site Classification ..... 9*
7.4.1 Liquefaction Potential ..... 9
*7.5 Engineered Fill ..... 10*
*7.6 Slabs-on-Grade ..... 10*
*7.7 Lateral Earth Pressure ..... 11*
*7.8 Sidewalks and Hard Surfacing ..... 11*
*7.9 Cement Type and Corrosion Potential ..... 11*
**8.0 CONSTRUCTION CONSIDERATIONS ..... 12**
**9.0 GROUNDWATER SEEPAGE ..... 12**

10.0 SITE SERVICES ..... 13

11.0 CLOSURE ..... 14

**APPENDICES**

Appendix A – Limitations of Report
Appendix B – Site and Borehole Location Plans
Appendix C – Borehole Records
Appendix D – Laboratory Test Results
Appendix E – Seismic Hazard Calculation
Appendix F – Relevant Standards
Appendix G – Site Grading, Drainage, and Sediment & Erosion Control Plan

GEOTECHNICAL INVESTIGATION AND
FOUNDATION DESIGN RECOMMENDATION REPORT
Office Complex at 1037 Carp Road, Stittsville, Ontario

# 1.0 INTRODUCTION

This report presents the factual findings obtained from a geotechnical investigation performed at the above-mentioned site for the proposed two-storey office complex with parking lot and no basement. The fieldwork was carried out on October 14, 2020, to October 15, 2020, and comprised of five foundation boreholes to a maximum depth of 9.3 m, and one pavement borehole in the parking lot to a depth of 2.1m.

The purpose of the investigation was to explore the subsurface conditions at this site and to provide borehole location plans, a record of borehole logs, and laboratory test results. This report provides anticipated geotechnical conditions influencing the design and construction of the proposed two-storey office buildings and the parking lot. The report also includes recommendations for the foundation and parking lot pavement design. Recommendations are offered based on the authors' interpretation of the subsurface investigation and test results. The readers are referred to Appendix A, Limitations of Report, which has an integral part of this document.

The investigation was performed at the request of the Jim Bell Architectural Design Inc.

This report is revised based on the Site Plan issued on March 24, 2023 for municipal review. A copy of the Site Plan is included in Appendix G.

# 2.0 SITE DESCRIPTION

The site is located in a mixed residential and commercial area. It is bounded by residential dwellings with chain link fence from the northeast side, and commercial properties at the northwest and southeast. The site is accessible from Carp Road at the southwest side through a gravel driveway. Drainage ditch is bounded the site along Carp Road and a corrugated steel pipe culvert is buried below the gravel driveway.

The lot is heavily vegetated with mature trees, dead logs, and bushes and the ground is covered with limestone, wood chips, roots, and tree leaves. Trees and bushes were partially cleared from the middle of the lot to provide access to the lot. The property and borehole locations are shown in Figure 2, in Appendix B.

# 3.0 PROJECT UNDERSTANDING

It is understood the site is cleared from all vegetation. The proposed office complex includes three buildings with 1750, 3500, and 3500 square feet of footprint area which may be constructed through separate phases.

All three phases are proposed two storey buildings without a basement. A total number of 46 parking spots are provisioned.

## 4.0 FIELD PROCEDURES

The staff of McIntosh Perry Consulting Engineers (McIntosh Perry) visited the site before the drilling investigation to mark out the proposed borehole locations to obtain utility clearance to identify the location of underground infrastructures. Utility clearance was carried out by Underground Service Locators (USL-1) on behalf of McIntosh Perry. Public and private utility authorities were informed, and all utility clearance documents were obtained before the commencement of drilling work.

The equipment used for drilling was owned and operated by CCC Geotechnical & Environmental Drilling Ltd. of Ottawa, Ontario. Boreholes were advanced using hollow stem augers aided by track-mounted CME 850 drill rig. Boreholes were advanced to a maximum depth of 9.3 m (El. 114.2 m) below the ground level. Soil samples were obtained at 0.75 m intervals in boreholes up to 3.7 m (El. 119.9 m). Below this level, due to the uniformity of the sand layer, samples were obtained at 1.5 m intervals between 3.7 m depth (El. ~ 114.2 m) and 7.6 m depth (El. ~ 116.0 m). below this level, the sample collection interval was changed back to 0.75 m as the soil stratigraphy changed. The samples were collected using a 51 mm outside diameter split spoon sampler following the Standard Penetration Test (SPT) procedure. Boreholes were backfilled with auger cuttings and restored to the original surface. Borehole locations are shown in Figure 2, included in Appendix B.

## 5.0 IDENTIFICATION AND TEST PROCEDURES

All samples were logged as retrieved, and visual description and soil type identification were added to the logs. Subsequently, soil descriptions were confirmed by additional tactile examination of the soils in the laboratory. Laboratory grain-size distribution analysis on representative SPT samples was performed at McIntosh Perry geotechnical lab in accordance with the American Society for Testing Materials (ASTM) test procedures.

Paracel Laboratories Ltd., in Ottawa, carried out chemical tests on two representative soil samples to determine the soil corrosivity characteristics.

Test procedures are listed below;

*ASTM C136 – Sieve Analysis of Fine and Coarse Aggregates (LS-602)*
*LS-702 – Determination of Particle Size Analysis of Soils*
*ASTM D1586 – Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*

The rest of the soil samples recovered will be stored in McIntosh Perry storage facility for a period of one month after submission of the final report. Samples will be disposed of after this time unless otherwise requested in writing by the Client.

# 6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

## 6.1 Site Geology

Based on published physiography maps of the area (Ontario Geological Survey), the site is located within the boundary region between Ottawa Valley Clay Plains and Smiths Falls Limestone Plain. Surficial geology maps of southern Ontario indicate the site is situated on glaciofluvial deposits, between organic deposits to the east and southwest, coarse-textured glaciomarine deposits to the northwest, and Paleozoic bedrock formation to the northeast and southeast. The glaciofluvial deposits in this region are predominantly river deposits, gravel, sand, silt and clay, and delta topset facies.

## 6.2 Subsurface Conditions

In general, the site stratigraphy consists of four layers of shallow topsoil, followed by a thick deposit of sand with different portions of silt and gravel. A till layer composes of silty sand with different portions of gravel and clay was encountered below the sand layer. The till layer is underlain by Inferred bedrock at ~ El 115.0 m. For classification purposes, the soils encountered at this site can be divided into three major zones.

a) Topsoil
b) Sand
c) Till
d) Inferred Bedrock

The soils encountered during the investigation, together with the field and laboratory test results, are shown on the Record of Borehole sheets included in Appendix C. Laboratory test results are included in Appendix D. Description of the strata encountered are given below.

### *6.2.1 Topsoil*

A layer of topsoil was encountered in at the existing surface that extend to an approximate depth of 0.9 (El. ~ 122.5 m). The topsoil layer was observed to be dark brown and composes of organic maters including peat, roots, and wood chips. Gravel and cobbles “Limestone” were encountered at the surface in BH20-3 and 20-06. The topsoil was observed to be dry to damp, very loose to loose with SPT ‘N’ value ranges from 2 to 9 blows/300mm.

### *6.2.2 Sand*

Underlying the topsoil, was a thick layer of sand with traces of silt and gravel, observed to be light brown, dry to moist, and loose to compact. The SPT ‘N’ value ranges from 7 to 30 blows/300mm. The sand layer is followed by a till layer.

Five samples underwent grain size analysis testing, and the layer was observed to contain, on average, 2.0% gravel, 90% sand, 9% silt and clay. In BH20-03 between 4.5 m and 5.5 m depths (El. 118.9 m to 117.9 m), the sand gradation changes to gravelly sand with traces of silt. The grainsize distribution of the soil between these levels changes to contain 22% gravel, 68% sand and 10% fins. Below level 117.9, the soil change back to sand.

A summary of the grain size distribution for this layer is shown in Table 6-1. Test results are shown in Figures 4 and 5, included in Appendix D.

**Table 6-1: Grain Size Distribution of the Sand Layer**

| Grain Size | Range (%) |
|---|---|
| Gravel | 0 – 4 |
| Sand | 82 – 96 |
| Fines | 4 – 15 |

### *6.2.3 Till: Silty Sand, Some Gravel and Clay*

A till layer composes of silty sand with different portions of gravel and clay was encountered below the sand at an approximate El. 116.0 m. The till was observed to grey, wet, and very loose to dense, with SPT 'N' values ranging from 1 to 54 blows/300mm. Two representative sample underwent grain size analysis testing, and the layer was observed to contain 15% gravel, 47% sand, 14% silt and clay. A summary of the grain size distribution for this layer is shown in Table 6-2.

**Table 6-2: Grain Size Distribution of the Silty Sand Layer in BH20-1**

| Grain Size | (%) |
|---|---|
| Gravel | 13 – 17 |
| Sand | 51 – 52 |
| Silt | 26 – 23 |
| Clay | 8 – 11 |

## 6.3 Groundwater

Groundwater was observed in five open boreholes. At the time of investigation, October 14 and 15, 2020, the depth of the groundwater ranged between 5.8 m (El. 117.8 m) to 6.1 m (El. 117.2 m). The depth and level of groundwater in five boreholes are summarized in Table 6-3. The groundwater level may be expected to fluctuate due to seasonal changes.

Table 6-3: Groundwater Level Readings in Open Boreholes

| Borehole | Measuring Date | Surface El. (m) | Groundwater Depth (m) | Water Table El. (m) |
|---|---|---|---|---|
| BH20-01 | 2020-10-14 | 123.6 | 5.8 | 117.8 |
| BH20-02 | 2020-10-14 | 124.1 | 5.8 | 118.3 |
| BH20-03 | 2020-10-14 | 123.4 | 5.7 | 117.7 |
| BH20-04 | 2020-10-15 | 123.5 | 5.8 | 117.7 |
| BH20-05 | 2020-10-15 | 123.3 | 6.1 | 117.2 |

### 6.4 Chemical Analysis

The chemical test results conducted by Paracel Laboratories in Ottawa, Ontario, to determine the resistivity, pH, sulphate and chloride content of two representative soil samples are shown in Table 6-4 below. Chemical test results are included in Appendix D and summarized in below table.

Table 6-4: Soil Chemical Analysis Results

| Borehole | Sample | Depth / El. (m) | pH | Sulphate (%) | Chloride (%) | Resistivity (Ohm-m) |
|---|---|---|---|---|---|---|
| BH20-01 | SS-03 | 1.5 ~ 2.1 | 8.06 | <0.0005 | 0.0009 | 126 |
| BH20-03 | SS-03 | 1.5 ~ 2.1 | 7.92 | <0.0005 | 0.0007 | 92 |

## 7.0 DISCUSSIONS AND RECOMMENDATIONS

### 7.1 General

This section of the report provides engineering recommendations on the geotechnical design aspect of the project based on the project requirements and our interpretation of the subsurface soil information. The recommendations presented herein are subject to the limitations noted in Appendix A “Limitations of Report” which forms an integral part of this document.

The foundation engineering recommendations presented in this section have been developed following Part 4 of the 2015 National Building Code of Canada (NBCC) and 2012 Ontario Building Code (OBC) extending the Limit State Design approach.

## 7.2 Overview

It is understood that the proposed office complex is a two storey structure without a basement. It is also understood that the finished floor elevation for the proposed development will be approximately at ~ 125.5 m to 126.0 m.

For the current project, the following list summarizes some key geotechnical facts that were considered in the suggested geotechnical recommendations:

- Topsoil is not a competent engineering material for construction and can undergo significant volume changes that can adversely affect the integrity of the structure, utilities as well as the parking lot pavement. Therefore, any loose materials, topsoil and organic maters need to be cleared from the footprint of the proposed buildings and the parking lot.
- Considering the order of structural loads expected at the foundation level, the provision of conventional strip footings is adequate. Footings are expected to be buried to resist overturning, sliding, and also to provide protection against frost action.
- The proposed structure can be designed using a seismic Site Class E provided that the boundary zones of the shear walls and all column loads are extended to and supported on the compact to dense sand layer by spread footings.
- Excavation for foundations will be advanced below the existing ground level through the topsoil and sand deposits. The sand deposit can exhibit collapsing behavior upon excavation. The sides of excavation shall to be sloped from its bottom at a minimum gradient of 3H:1V. For trench excavation that is deeper than 1.2 m or a worker is required to enter, excavation shall be carried out within trench boxes, which is fully braced to resist lateral earth pressure.
- In addition, the footprint of the proposed development is adjacent to occupied residential and commercial buildings on the south, north and east, and Carp Road at west side. If excavations depth near adjacent building extend below their foundation depth, shoring system, such as sheet piles shall be required.
- The surface and groundwater inflow to the excavation can be handled by pumping from well-filtered sumps established on the floor of the excavation. The actual inflow into the excavation will depend on many factors including, but not limited to, the contractor's schedule, the rate of excavation, the size of the excavation, and the time of the year at which the excavation is to occur. Based on the encountered stratigraphy and the amount of groundwater intake, application for PTTW will be required only if excavations extend below groundwater level (El. ~ 119.0 m). If more precise information on potential groundwater seepage is needed, a separate permeability test can be carried in the existing monitoring well as part of a separate scope of work.

- Long-term consolidation settlements are not expected at this site. The native sand till is classified as compact. Grade raises up to 1.5 m are allowed without subgrade treatment.

## 7.3 Foundations

In general, the subsurface conditions in the area of the proposed low-rise building consists of a thick layer of sand that is followed by a till layer composes of silty sand with some gravel and clay layer. The depth of the bedrock is approximately at 8.6 to 9.4 m (El. ~ 114.8 m) from the existing ground surface.

It is understood that the level of finished floor for the new proposed buildings is approximately at 125.5 m to 126.0 m. Based on the freezing index for the Southern Ontario Region provided for this site, the frost penetration depth is expected at 1.8 m below the ground surface. The underside of the foundations will likely be at an elevation of 123.7 to 124.2 m. Based on these elevations, grade raise on engineered fill may be required. Granular A conforming to OPSS 1010 compacted to 100% Standard Proctor Maximum Dry Density (SPMDD) shall be used for grade raise below the foundation level.

The SPT field test results, 'N' values within the expected depth and influence zone (twice of the footing width) of a spread footing range between 4 to 24 blows/300mm. The sand layer can be classified according to the Canadian Foundation Engineering Manual (CFEM) (2006) as loose to compacted sand. The estimated average angle of internal friction ($\phi'$) within the stress influence zone below the footing is approximately 28°. The sand layer is a competent layer and can provide suitable support to the expected loads from the structure.

### *7.3.1 Foundation Excavation*

Excavation for the construction of the foundation will proceed through the native topsoil and sand deposits. Excavating of overburden soil shall be performed using conventional hydraulic excavating equipment. The Occupational Health and Safety Act (OHSA) of Ontario indicated that side slopes in the sand above the water table could be classified as Type 3 soil and below the water table as Type 4 soil and sloped no steeper than 3H:1V or be shored. If space restrictions exist, the excavations of depth greater than 1.2 m can be carried out within trench boxes, which is fully braced to resist lateral earth pressure.

In order to limit the amount of differential settlement, all footings shall be bearing on similar subgrade conditions. The subgrade shall be cleaned from all deleterious material and to be proof rolled to reduce loose spots and to prepare a smooth surface before receiving the foundation concrete. Granular A conforming to OPSS 1010 compacted to 100% Standard Proctor Maximum Dry Density (SPMDD) shall be used for grade raise or to level any over excavation below the foundation level.

Excavation shall be kept reasonably free of water or dry and cobbles or boulders larger than 300 mm in diameter, if encountered, should be removed from the side slopes for worker safety.

### *7.3.2 Shallow Foundations*

For shallow spread footings, the overburden soil below the columns and foundation walls can be excavated to the level of founding. The subgrade shall be proof rolled before constructing the spread footings.

#### *7.3.2.1 Bearing Resistance*

Due to the presence of a competent sand layer, shallow footings with a minimum of 1.0 m in a shorter dimension bearing on the sand may be considered to support the structural loads of the proposed development if recommended bearing capacities are adequate.

Bearing capacities are calculated based on the methodology recommended by the Canadian Foundation Engineering Manual (CFEM). The mechanical properties of the sand layer were derived from SPT field test. The average value of SPT 'N' blows for 2B distance below the foundation level was used to estimate the effective soil friction angle, $\phi'$. The $\phi'$-value and the horizontal soil-footing interface friction angle, $\delta'$ are given in Table 8-2. Load and Resistance Factor Design (LRFD) approach following the National Building Code of Canada (NBCC) (2015) recommendations were used to determine the Ultimate Limit State (ULS) and Serviceability Limit State (SLS) geotechnical resistances. For ULS conditions, the unfactored ULS bearing capacity of the spread footing was determined using the general bearing capacity formula as per the CFEM (2006) using the effective soil friction angle, $\phi'$ value in Table 7-2. A geotechnical resistance factor of 0.5 as per the NBCC recommendations can be used to obtain the factored ULS bearing resistance. Furthermore, For SLS bearing capacity, allowable bearing capacity based on SPT test results and 25 mm settlement was determined.

Bearing capacities are calculated for an undisturbed subgrade within the sand layer and minimum of 1.8 m of soil cover above all footings. Given the sandy nature of the site and the existing groundwater level, tree planting is not expected to negatively affect the load bearing of the footing or impose any additional settlements. The bearing capacity of footings is also a function of the soil surcharge above the footing. Footings shall not be designed for any elevation above those noted in the bearing capacity table.

Geotechnical resistance values at the founding level (bearing capacities) are provided for Ultimate Limit State (ULS) and Serviceability Limit State (SLS). Bearing capacities are listed in the below table;

**Table 7-1: Factored ULS and SLS Bearing Resistance**

| Footing Type | Max. El. (m) | Min. Soil Cover (m) | Min dim. (m) | ULS (kPa) | SLS (kPa) |
|---|---|---|---|---|---|
| square footing | 121.5 | 1.8 | 1.0 | 300 | 175 |
| Strip footing | 121.5 | 1.8 | 1.0 | 250 | 150 |

**Table 7-2: Unfactored Shearing Parameters for the Sand and Till based on SPT 'N' values**

| Soil Layer | $\phi'$ § | | $\delta'$ * |
|---|---|---|---|
| | Hatanaka and Uchida (1996) | Schmertmann (1975) | |
| Sand | 28° | 28° | 21° |
| Till | 30° | 30° | 21° |

§ $\phi'$: Effective Soil Friction Angle

* $\delta'$: Horizontal Soil-Footing Interface Friction Angle ($\delta' = 0.75\phi'$)

#### *7.3.2.2 Frost Protection*

Based on the freezing index for the Southern Ontario Region provided for this site, the frost penetration depth is expected at 1.8 m below the ground surface. Frost penetration depth is estimated based on the OPSD 3090.101, Foundation Frost Penetration Depths for Southern Ontario.

The encountered native sand is classified as low frost susceptibility material based on provincial guidelines.

All perimeter and exterior foundation elements or interior foundation elements in unheated areas should be provided with a minimum of 1.8 meters of earth cover for frost protection purposes. Frost protection depth can be reduced to 1.5 m for those buildings constantly heated during the cold season.

## 7.4 Seismic Site Classification

Seismic site classification is completed based on NBCC (2015) and OBC (2012) Section 4.1.8.4 and Table 4.1.8.4.A. This classification system is based on the average soil properties in the upper 30 m and accounts for site-specific shear wave velocity, standard penetration resistance, and plasticity parameters of cohesive soils.

Selected spectral responses in the general vicinity of the site for 2% chance of exceedance in 50 years (2500 years return period) are as indicated in Table 7-3, shown below and in Appendix E;

**Table 7-3: Selected Seismic Spectral Responses (2% in 50 Yrs) – NRCan 2010**

| Sa(0.2) | Sa(0.5) | Sa(1.0) | Sa(2.0) | PGA |
|---|---|---|---|---|
| 0.630 | 0.305 | 0.136 | 0.046 | 0.322 |

Based on the subsurface condition and field and SPT values, the site can be classified as Seismic Site Class (E).

### *7.4.1 Liquefaction Potential*

Soil stratigraphy for the site consists of a thick sand deposit that extends to approximately 7.6 m below the existing ground level. The native sand layer is followed by a till layer that is approximately 1.3 m thick and

followed by inferred bedrock. The groundwater is approximately at 5.7 m depth below the existing ground surface.

Herein liquefaction susceptibility of the native sand and till was evaluated. The native sand and till were found non-susceptible to liquefaction. The results of the analysis are presented in Appendix E.

## 7.5 Engineered Fill

Footings shall be installed on native soil. Any over excavation shall be leveled by engineered fill. Granular A conforming to OPSS 1010 compacted to 100% Standard Proctor Maximum Dry Density (SPMDD) shall be used to level any over excavation below the foundation level. The proposed engineered fill, beyond footings influence zone, can be any material conforming to granular criteria as outlined in OPSS 1010. Material conforming to 'Granular' criteria are considered free draining and compactable and can be utilized as the engineered fill. This can apply to the backfill beyond foundation walls and engineered fill in between the footings. The engineered fill shall be compacted to a minimum of 98% SPMDD.

All fill should be placed in horizontal lifts of uniform thickness of no more than 300 mm before compaction at appropriate moisture content determined by the Proctor test. The requirement for fill material and compaction may be addressed with a note on the structural drawing for foundation or grading drawing, and with a Non-Standard Special Provision (NSSP). Any topsoil, organics, or loose sand should be removed before placing engineered fill material.

## 7.6 Slabs-on-Grade

Slab-on-grades are considered free-floating (not attached to the foundation walls) and should be supported on a minimum of 200 mm of Granular A bedding compacted to 100% SPMDD. The requirements of the fill underneath slab-on-grade is noted in section 7.7 Engineered Fill.

If the slab on grade is proposed to support concentrated linear or point loads, the design loading shall be indicated in the structural specifications.

It is recommended that subgrade preparation and compaction efforts are approved under the supervision of a geotechnical representative.

For the design of the slab-on-grade, the modulus of subgrade reaction (k) is required. Modulus of subgrade reaction is a multi-function complex correlation that varies with the subgrade material, grade-raise fill material, and the flexural stiffness of the structural slab. However, simplified assumptions were made to estimate the spring modulus for slab-on-grade on compacted Granular A. To estimate the modulus of subgrade reaction, it was assumed that a 2 m square section of the concrete slab-on-grade under the applied loads. Since the modulus of subgrade reaction is needed for the ultimate failure design of the slab, it is assumed the failure can occur at a 25 mm deformation. Considering these assumptions, a subgrade reaction modulus of 20,000

kN/m$^2$/m can be used for the design of the interior slab-on-grade. This k-value is only valid for the construction of slab-on-grade on compacted Granular A bedding. This value shall not be used for the native subgrade.

## 7.7 Lateral Earth Pressure

Free draining material should be used as backfill material for foundation walls. If proper drainage is provided, "at rest" condition may be assumed for calculation of earth pressure on foundation walls. The following parameters are recommended for the granular backfill.

**Table 7-4: Lateral Pressure parameters for Granular A and B and Horizontal Backfill**

| Pressure Parameter | | Expected Value | | | |
|---|---|---|---|---|---|
| | | Granular A | Granular B | Other OPSS1010 'Granular' | Native Sand |
| Unit Weight ($\gamma$) $kN/m^3$ | Above groundwater | 22.5 | 21.7 | 21.7 | 17.0 |
| | Below groundwater | 12.7 | 11.9 | 11.9 | 7.19 |
| Angle of Internal Friction ($\phi$) | | 35° | 32° | 31° | 28° |
| Coefficient of Active Earth Pressure ($k_a$) | | 0.27 | 0.31 | 0.32 | 0.36 |
| Coefficient of Passive Earth Pressure ($k_p$) | | 3.69 | 3.23 | 3.12 | 2.77 |
| Coefficient of Earth Pressure at Rest ($k_o$) | | 0.43 | 0.47 | 0.48 | 0.53 |

## 7.8 Sidewalks and Hard Surfacing

The width and extent of the sidewalks will be defined as per the architectural drawings. The designer shall provision adequate slope, based on applicable codes, to provide appropriate runoff discharge. Expansion, construction, and dummy joints shall be spaced as required by the applicable standards. Sidewalks can be categorized under residential/commercial use, and therefore, the concrete sidewalks should have a thickness of 150 to 200 mm. Requirements of OPSD 310.010 'Concrete Sidewalk', OPSD 310.020 'Concrete Sidewalks Adjacent to Curb and Gutter' and OPSD 310.030 'Concrete Sidewalk Ramps at intersection' are recommended for the construction of the concrete sidewalk. A minimum of 150 mm bedding of OPSS Granular A compacted to 100% SPMDD is required for the concrete sidewalk panels.

All proposed new curbs shall be constructed as per applicable standards. It is recommended to follow City of Ottawa detail provided in SC3, Concrete Curb, and Sidewalk as a minimum requirement. All curbs shall receive a minimum of 150 mm Granular A bedding on approved subgrade free from soft, loose, and organic material.

## 7.9 Cement Type and Corrosion Potential

Seven soil samples were submitted to Parcel laboratories for testing of chemical properties relevant to exposure of concrete elements to sulphate attacks as well as potential soil corrosivity effects on buried metallic structural elements. Test results are presented in Table 6-4.

The potential for sulphate attack on concrete structures is moderate to low. Therefore, Type GU Portland cement may be adequate to protect buried concrete elements in the subsurface conditions encountered.

Based on electrical resistivity results and chloride content, the corrosion potential for buried steel elements is within the nonaggressive range.

# 8.0 CONSTRUCTION CONSIDERATIONS

Any organic material and loose sand of any kind should be removed from the footprint of the footings and all structurally load-bearing elements. Site preparation and requirements of engineered fill placement are noted in through previous sections. Refer to relevant sections for material and compaction requirements.

As noted in the previous sections, all grade adjustments due to over-excavation, within the shallow footings influence zone, shall be done using OPSS Granular A.

All backfilling shall comply with the City of Ottawa Special Provision General No. D-029 for compaction requirements, unless the design recommendations included in this report exceed provisions of D-029.

Foundation walls should be backfilled with free-draining material with granular material conforming to OPSS 1010 Granular criteria. However, the native soil can provide drainage if it is proposed to be used for any portion of the design with no compaction requirement.

A geotechnical engineer or technician should attend the site to confirm the native subgrade, type of fill material, and level of compaction. All bearing surfaces should be inspected by experienced geotechnical personnel prior to placing the footings to ensure the excavated subgrade it as the reported and recommended condition.

Vibration monitoring should be carried out during excavation and construction phases to ensure that the vibration levels at the existing surrounding structures and utilities are maintained below tolerable levels.

# 9.0 GROUNDWATER SEEPAGE

The groundwater is expected to be below the depth of the foundation level. However, depending on the construction season, surface runoff can seep into the excavation due to high hydraulic permeability of the native sand and groundwater may present above the depth of excavation. Hydraulic conductivity value of the native sand is expected approximately 1x10E-3. This hydraulic conductivity values are estimated based on soil gradation analysis. In-situ percolation tests were not performed as part of this investigation. The provided hydraulic conductivity value can be used for the selection of the pump capacity for dewatering. The excavated subgrade must be kept dry at all times to minimize the disturbance of the subgrade. If excavation proceeds below the groundwater level, the water level shall be lowered to a minimum of 1 m below the proposed bottom of excavation before excavation and compaction. Groundwater elevation is expected to fluctuate seasonally.

Any surface water infiltrating into the open excavation can be removed through conventional sump and pump methods. The subgrade shall be kept dry at all times, especially before compaction and proof rolling.

Under the new regulations (O.Reg 63/16 and O.Reg 387/04), a Permit to Take Water (PTTW) is required from the Ministry of the Environment, Conservation and Parks (MOECP) if a volume of water greater than 400,000 liters per day is pumped from the excavation under normal operation, but more than 50,000 liters per day, the water taking will not require a PTTW, but will need to be registered in the EASR as a prescribed activity. Since the excavations will likely be above the groundwater level, it is considered unlikely that a PTTW would be required. The site designer shall decide on the permit application based on the expected excavation volume.

The design of the dewatering system should be the responsibility of the contractor. An outlet(s) should be identified, which the contractor can use to dispose of the pumped groundwater and incident precipitation. In order for pumped groundwater to be discharged to a City sewer, the groundwater quality needs to meet the City of Ottawa Sewer Use By-law limits, and a separate sewer discharge permit or City approval is required.

# 10.0 SITE SERVICES

At the subject site, the burial depth of water-bearing utility lines is typically 2.4 m below the ground surface. If this depth is not achievable, equivalent thermal insulation should be provided. The contractor should retain a professional engineer to provide detailed drawings for excavation and temporary support of the excavation walls during construction.

The Occupational Health and Safety Act (OHSA) of Ontario indicated that side slopes in the sand above the water table could be classified as Type 3 soil and below the water table as Type 4 soil and sloped no steeper than 3H:1V or be shored. If space restrictions exist, the excavations can be carried out within trench boxes, which is fully braced to resist lateral earth pressure.

Due to the potential for long term settlement of topsoil and organic materials and the effects of this settlement on service lines sensitive to level change, the existing topsoil, and organic materials are not considered suitable for the support of site services. Utilities should be supported on a minimum of 150 mm bedding of Granular A compacted to a minimum of 98% of SPMDD. Utility cover can be Granular A or Granular B type II compacted to 96% SPMDD. All covers are to be compacted to 100% SPMDD if they are intersecting structural elements. The engineer designing utilities shall ensure the proposed utility pipes can tolerate compaction loads.

To extend the life of buried utilities, it is recommended utility bedding and backfill to be separated from the native soil by filter geotextile.

Given the sandy nature of the subgrade, clay plugs are not required for the utility trenches.

# 11.0 CLOSURE

We trust this geotechnical investigation report meets the requirements of your project. The "Limitations of Report" presented in Appendix A are an integral part of this report. Please contact the undersigned should you have any questions or concerns.

**McIntosh Perry Consulting Engineers Ltd.**


Mohammed Al-Khazaali, Ph.D., P.Eng.
Geotechnical Engineer

N'eem Tavakkoli, M.Eng., P.Eng.
Senior Geotechnical Engineer

# REFERENCES

1) Canadian Geotechnical Society, "Canadian Foundation Engineering Manual", 4th Edition, 2006.

2) Ontario Ministry of Natural Resources (OMNR), Ontario Geological Survey, Special Volume 2, "The Physiography of Southern Ontario", 3rd Edition, 1984.

3) Google Earth, Google, 2015.

4) Government of Canada, National Building Code of Canada (NBCC), "Seismic Hazard Calculation" (online), 2010.

5) Canadian Standards Association (CSA), "Concrete Materials and Methods of Concrete Construction", A23.1, 2009

6) Government of Ontario, "Ontario Building Code (OBC)," (online), 2012.

7) MTO – Pavement Design and Rehabilitation Manual

8) Natural Resources Canada – Seismic Hazard Calculator

# GEOTECHNICAL INVESTIGATION
# OFFICE COMPLEX AT 1037 CARP ROAD

## APPENDIX A
## LIMITATIONS OF REPORT

McINTOSH PERRY

# LIMITATIONS OF REPORT

McIntosh Perry Consulting Engineers Ltd. (McIntosh Perry) carried out the field work and prepared the report. This document is an integral part of the Foundation Investigation and Design report presented.

The conclusions and recommendations provided in this report are based on the information obtained at the borehole locations where the tests were conducted. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the specific locations where tests were conducted and conditions may become apparent during construction, which were not detected and could not be anticipated at the time of the site investigation. The benchmark level used and borehole elevations presented in this report are primarily to establish relative differenced in elevations between the borehole locations and should not be used for other purposes such as to establish elevations for grading, depth of excavations or for planning construction.

The recommendations presented in this report for design are applicable only to the intended structure and the project described in the scope of the work, and if constructed in accordance with the details outlined in the report. Unless otherwise noted, the information contained in this report does not reflect on any environmental aspects of either the site or the subsurface conditions.

The comments or recommendation provided in this report on potential construction problems and possible construction methods are intended only to guide the designer. The number of boreholes advanced at this site may not be sufficient or adequate to reveal all the subsurface information or factors that may affect the method and cost of construction. The contractors who are undertaking the construction shall make their own interpretation of the factual data presented in this report and make their conclusions, as to how the subsurface conditions of the site may affect their construction work.

The boundaries between soil strata presented in the report are based on information obtained at the borehole locations. The boundaries of the soil strata between borehole locations are assumed from geological evidences. If differing site conditions are encountered, or if the Client becomes aware of any additional information that differs from or is relevant to the McIntosh Perry findings, the Client agrees to immediately advise McIntosh Perry so that the conclusions presented in this report may be re-evaluated.

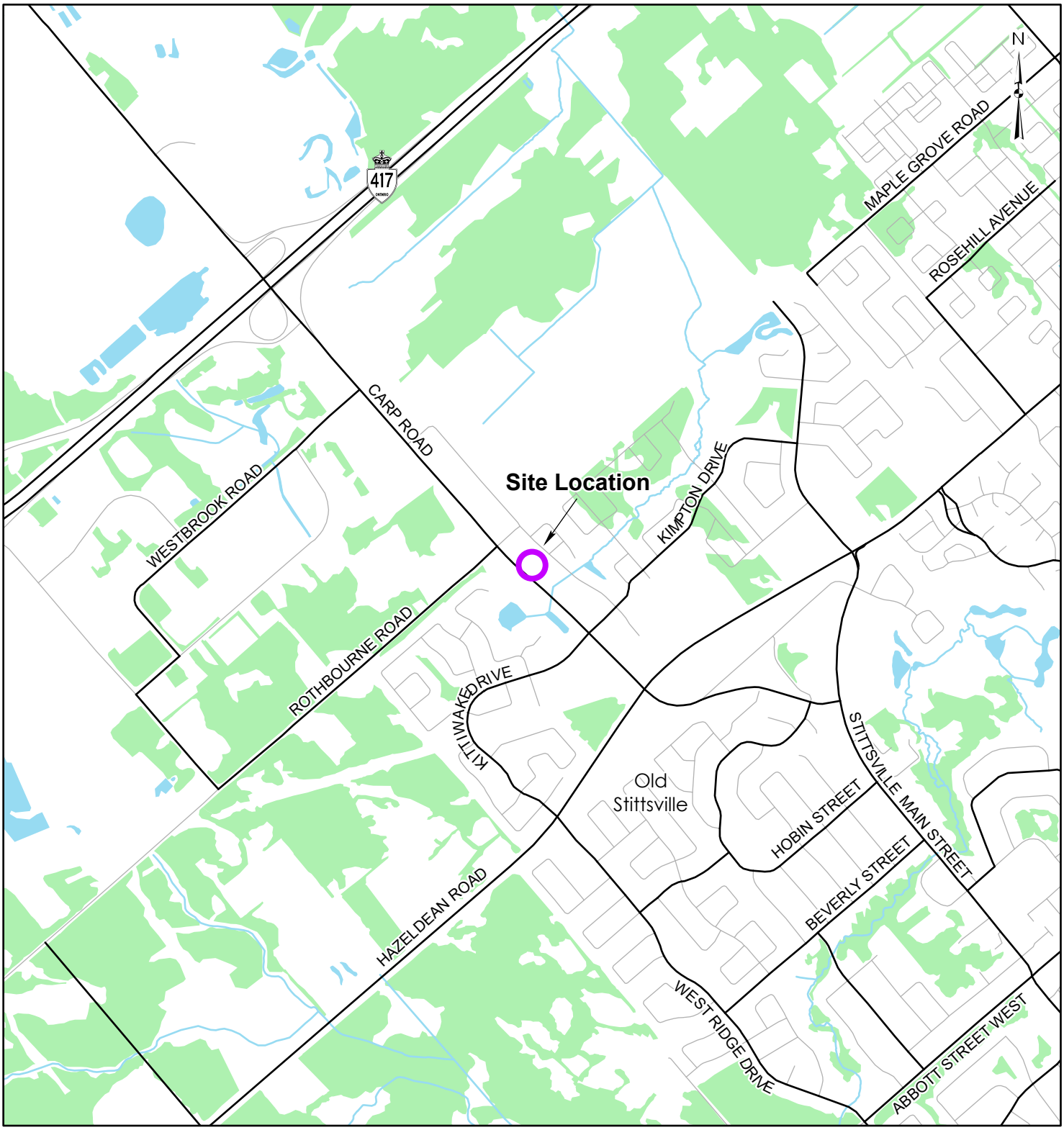
Under no circumstances shall the liability of McIntosh Perry for any claim in contract or in tort, related to the services provided and/or the content and recommendations in this report, exceed the extent that such liability is covered by such professional liability insurance from time to time in effect including the deductible therein, and which is available to indemnify McIntosh Perry. Such errors and omissions policies are available for inspection by the Client at all times upon request, and if the Client desires to obtain further insurance to protect it against any risks beyond the coverage provided by such policies, McIntosh Perry will co-operate with the Client to obtain such insurance.

McIntosh Perry prepared this report for the exclusive use of the Client. Any use which a third party makes of this report, or any reliance on or decision to be made based on it, are the responsibility of such third parties. McIntosh Perry accepts no responsibility and will not be liable for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

# GEOTECHNICAL INVESTIGATION
# OFFICE COMPLEX AT 1037 CARP ROAD

## APPENDIX B
## SITE AND BOREHOLE LOCATION PLANS

McINTOSH PERRY




500 250 0 500

Scale 1:20,000 Metres

LEGEND

- Site Location
- Local Road
- Major Road
- Watercourse
- Waterbody
- Wooded Area

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2020.

CLIENT: JIM BELL ARCHITECTURAL DESIGN INC.

PROJECT: GEOTECHNICAL INVESTIGATION OF OFFICE BUILDING AT 1037 CARP ROAD

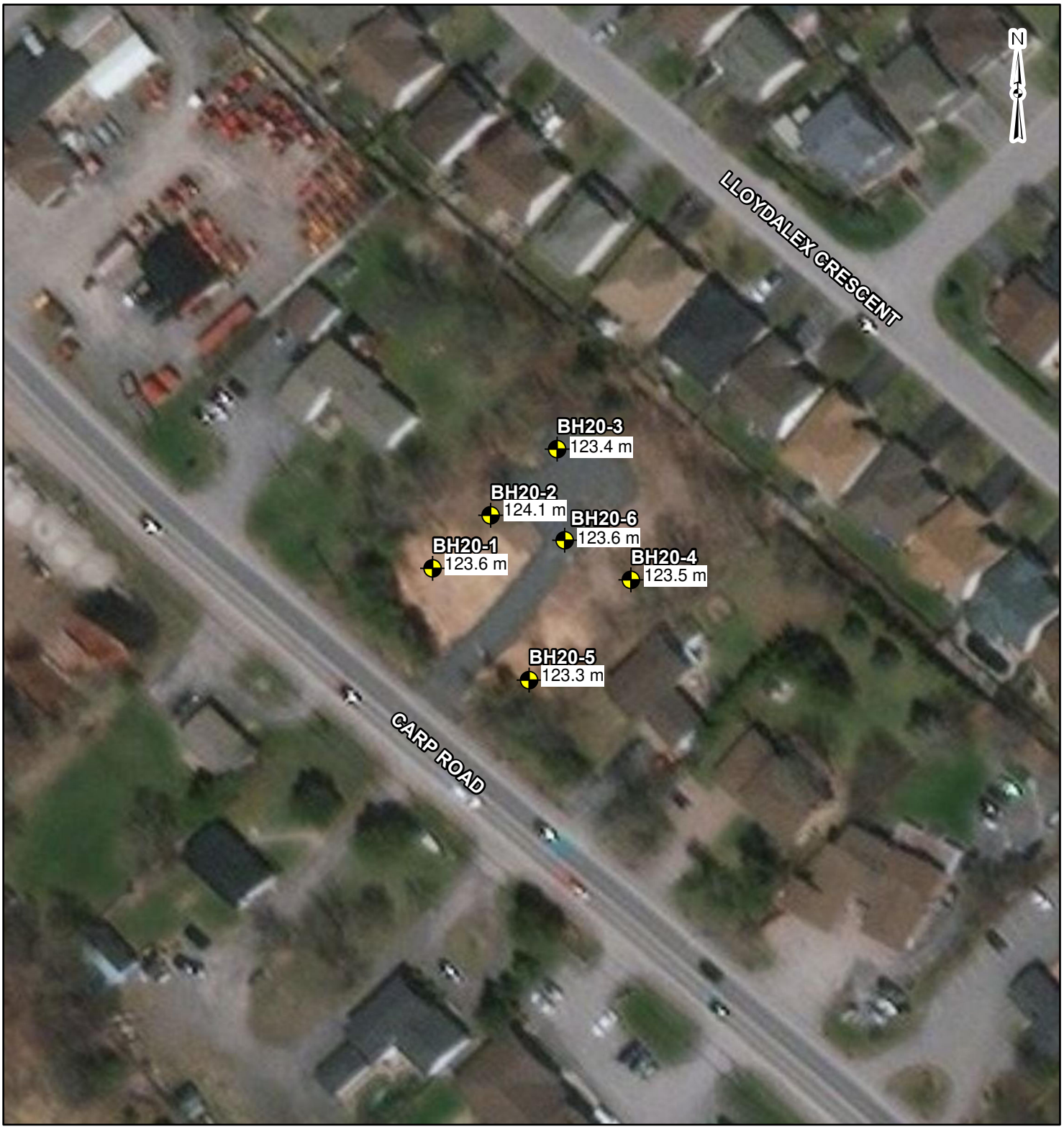
TITLE: SITE LOCATION

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

| | |
|---|---|
| PROJECT NO:CCO-19-0125 | |
| Date | Nov., 12, 2020 |
| GIS | EU |
| Checked By | MA |

FIGURE: 1

C:\Users\e.ungun\McIntosh Perry\GIS - Documents\Projects\2019\CCO\CCO-19-0125 Bekim Concrete Inc. - 1037 Carp Road\aprx\Geotech\CCO-19-0125-Geotech.aprx




LEGEND

Borehole Location

30 15 0 30

Scale 1:1,000 Metres

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2020.

CLIENT: JIM BELL ARCHITECTURAL DESIGN INC.

PROJECT: GEOTECHNICAL INVESTIGATION OF OFFICE BUILDING AT 1037 CARP ROAD

TITLE: BOREHOLE LOCATIONS

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

| | |
|---|---|
| PROJECT NO:CCO-19-0125 | |
| Date | Nov., 12, 2020 |
| GIS | EU |
| Checked By | MA |

FIGURE: 2

C:\Users\e.ungun\McIntosh Perry\GIS - Documents\Projects\2019\CCO\CCO-19-0125 Bekim Concrete Inc. - 1037 Carp Road\aprx\Geotech\CCO-19-0125-Geotech.aprx

# GEOTECHNICAL INVESTIGATION
# OFFICE COMPLEX AT 1037 CARP ROAD

## APPENDIX C
## BOREHOLE LOGS

McINTOSH PERRY

# EXPLANATION OF TERMS USED IN REPORT

N-VALUE: THE STANDARD PENETRATION TEST (SPT) N-VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5 kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N-VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N-VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ($c_u$) AS FOLLOWS:

| $C_u$ (kPa) | 0 – 12 | 12 – 25 | 25 – 50 | 50 – 100 | 100 – 200 | >200 |
|---|---|---|---|---|---|---|
| | *VERY SOFT* | *SOFT* | *FIRM* | *STIFF* | *VERY STIFF* | *HARD* |

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 – 5 | 5 – 10 | 10 – 30 | 30 – 50 | >50 |
|---|---|---|---|---|---|
| | *VERY LOOSE* | *LOOSE* | *COMPACT* | *DENSE* | *VERY DENSE* |

ROCKS ARE DESCRIBED BY THEIR COMPOSION AND STRUCUTRAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY IS:

| RQD (%) | 0 – 25 | 25 – 50 | 50 – 75 | 75 – 90 | 90 – 100 |
|---|---|---|---|---|---|
| | *VERY POOR* | *POOR* | *FAIR* | *GOOD* | *EXCELLENT* |

JOINT AND BEDDING:

| SPACING | 50mm | 50 – 300mm | 0.3m – 1m | 1m – 3m | >3m |
|---|---|---|---|---|---|
| JOINTING | *VERY CLOSE* | *CLOSE* | *MOD. CLOSE* | *WIDE* | *VERY WIDE* |
| BEDDING | *VERY THIN* | *THIN* | *MEDIUM* | *THICK* | *VERY THICK* |

# ABBREVIATIONS AND SYMBOLS

## FIELD SAMPLING

| | | | |
|---|---|---|---|
| SS | SPLIT SPOON | TP | THINWALL PISTON |
| WS | WASH SAMPLE | OS | OSTERBERG SAMPLE |
| ST | SLOTTED TUBE SAMPLE | RC | ROCK CORE |
| BS | BLOCK SAMPLE | PH | TW ADVANCED HYDRAULICALLY |
| CS | CHUNK SAMPLE | PM | TW ADVANCED MANUALLY |
| TW | THINWALL OPEN | FS | FOIL SAMPLE |

## STRESS AND STRAIN

| | | |
|---|---|---|
| $u_w$ | kPa | PORE WATER PRESSURE |
| $r_u$ | 1 | PORE PRESSURE RATIO |
| $\sigma$ | kPa | TOTAL NORMAL STRESS |
| $\sigma'$ | kPa | EFFECTIVE NORMAL STRESS |
| $\tau$ | kPa | SHEAR STRESS |
| $\sigma_1, \sigma_2, \sigma_3$ | kPa | PRINCIPAL STRESSES |
| $\varepsilon$ | % | LINEAR STRAIN |
| $\varepsilon_1, \varepsilon_2, \varepsilon_3$ | % | PRINCIPAL STRAINS |
| E | kPa | MODULUS OF LINEAR DEFORMATION |
| G | kPa | MODULUS OF SHEAR DEFORMATION |
| $\mu$ | 1 | COEFFICIENT OF FRICTION |

## MECHANICALL PROPERTIES OF SOIL

| | | |
|---|---|---|
| $m_v$ | $kPa^{-1}$ | COEFFICIENT OF VOLUME CHANGE |
| $c_c$ | 1 | COMPRESSION INDEX |
| $c_s$ | 1 | SWELLING INDEX |
| $c_a$ | 1 | RATE OF SECONDARY CONSOLIDATION |
| $c_v$ | $m^2/s$ | COEFFICIENT OF CONSOLIDATION |
| H | m | DRAINAGE PATH |
| $T_v$ | 1 | TIME FACTOR |
| U | % | DEGREE OF CONSOLIDATION |
| $\sigma'_{vo}$ | kPa | EFFECTIVE OVERBURDEN PRESSURE |
| $\sigma'_p$ | kPa | PRECONSOLIDATION PRESSURE |
| $\tau_f$ | kPa | SHEAR STRENGTH |
| c' | kPa | EFFECTIVE COHESION INTERCEPT |
| $\Phi'$ | $^{-o}$ | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| $c_u$ | kPa | APPARENT COHESION INTERCEPT |
| $\Phi_u$ | $^{-o}$ | APPARENT ANGLE OF INTERNAL FRICTION |
| $\tau_R$ | kPa | RESIDUAL SHEAR STRENGTH |
| $\tau_r$ | kPa | REMOULDED SHEAR STRENGTH |
| $S_t$ | 1 | SENSITIVITY = $c_u / \tau_r$ |

## PHYSICAL PROPERTIES OF SOIL

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\rho_s$ | $kg/m^3$ | DENSITY OF SOLID PARTICLES | e | 1,% | VOID RATIO | $e_{min}$ | 1,% | VOID RATIO IN DENSEST STATE |
| $\gamma_s$ | $kN/m^3$ | UNIT WEIGHT OF SOLID PARTICLES | n | 1,% | POROSITY | $I_D$ | 1 | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| $\rho_w$ | $kg/m^3$ | DENSITY OF WATER | w | 1,% | WATER CONTENT | D | mm | GRAIN DIAMETER |
| $\gamma_w$ | $kN/m^3$ | UNIT WEIGHT OF WATER | $s_r$ | % | DEGREE OF SATURATION | $D_n$ | mm | N PERCENT – DIAMETER |
| $\rho$ | $kg/m^3$ | DENSITY OF SOIL | $w_L$ | % | LIQUID LIMIT | $C_u$ | 1 | UNIFORMITY COEFFICIENT |
| $\gamma$ | $kN/m^3$ | UNIT WEIGHT OF SOIL | $w_P$ | % | PLASTIC LIMIT | h | m | HYDRAULIC HEAD OR POTENTIAL |
| $\rho_d$ | $kg/m^3$ | DENSITY OF DRY SOIL | $w_s$ | % | SHRINKAGE LIMIT | q | $m^3/s$ | RATE OF DISCHARGE |
| $\gamma_d$ | $kN/m^3$ | UNIT WEIGHT OF DRY SOIL | $I_P$ | % | PLASTICITY INDEX = $(W_L - W_L)$ | v | m/s | DISCHARGE VELOCITY |
| $\rho_{sat}$ | $kg/m^3$ | DENSITY OF SATURATED SOIL | $I_L$ | 1 | LIQUIDITY INDEX = $(W - W_P)/ I_P$ | i | 1 | HYDAULIC GRADIENT |
| $\gamma_{sat}$ | $kN/m^3$ | UNIT WEIGHT OF SATURATED SOIL | $I_C$ | 1 | CONSISTENCY INDEX = $(W_L - W) / 1_P$ | k | m/s | HYDRAULIC CONDUCTIVITY |
| $\rho'$ | $kg/m^3$ | DENSITY OF SUBMERED SOIL | $e_{,max}$ | 1,% | VOID RATIO IN LOOSEST STATE | j | $kN/m^3$ | SEEPAGE FORCE |
| $\gamma'$ | $kN/m^3$ | UNIT WEIGHT OF SUBMERGED SOIL | | | | | | |

McINTOSH PERRY

# BOREHOLE No 20-1

| | | | | | |
|---|---|---|---|---|---|
| **DATE:** | 14/10/2020 - 14/10/2020 | **LOCATION:** | 1037 Carp Road, Ottawa | **ORIGINATED BY:** | A.L. |
| **PROJECT:** | 19-0125_1037_CARP | **COORDINATES:** | Lat: 45.271821 , Lon: -75.944760 | **COMPILED BY:** | AL |
| **CLIENT:** | Jim Bell Architectural Design Inc. | **DATUM:** | Geodetic | **CHECKED BY:** | NT |
| **ELEVATION:** | 123.60 m | **REMARK:** | | **REPORT DATE:** | 13/11/2020 |

| DEPTH - feet | DEPTH - meters | SOIL PROFILE: ELEVATION - m / DEPTH - m | DESCRIPTION | SYMBOL | SAMPLES: TYPE AND NUMBER | STATE | RECOVERY | "N" or RQD | GROUNDWATER CONDITIONS | DYNAMIC CONE PEN. RESISTANCE PLOT / SHEAR STRENGTH (kPa) | WATER CONTENT and LIMITS (%) | REMARKS & GRAIN SIZE DISTRIBUTION (%) G | S | M | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 123.6 | Natural ground surface | | | | | | | | | | | | |
| | | 0.0 / 123.0 | Topsoil: Peat, dark brown, loose. Presence of organic matter. | | SS-01 | | 0 | 4 | | | | | | | |
| | | 0.6 | Sand, some silt, traces of gravel, light brown, dry, compact. | | | | | | | | | | | | |
| | 1 | | | | SS-02 | | 54 | 9 | | | | | | | |
| 5 | | | | | | | | | | | | | | | |
| | 2 | | | | SS-03 | | 58 | 21 | | | | | | | |
| | | | | | SS-04 | | 54 | 16 | | | | | | | |
| 10 | 3 | | | | | | | | | | | | | | |
| | | | | | SS-05 | | 87 | 7 | | | | 4 | 82 | | 15 |
| | 4 | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | |
| | 5 | | | | SS-06 | | 83 | 24 | | | | | | | |
| | | | | | | | | | 5.8 m | | | | | | |
| 20 | 6 | | | | | | | | | | | | | | |
| | | | | | SS-07 | | 79 | 12 | | | | | | | |
| | 7 | | | | | | | | | | | | | | |
| | | 116.0 | | | | | | | | | | | | | |
| 25 | | 7.6 | Silty sand, some clay and gravel, grey, wet, compact. | | | | | | | | | | | | |
| | 8 | | | | SS-08 | | 71 | 34 | | | | | | | |
| | | | | | SS-09 | | 87 | 9 | | | | 13 | 51 | 26 | 11 |
| | 9 | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | |
| | | 114.2 | | | SS-10 | | | REF | | | | | | | |

DYNAMIC CONE PEN. RESISTANCE PLOT: 20 40 60 80

SHEAR STRENGTH (kPa): Vane test (◇ Intact, ◆ Remolded); Lab vane (□ Intact, ■ Remolded); 20 40 60 80 100

WATER CONTENT and LIMITS (%): $W_P$ W $W_L$; 25 50 75

McINTOSH PERRY

# BOREHOLE No 20-1

| | | | | | |
|---|---|---|---|---|---|
| **DATE:** | 14/10/2020 - 14/10/2020 | **LOCATION:** | 1037 Carp Road, Ottawa | **ORIGINATED BY:** | A.L. |
| **PROJECT:** | 19-0125_1037_CARP | **COORDINATES:** | Lat: 45.271821 , Lon: -75.944760 | **COMPILED BY:** | AL |
| **CLIENT:** | Jim Bell Architectural Design Inc. | **DATUM:** | Geodetic | **CHECKED BY:** | NT |
| **ELEVATION:** | 123.60 m | **REMARK:** | | **REPORT DATE:** | 13/11/2020 |

| DEPTH - feet | DEPTH - meters | SOIL PROFILE: ELEVATION - m / DEPTH - m | SOIL PROFILE: DESCRIPTION | SYMBOL | SAMPLES: TYPE AND NUMBER | SAMPLES: STATE | SAMPLES: RECOVERY | SAMPLES: "N" or RQD | GROUNDWATER CONDITIONS | DYNAMIC CONE PEN. RESISTANCE PLOT / SHEAR STRENGTH (kPa) | WATER CONTENT and LIMITS (%) | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Inferred Bedrock**<br>**END OF BOREHOLE**<br><br>**Water was mesured in open borehole** | | | | | | | | | Spoon Refusal at 9.4 m<br>G S M C |
| 35 | 10 | | | | | | | | | | | |
| | 11 | | | | | | | | | | | |
| 40 | 12 | | | | | | | | | | | |
| | 13 | | | | | | | | | | | |
| 45 | 14 | | | | | | | | | | | |
| 50 | 15 | | | | | | | | | | | |
| | 16 | | | | | | | | | | | |
| 55 | 17 | | | | | | | | | | | |
| | 18 | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |

DYNAMIC CONE PEN. RESISTANCE PLOT: 20 40 60 80

SHEAR STRENGTH (kPa): Vane test (◇ Intact, ◆ Remolded); Lab vane (□ Intact, ■ Remolded); 20 40 60 80 100

WATER CONTENT and LIMITS (%): $W_P$ W $W_L$; 25 50 75

McINTOSH PERRY

# BOREHOLE No 20-2

**DATE:** 14/10/2020 - 14/10/2020
**PROJECT:** 19-0125_1037_CARP
**CLIENT:** Jim Bell Architectural Design Inc.
**ELEVATION:** 124.10 m

**LOCATION:** 1037 Carp Road, Ottawa
**COORDINATES:** Lat: 45.271908 , Lon: -75.944623
**DATUM:** Geodetic
**REMARK:**

**ORIGINATED BY:** A.L.
**COMPILED BY:** AL
**CHECKED BY:** NT
**REPORT DATE:** 13/11/2020

| DEPTH - feet | DEPTH - meters | SOIL PROFILE: ELEVATION - m / DEPTH - m | DESCRIPTION | SYMBOL | SAMPLES: TYPE AND NUMBER | STATE | RECOVERY | "N" or RQD | GROUNDWATER CONDITIONS | DYNAMIC CONE PEN. RESISTANCE PLOT / SHEAR STRENGTH (kPa) | WATER CONTENT and LIMITS (%) | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 124.1 | Natural ground surface | | | | | | | | | |
| | | 0.0 | Topsoil: Peat, dark brown, dry, loose. Presence of organic matter. | | SS-01 | | 29 | 9 | | | | |
| | | 123.5 | | | | | | | | | | |
| | | 0.6 | Sand, traces of silt, light brown, dry, compact. | | | | | | | | | |
| | 1 | | | | SS-02 | | 79 | 22 | | | | |
| 5 | | | | | | | | | | | | |
| | 2 | | | | SS-03 | | 79 | 20 | | | | |
| | | | | | SS-04 | | 79 | 22 | | | | |
| 10 | 3 | | | | | | | | | | | |
| | | | | | SS-05 | | 75 | 9 | | | | |
| | 4 | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| | 5 | | | | SS-06 | | 71 | 17 | | | | |
| | | | | | | | | | ▼ 5.8 m | | | |
| | 6 | | | | | | | | | | | |
| 20 | | | | | | | | | | | | |
| | 7 | | | | SS-07 | | 79 | 18 | | | | |
| | | 116.5 | | | | | | | | | | |
| 25 | | 7.6 | Silty sand, grey, wet, very loose to loose. | | | | | | | | | |
| | 8 | | | | SS-08 | | 100 | 2 | | | | |
| | | | | | SS-09 | | 44 | REF | | | | |
| | | 115.2 | | | | | | | | | | |
| | 9 | 8.9 | **Inferred Bedrock** | | | | | | | | | |
| 30 | | | **END OF BOREHOLE** | | | | | | | | | |
| | | | **Water was measured in open** | | | | | | | | | |

Split spoon sampler refusal at 8.8 m
Auger refusal at 8.9 m

\\LICENSES\Sobek\Geotec80\Style\Log_Borehole_v5_NEW.sty

McINTOSH PERRY

# BOREHOLE No 20-3

| | | | | | |
|---|---|---|---|---|---|
| **DATE:** | 14/10/2020 - 14/10/2020 | **LOCATION:** | 1037 Carp Road, Ottawa | **ORIGINATED BY:** | A.L. |
| **PROJECT:** | 19-0125_1037_CARP | **COORDINATES:** | Lat: 45.272017 , Lon: -75.944466 | **COMPILED BY:** | M.A. |
| **CLIENT:** | Jim Bell Architectural Design Inc. | **DATUM:** | Geodetic | **CHECKED BY:** | NT |
| **ELEVATION:** | 123.40 m | **REMARK:** | | **REPORT DATE:** | 13/11/2020 |

| DEPTH - feet | DEPTH - meters | SOIL PROFILE: ELEVATION - m / DEPTH - m | SOIL PROFILE: DESCRIPTION | SYMBOL | SAMPLES: TYPE AND NUMBER | SAMPLES: STATE | SAMPLES: RECOVERY | SAMPLES: "N" or RQD | GROUNDWATER CONDITIONS | DYNAMIC CONE PEN. RESISTANCE PLOT / SHEAR STRENGTH (kPa) | WATER CONTENT and LIMITS (%) | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 123.4 / 0.0 | Natural ground surface | | | | | | | | | |
| | | 123.2 / 0.2 | Topsoil: Gravel, peat, Presence of cobbles and organic matter. | | | | | | | | | |
| | | | Topsoil: Peat and organic matter, dark brown, dry to moist. | | SS-01 | | 0 | 5 | | | | |
| | | 122.5 | | | | | | | | | | |
| | 1 | 0.9 | Sand, traces of silt and gravel, light brown, dry, compact. | | SS-02 | | 29 | 7 | | | | |
| 5 | | | | | SS-03 | | 87 | 28 | | | | |
| | 2 | | | | | | | | | | | |
| | | | | | SS-04 | | 96 | 22 | | | | |
| 10 | 3 | | | | SS-05 | | 100 | 26 | | | | |
| | 4 | | | | | | | | | | | |
| | | 119.0 | | | | | | | | | | |
| 15 | | 4.4 | Gravelly sand, traces of silt, light brown, damp to moist, compact. Presence of cobbles. | | SS-06 | | 92 | 58 | | | | 22 68 10 |
| | 5 | | | | | | | | | | | Auger ruttling |
| | | 117.9 | | | | | | | 5.7 m | | | |
| | | 5.5 | Sand, traces of silt and gravel, brown, wet, compact. | | | | | | | | | |
| 20 | 6 | | | | SS-07 | | 92 | 23 | | | | |
| | 7 | | | | | | | | | | | |
| | | 115.8 | | | | | | | | | | |
| 25 | | 7.6 | Silty sand, some gravel, traces of clay, grey, wet, loose. | | SS-08 | | 29 | 6 | | | | |
| | 8 | | | | | | | | | | | |
| | | | | | SS-09 | | 95 | REF | | | | 17 52 23 8 |
| | | 114.5 | | | | | | | | | | |
| 30 | 9 | 8.9 | **Inferred Bedrock** | | | | | | | | | |
| | | | **END OF BOREHOLE** | | | | | | | | | |
| | | | **Water was measured in open** | | | | | | | | | |

DYNAMIC CONE PEN. RESISTANCE PLOT: 20 40 60 80

SHEAR STRENGTH (kPa): Vane test (◇ Intact, ◆ Remolded) Lab vane (□ Intact, ■ Remolded); 20 40 60 80 100

WATER CONTENT and LIMITS (%): $W_P$ W $W_L$; 25 50 75

REMARKS & GRAIN SIZE DISTRIBUTION (%): G S M C

\\LICENSES7\Sobek\Geotec80\Style\Log_Borehole_v5_NEW.sty

McINTOSH PERRY

# BOREHOLE No 20-4

| | | | | | |
|---|---|---|---|---|---|
| **DATE:** | 15/10/2020 - 15/10/2020 | **LOCATION:** | 1037 Carp Road, Ottawa | **ORIGINATED BY:** | A.L. |
| **PROJECT:** | 19-0125_1037_CARP | **COORDINATES:** | Lat: 45.271800 , Lon: -75.944295 | **COMPILED BY:** | M.A. |
| **CLIENT:** | Jim Bell Architectural Design Inc. | **DATUM:** | Geodetic | **CHECKED BY:** | N.T. |
| **ELEVATION:** | 123.50 m | **REMARK:** | | **REPORT DATE:** | 13/11/2020 |

| DEPTH - feet | DEPTH - meters | SOIL PROFILE: ELEVATION - m / DEPTH - m | SOIL PROFILE: DESCRIPTION | SYMBOL | SAMPLES: TYPE AND NUMBER | SAMPLES: STATE | SAMPLES: RECOVERY | SAMPLES: "N" or RQD | GROUNDWATER CONDITIONS | DYNAMIC CONE PEN. RESISTANCE PLOT / SHEAR STRENGTH (kPa) | WATER CONTENT and LIMITS (%) | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 123.5 | Natural ground surface | | | | | | | | | |
| | | 0.0 | Topsoil: Peat and organic matter, dark brown, dry, loose. | | SS-01 | | 29 | 7 | | | | |
| | | 123.0 / 0.5 | Sand, traces of silt and gravel, light brown, dry to moist, compact. | | SS-02 | | 100 | 24 | | | | |
| | 1 | | | | | | | | | | | |
| 5 | | | | | SS-03 | | 100 | 25 | | | | |
| | 2 | | | | | | | | | | | |
| | | | | | SS-04 | | 75 | 30 | | | | |
| 10 | 3 | | | | | | | | | | | |
| | | | | | SS-05 | | 100 | 24 | | | | |
| | 4 | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| | 5 | | | | SS-06 | | 79 | 18 | | | | |
| | | | | | | | | | 5.8 m | | | |
| 20 | 6 | | | | | | | | | | | |
| | | | | | SS-07 | | | 14 | | | | |
| | 7 | | | | | | | | | | | |
| 25 | | 115.9 / 7.6 | Silty sand, grey, wet, very loose. | | SS-08 | | 25 | 1 | | | | |
| | 8 | | | | | | | | | | | |
| | | 114.9 / 8.6 | **Inferred Bedrock** | | SS-09 | | 83 | REF | | | | |
| | 9 | | **END OF BOREHOLE** | | | | | | | | | |
| 30 | | | **Water was measured in open** | | | | | | | | | |

DYNAMIC CONE PEN. RESISTANCE PLOT: 20 40 60 80

SHEAR STRENGTH (kPa): Vane test (◇ Intact, ◆ Remolded) Lab vane (□ Intact, ■ Remolded); 20 40 60 80 100

WATER CONTENT and LIMITS (%): $W_P$ W $W_L$; 25 50 75

REMARKS & GRAIN SIZE DISTRIBUTION (%): G S M C

\\LICENSES7\Sobek\Geotec80\Style\Log_Borehole_v5_NEW.sty

McINTOSH PERRY

# BOREHOLE No 20-5

| | | | | | |
|---|---|---|---|---|---|
| **DATE:** | 15/10/2020 - 15/10/2020 | **LOCATION:** | 1037 Carp Road, Ottawa | **ORIGINATED BY:** | A.L. |
| **PROJECT:** | 19-0125_1037_CARP | **COORDINATES:** | Lat: 45.271635 , Lon: -75.944536 | **COMPILED BY:** | M.A. |
| **CLIENT:** | Jim Bell Architectural Design Inc. | **DATUM:** | Geodetic | **CHECKED BY:** | NT |
| **ELEVATION:** | 123.30 m | **REMARK:** | | **REPORT DATE:** | 13/11/2020 |

| DEPTH - feet | DEPTH - meters | SOIL PROFILE: ELEVATION - m / DEPTH - m | DESCRIPTION | SYMBOL | SAMPLES: TYPE AND NUMBER | STATE | RECOVERY | "N" or RQD | GROUNDWATER CONDITIONS | DYNAMIC CONE PEN. RESISTANCE PLOT / SHEAR STRENGTH (kPa) | WATER CONTENT and LIMITS (%) | REMARKS & GRAIN SIZE DISTRIBUTION (%) G | S | M | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 123.3 | Natural ground surface | | | | | | | | | | | | |
| | | 0.0 / 122.7 | Topsoil: Peat, wood chips, organic matter. | | SS-01 | | 0 | 2 | | | | | | | |
| | 1 | 0.6 | Sand, traces of silt and gravel, light brown to brown, dry, Loose to compact. | | SS-02 | | 54 | 8 | | | | | | | |
| 5 | 2 | | | | SS-03 | | 75 | 15 | | | | | | | |
| | | | | | SS-04 | | 71 | 15 | | | | 1 | 96 | | 4 |
| 10 | 3 | | | | SS-05 | | 33 | 27 | | | | | | | |
| | 4 | | | | | | | | | | | | | | |
| 15 | | | | | SS-06 | | 75 | 15 | | | | | | | |
| | 5 | | | | | | | | ▼ 6.1 m | | | | | | |
| 20 | 6 | 117.2 / 6.1 | Sand, some silt, grey, wet, compact to dense. | | SS-07 | | 92 | 16 | | | | | | | |
| | 7 | | | | SS-08 | | 62 | 32 | | | | 0 | 89 | | 11 |
| 25 | 8 | 115.1 / 8.2 | **END OF BOREHOLE**<br><br>**Water was measured in open borehole** | | SS-09 | | 71 | 54 | | | | | | | |
| | 9 | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | |

McINTOSH PERRY

# BOREHOLE No 20-6

| | | | | | |
|---|---|---|---|---|---|
| **DATE:** | 15/10/2020 - 15/10/2020 | **LOCATION:** | 1037 Carp Road, Ottawa | **ORIGINATED BY:** | A.L. |
| **PROJECT:** | 19-0125_1037_CARP | **COORDINATES:** | Lat: 45.271866 , Lon: -75.944450 | **COMPILED BY:** | M.A. |
| **CLIENT:** | Jim Bell Architectural Design Inc. | **DATUM:** | Geodetic | **CHECKED BY:** | NT |
| **ELEVATION:** | 123.60 m | **REMARK:** | | **REPORT DATE:** | 13/11/2020 |

| DEPTH - feet | DEPTH - meters | SOIL PROFILE: ELEVATION - m / DEPTH - m | DESCRIPTION | SYMBOL | SAMPLES: TYPE AND NUMBER | STATE | RECOVERY | "N" or RQD | GROUNDWATER CONDITIONS | DYNAMIC CONE PEN. RESISTANCE PLOT / SHEAR STRENGTH (kPa) | WATER CONTENT and LIMITS (%) | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 123.6 | Natural ground surface | | | | | | | | | |
| | | 0.0 / 123.3 | Topsoil: Gravel, loose. Presence of cobbles and organic matter. | | SS-01 | | 12 | 6 | | | | |
| | | 0.3 / 122.8 | Topsoil: Peat,organic matter. | | | | | | | | | |
| | 1 | 0.8 | Sand, traces of silt and gravel, light brown, dry, loose to compact. | | SS-02 | | 42 | 4 | | | | |
| 5 | | | | | SS-03 | | 71 | 19 | | | | G 1 S 93 M 7 C |
| | 2 | 121.5 | | | | | | | | | | |
| | | 2.1 | **ENF OF BOREHOLE** | | | | | | | | | |
| 10 | 3 | | | | | | | | | | | |
| | 4 | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| | 5 | | | | | | | | | | | |
| 20 | 6 | | | | | | | | | | | |
| | 7 | | | | | | | | | | | |
| 25 | | | | | | | | | | | | |
| | 8 | | | | | | | | | | | |
| | 9 | | | | | | | | | | | |
| 30 | | | | | | | | | | | | |

DYNAMIC CONE PEN. RESISTANCE PLOT: 20 40 60 80

SHEAR STRENGTH (kPa): Vane test (◇ Intact, ◆ Remolded) Lab vane (□ Intact, ■ Remolded) 20 40 60 80 100

WATER CONTENT and LIMITS (%): $W_P$ W $W_L$ 25 50 75

REMARKS & GRAIN SIZE DISTRIBUTION (%): G S M C

\\LICENSES7\Sobek\Geotec80\Style\Log_Borehole_v5_NEW.sty

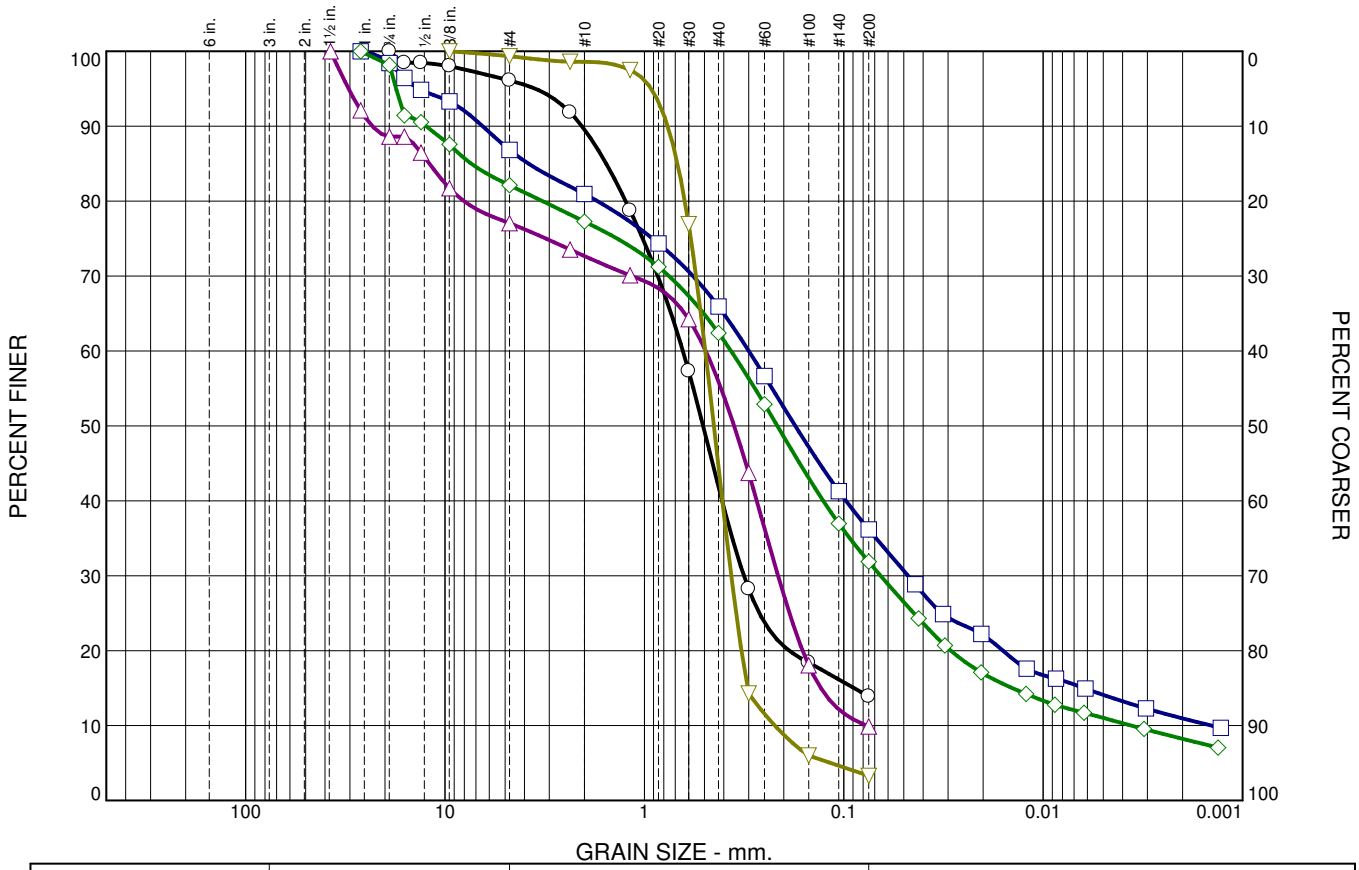
# GEOTECHNICAL INVESTIGATION
# OFFICE COMPLEX AT 1037 CARP ROAD

## APPENDIX D
## LAB RESULTS

**Only selected pages from the third-party lab are included in this appendix**

McINTOSH PERRY

# Particle Size Distribution Report




| | % +75mm | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| ○ | 0.0 | 0.0 | 3.9 | 6.5 | 47.7 | 28.0 | 13.9 | |
| □ | 0.0 | 1.5 | 11.7 | 5.8 | 15.1 | 29.7 | 25.2 | 11.0 |
| △ | 0.0 | 11.4 | 11.5 | 4.4 | 16.8 | 46.0 | 9.9 | |
| ◇ | 0.0 | 1.8 | 16.1 | 4.8 | 14.9 | 30.5 | 23.7 | 8.2 |
| ▽ | 0.0 | 0.0 | 0.7 | 0.7 | 54.1 | 41.2 | 3.3 | |

## SOIL DATA

| SYMBOL | SOURCE | SAMPLE NO. | DEPTH (ft.) | Material Description | USCS |
|---|---|---|---|---|---|
| ○ | 1037 Carp. Rd. | BH2001SS05 | 10.0-12.0' | Sand some Silt trace Gravel | |
| □ | 1037 Carp. Rd. | BH2001SS09 | 27.5'-29.5' | Silty Sand some Gravel some Clay | |
| △ | 1037 Carp. Rd. | BH2003SS06 | 15.0-17.0' | Gravelly Sand trace Silt | |
| ◇ | 1037 Carp. Rd. | BH2003SS09 | 27.5-29.0' | Silty Sand some Gravel trace Clay | |
| ▽ | 1037 Carp. Rd. | BH2005SS04 | 7.5-9.5' | Sand trace Silt | SP |

McINTOSH PERRY

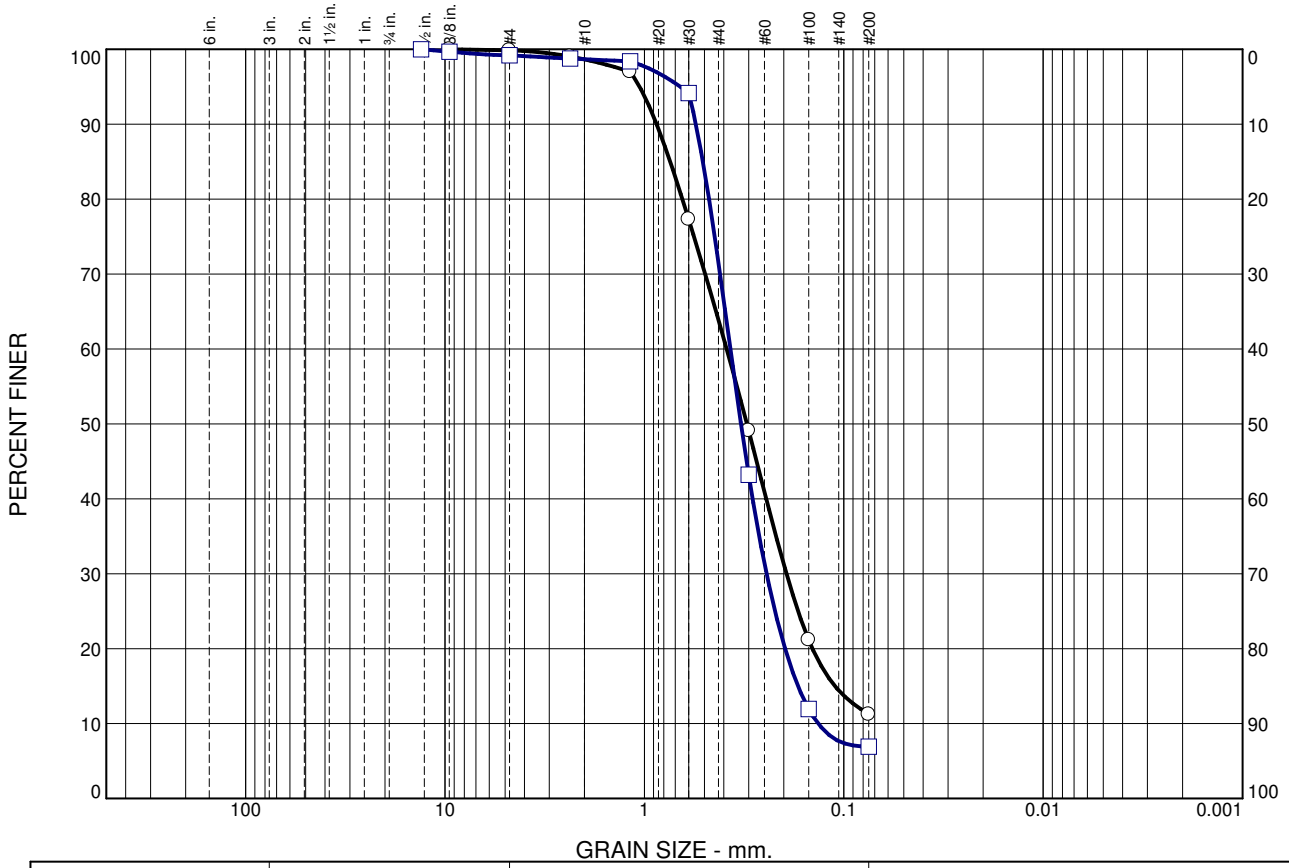
**Client:** Jim Bell Architectural Design Inc.

**Project:** Geotech Investigation - Proposed Office Buildings 1037 Carp. Rd. Ottawa, ON.

**Project No.:** CP19-0125 **Figure** 3

**Checked By:** H.Smith

# Particle Size Distribution Report




| | % +75mm | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| ○ | 0.0 | 0.0 | 0.1 | 1.2 | 34.8 | 52.7 | 11.2 | |
| □ | 0.0 | 0.0 | 0.8 | 0.5 | 27.2 | 64.6 | 6.9 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## SOIL DATA

| SYMBOL | SOURCE | SAMPLE NO. | DEPTH (ft.) | Material Description | USCS |
|---|---|---|---|---|---|
| ○ | 1037 Carp. Rd. | BH2005SS08 | 22.5-24.5' | Sand some Silt | |
| □ | 1037 Carp. Rd. | BH2006SS03 | 5.0-7.0' | Sand trace Silt | |
| | | | | | |
| | | | | | |
| | | | | | |

McINTOSH PERRY

**Client:** Jim Bell Architectural Design Inc.

**Project:** Geotech Investigation - Proposed Office Buildings 1037 Carp. Rd. Ottawa, ON.

**Project No.:** CP19-0125 **Figure** 4

**Checked By:** H.Smith

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

# Certificate of Analysis

**McIntosh Perry Consulting Eng. (Nepean)**

215 Menten Place, Unit 104
Nepean, ON K2H 9C1
Attn: Harrison Smith

Client PO:
Project: CP19-0125
Custody: 128663

Report Date: 2-Nov-2020
Order Date: 28-Oct-2020

**Order #: 2044382**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

| Paracel ID | Client ID |
|---|---|
| 2044382-01 | BH20-01 SS03 - Carp Rd. |
| 2044382-02 | BH20-03 SS03 - Carp Rd. |

Approved By:

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 02-Nov-2020

**Client: McIntosh Perry Consulting Eng. (Nepean)**

Order Date: 28-Oct-2020

**Client PO:**

**Project Description: CP19-0125**

## Analysis Summary Table

| Analysis | Method Reference/Description | Extraction Date | Analysis Date |
|---|---|---|---|
| Anions | EPA 300.1 - IC, water extraction | 30-Oct-20 | 30-Oct-20 |
| pH, soil | EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext. | 28-Oct-20 | 29-Oct-20 |
| Resistivity | EPA 120.1 - probe, water extraction | 30-Oct-20 | 30-Oct-20 |
| Solids, % | Gravimetric, calculation | 29-Oct-20 | 29-Oct-20 |

Certificate of Analysis

Report Date: 02-Nov-2020

**Client:** **McIntosh Perry Consulting Eng. (Nepean)**

Order Date: 28-Oct-2020

**Client PO:**

**Project Description: CP19-0125**

| | **Client ID:** | BH20-01 SS03 - Carp Rd. | BH20-03 SS03 - Carp Rd. | - | - |
|---|---|---|---|---|---|
| | **Sample Date:** | 15-Oct-20 09:00 | 15-Oct-20 09:00 | - | - |
| | **Sample ID:** | 2044382-01 | 2044382-02 | - | - |
| | **MDL/Units** | Soil | Soil | - | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 96.6 | 94.3 | - | - |
| **General Inorganics** | | | | | |
| pH | 0.05 pH Units | 8.06 | 7.92 | - | - |
| Resistivity | 0.10 Ohm.m | 126 | 92.0 | - | - |
| **Anions** | | | | | |
| Chloride | 5 ug/g dry | 9 | 7 | - | - |
| Sulphate | 5 ug/g dry | <5 | <5 | - | - |

**Qualifier Notes:**

None

**Sample Data Revisions**

None

**Work Order Revisions / Comments:**

None

**Other Report Notes:**

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.
NC: Not Calculated

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

# GEOTECHNICAL INVESTIGATION OF OFFICE BUILDNG AT 1037 CARP ROAD

## APPENDIX E
## SEISMIC HAZARD CALCULATION

McINTOSH PERRY

# 2010 National Building Code Seismic Hazard Calculation

**INFORMATION:** Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

**Site:** 45.272N 75.945W **User File Reference:** 1037 Carp Road 2020-11-12 15:13 UT

**Requested by:** McIntosh Perry

| Probability of exceedance per annum | 0.000404 | 0.001 | 0.0021 | 0.01 |
|---|---|---|---|---|
| Probability of exceedance in 50 years | 2 % | 5 % | 10 % | 40 % |
| Sa (0.2) | 0.600 | 0.369 | 0.234 | 0.083 |
| Sa (0.5) | 0.293 | 0.178 | 0.117 | 0.041 |
| Sa (1.0) | 0.132 | 0.084 | 0.053 | 0.017 |
| Sa (2.0) | 0.044 | 0.027 | 0.017 | 0.006 |
| PGA (g) | 0.308 | 0.191 | 0.115 | 0.034 |

**Notes:** Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 $m/s^2$). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

---

## References

**National Building Code of Canada 2015 NRCC no. 56190;** Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

**Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)**
**Commentary J**: Design for Seismic Effects

**Geological Survey of Canada Open File 7893** Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

**Liquefaction Evaluation for the Proposed Development on**

**1037 Carp Road**

**Project #: CP-19-0125**

Soil stratigraphy for the site consists of a thick sand deposit that extends to approximately 7.6 m below the existing ground level. The native sand layer is followed by a till layer that is approximately 1.3 m thick and followed by inferred bedrock. The groundwater is approximately at 5.7 m depth below the existing ground surface. Herein liquefaction susceptibility of the native sand layer and the till layer is evaluated.

For coarse-grained soils with fines content up to 35%, the corrected SPT resistance can be used to determine the susceptibility of the coarse-grained soil to liquefaction according to Canadian Foundation Engineering Manual CFEM (2006). Seven representative samples from the native sand and till layers underwent grain size analysis. The percentage of gravel, sand, silt and clay are presented in Table 1.

**Table 1: Grain Size Distribution of native Sand/Silty Sand**

| Borehole No. | Sample No. | $(N_1)_{60}$ | Depth (m) | Gravel (%) | Sand (%) | Silt (%) | Clay (%) | $r_d$ | *CSR* |
|---|---|---|---|---|---|---|---|---|---|
| BH20-01 | SS-05 | 9 | 3.0 – 3.6 | 4 | 82 | 15 | | 0.97 | 0.020 |
| BH20-01 | SS-09 | 11 | 8.3 – 8.9 | 13 | 51 | 26 | 11 | 0.93 | 0.024 |
| BH20-03 | SS-06 | 64 | 4.5 – 5.1 | 22 | 68 | 10 | | 0.96 | 0.020 |
| BH20-03 | SS-09 | 8 | 7.6 – 8.2 | 17 | 52 | 23 | 8 | 0.94 | 0.023 |
| BH20-05 | SS-04 | 23 | 2.3 – 2.9 | 1 | 96 | 4 | | 0.98 | 0.020 |
| BH20-05 | SS-08 | 40 | 8.3 – 8.9 | 0 | 89 | 11 | | 0.93 | 0.024 |
| BH20-05 | SS-03 | 34 | 1.5 – 2.1 | 1 | 93 | 7 | | 0.99 | 0.020 |

To evaluate the liquefaction susceptibility of the native sand and till layers using SPT test results, Cyclic Stress Ratio (CSR) has to be estimated based on site seismicity characteristics that were obtained from seismic calculator available on Natural Resources Canada website. CSR can be calculated using the following formula:

$$CSR = 0.65 \times \frac{a_{max} . \sigma_v}{g . \sigma'_{v0}} \times r_d$$

where $a_{max}$ is the peak ground surface acceleration for the designed earthquake, $g$ is gravity acceleration (9.81 m/s$^2$), $\sigma_v$ is total vertical overburden pressure, $\sigma'_{v0}$ is the initial effective overburden pressure and $r_d$ is stress reduction factor at the depth of interest. $r_d$ and *CSR* values are presented in Table 1.

Based on the calculated CSR and corrected SPT values, Figure 1 from CFEM can be used to evaluate the native sand and till layers susceptibility to liquefaction. The CSR results and the corrected SPT 'N' values were plotted on the figure and the native sand and till layers were found to be non-susceptible to liquefaction.

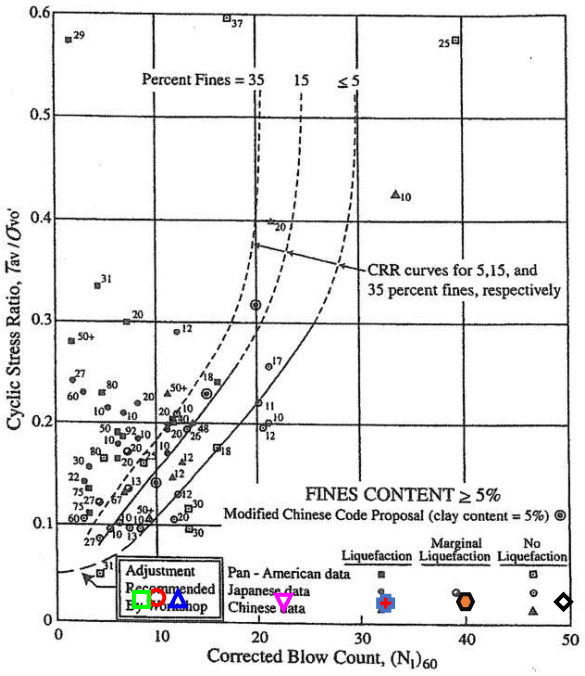
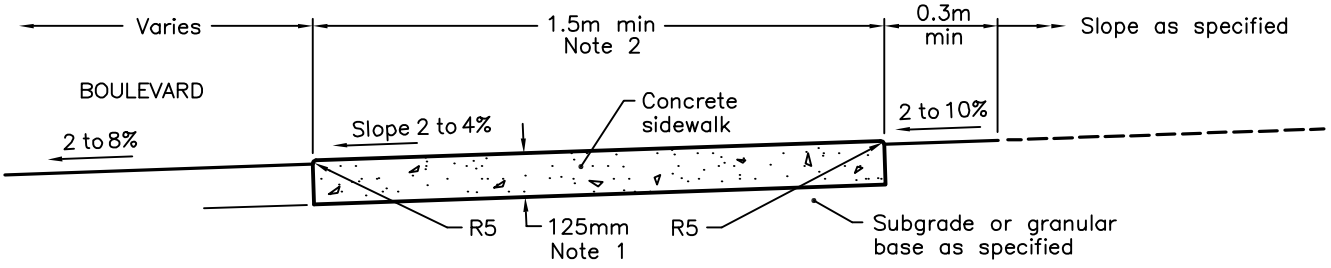



Figure 1: CRS vs Corrected SPT N value, $(N_1)_{60}$ (modified from CFEM 2006)

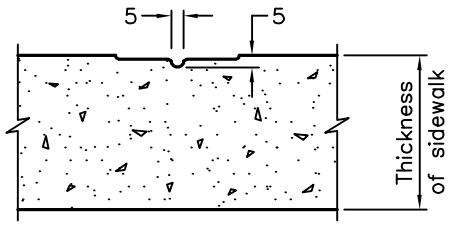
# GEOTECHNICAL INVESTIGATION
# OFFICE COMPLEX AT 1037 CARP ROAD

## APPENDIX F
## RELEVANT STANDARDS

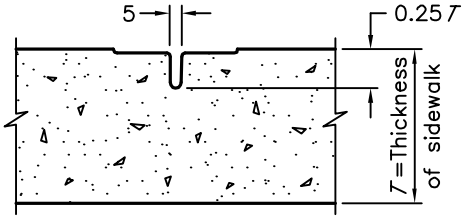
McINTOSH PERRY



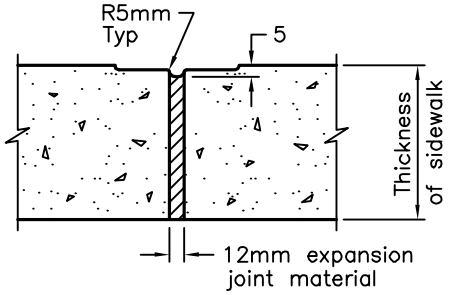

**TYPICAL SECTION**



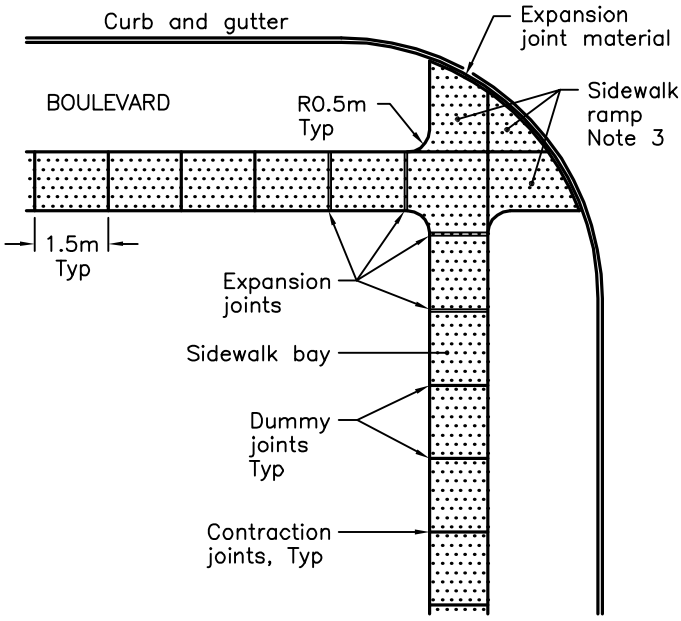

**DUMMY JOINT (OPTIONAL)**




**CONTRACTION JOINT**




**EXPANSION JOINT**




**JOINT LAYOUT**

NOTES:

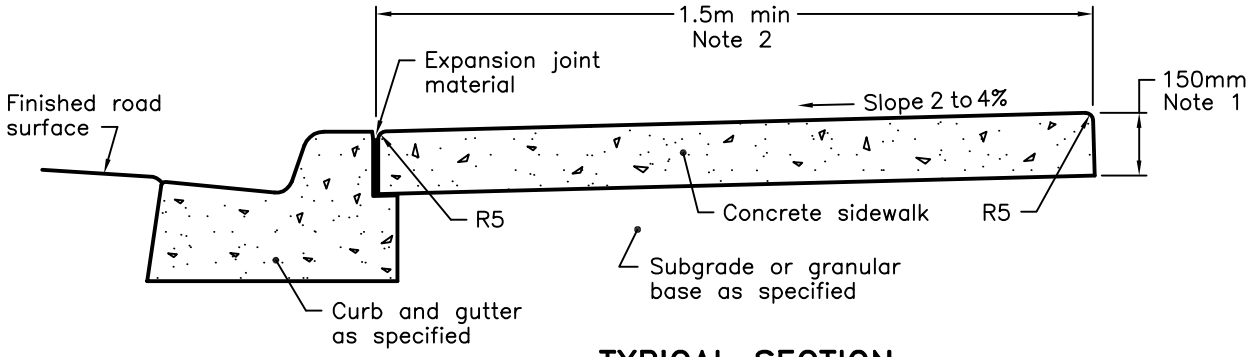
1 Sidewalk thickness at residential driveways and adjacent to curb shall be 150mm. At commercial and industrial driveways, the thickness shall be 200mm.

2 Sidewalk width shall be wider when specified.

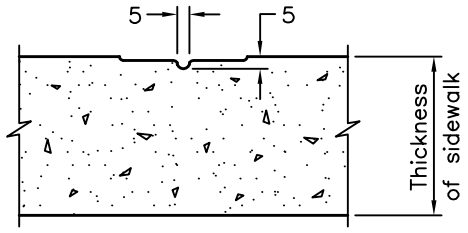
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.032, 310.033 and 310.039.

A All dimensions are in millimetres unless otherwise shown.

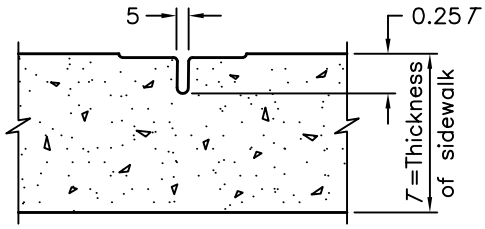
| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev | 2 |
|---|---|---|---|
| **CONCRETE SIDEWALK** | | | |
| | **OPSD 310.010** | | |



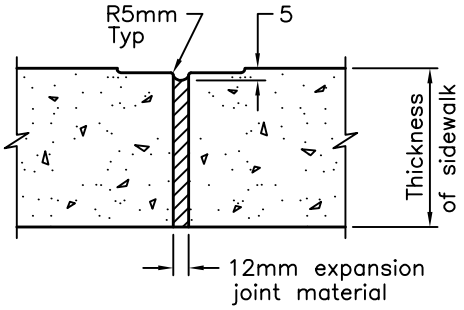

## TYPICAL SECTION



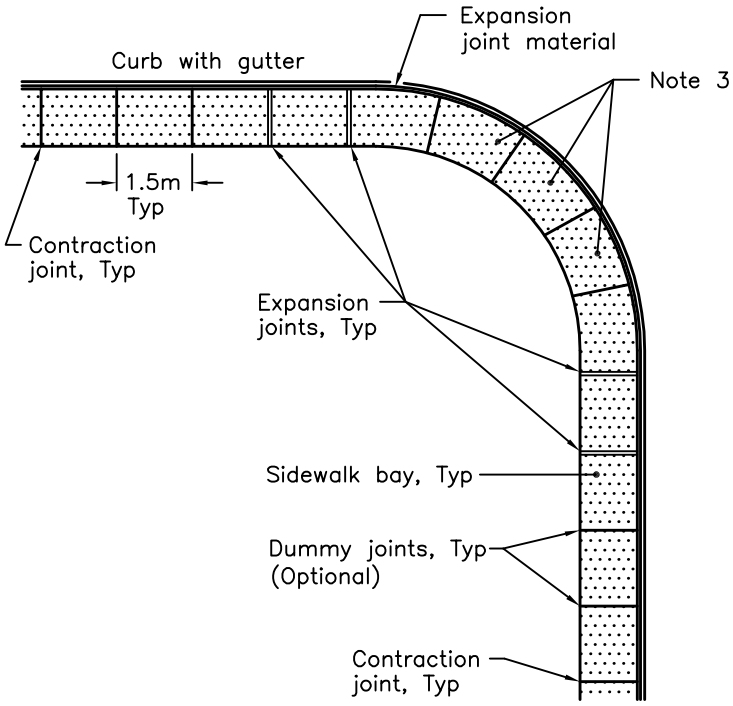

## DUMMY JOINT




## CONTRACTION JOINT




## EXPANSION JOINT




## JOINT LAYOUT

NOTES:

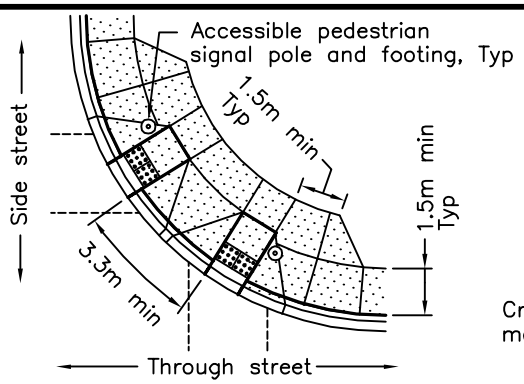
1 At commercial and industrial driveways, the thickness shall be 200mm.

2 Sidewalk width shall be wider when specified.

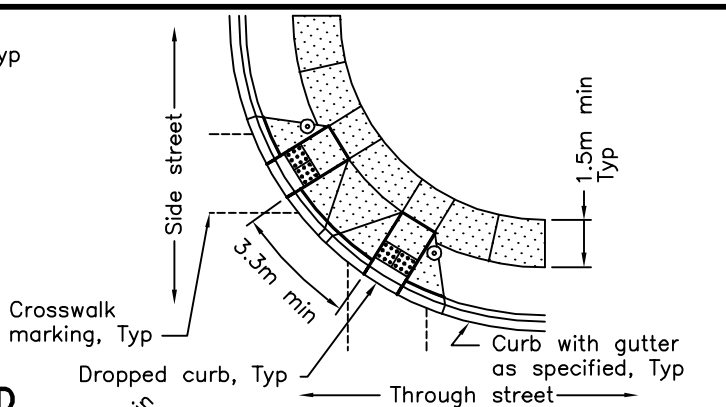
3 This OPSD shall be read in conjunction with OPSD 310.030, 310.031, 310.033, and 310.039.

A All dimensions are in millimetres unless otherwise shown.

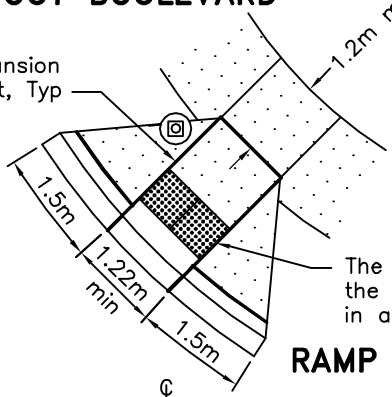
| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2019 | Rev | 3 |
|---|---|---|---|
| CONCRETE SIDEWALK<br>ADJACENT TO CURB WITH GUTTER | | | OPSD 310.020 |




## DOUBLE RAMP WITHOUT BOULEVARD

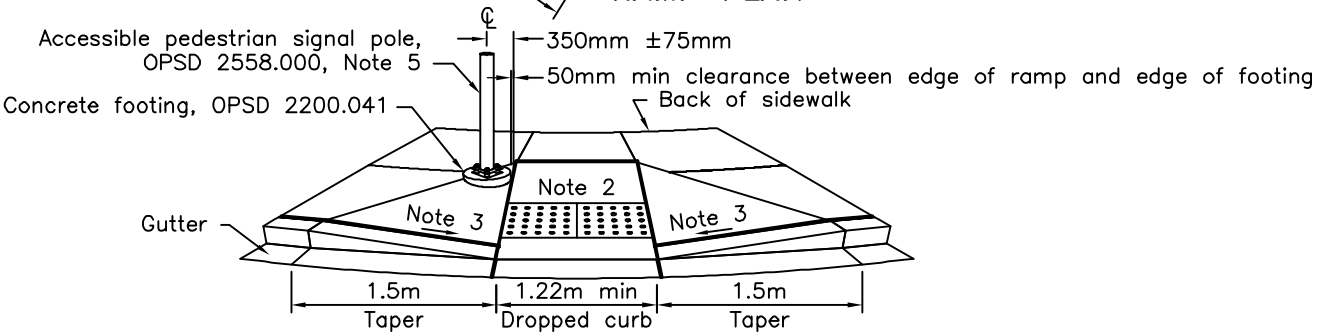



## DOUBLE RAMP WITH BOULEVARD

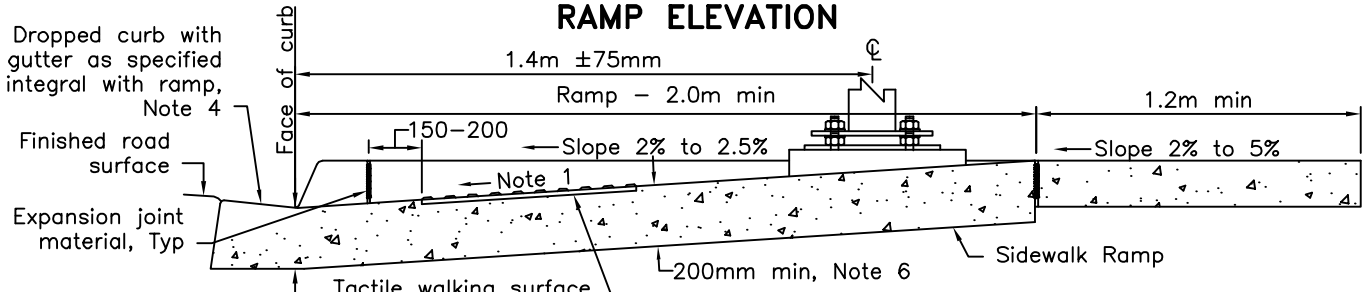



The plates shall extend the entire width of the sidewalk ramp at a minimum length of 610mm, in accordance with OPSD 310.039

## RAMP PLAN




## RAMP ELEVATION



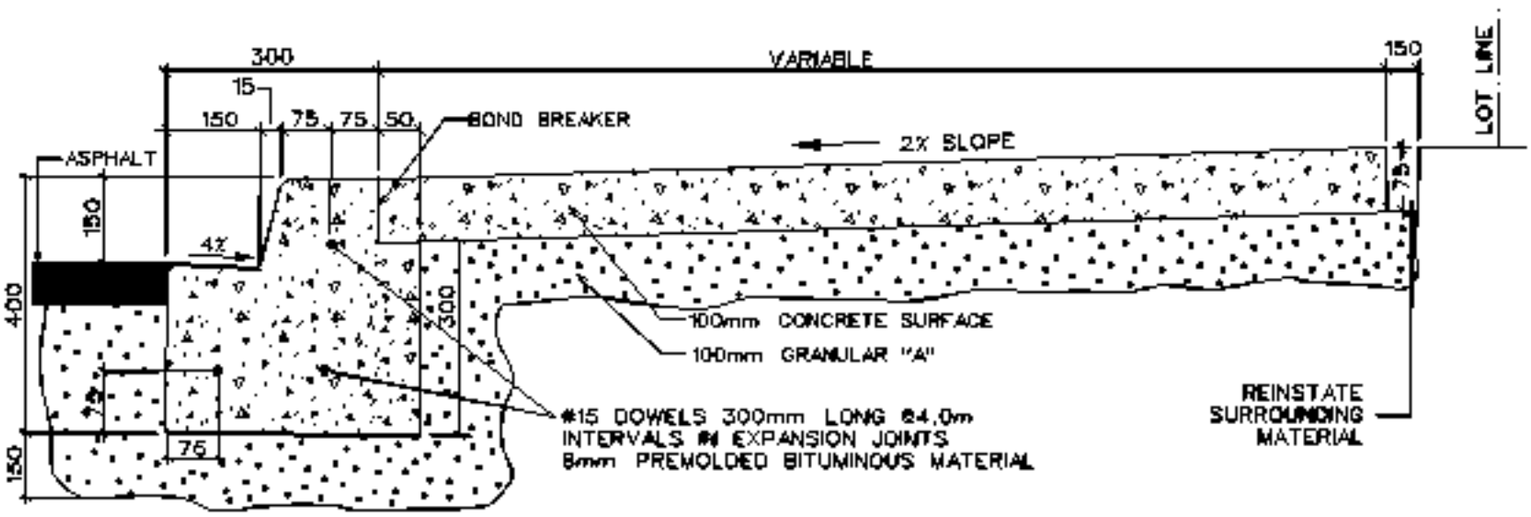

## RAMP SECTION

NOTES:

1 Slope of ramp shall not exceed 8%.
2 Cross slope of ramp shall not exceed 2% in either direction.
3 Cross slope of flared side of ramp shall not exceed 8%.
4 Dropped curb at ramp shall be modified to eliminate 30 mm step at gutter.
5 Accessible pedestrian signal to have tactile arrow that aligns with direction of crosswalk.
6 Minimum thickness of ramp is 200mm. Minimum thickness of sidewalk and flared sides adjacent to ramp is 150mm.

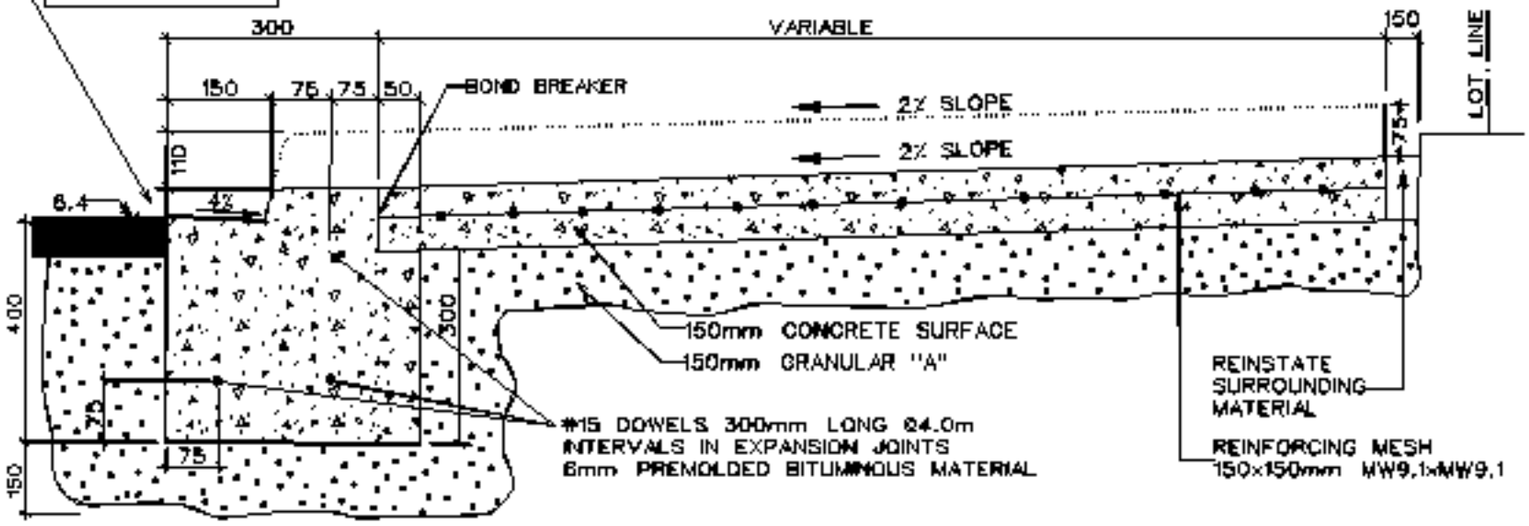
A Where only one crosswalk is present at an intersection, only one curb ramp is required.
B All dimensions are in millimetres unless otherwise shown.

| ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev | 1 |
|---|---|---|---|
| # CONCRETE SIDEWALK RAMPS AT SIGNALIZED INTERSECTIONS | | | |
| | OPSD 310.030 | | |

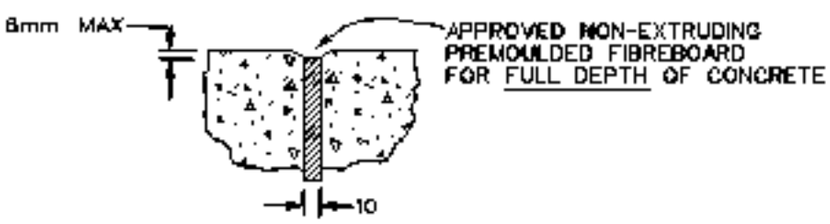



TYPICAL SIDEWALK SECTION

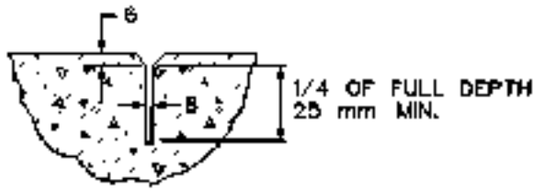
| PEDESTRIAN | |
|---|---|
| MINIMUM | 0mm |
| DESIRED | 15mm |
| MAXIMUM | 25mm |
| **VEHICULAR** | |
| MINIMUM | 15mm |
| DESIRED | 25mm |
| MAXIMUM | 40mm |




SECTION AT DRIVEWAY AND PEDESTRIAN RAMPS




EXPANSION JOINT PROFILE




DUMMY JOINT PROFILE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.

# CONCRETE CURB AND GUTTER WITH SIDEWALK

DATE: MAY 2001

REV. DATE: MARCH 2002

DWG. No.: SC3

# GEOTECHNICAL INVESTIGATION
# OFFICE COMPLEX AT 1037 CARP ROAD

## APPENDIX E
## SITE GRADING, DRAINAGE, AND SEDIMENT & EROSION CONTROL PLAN

McINTOSH PERRY

## GENERAL NOTES

1. THE ORIGINAL TOPOGRAPHY, GROUND ELEVATION AND SURVEY DATA SHOWN ARE SUPPLIED FOR INFORMATION PURPOSES ONLY, AND IMPLY NO GUARANTEE OF ACCURACY. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION SHOWN.
2. THIS PLAN IS NOT A CADASTRAL SURVEY SHOWING LEGAL PROPERTY BOUNDARIES AND EASEMENTS. THE PROPERTY BOUNDARIES SHOWN HEREON HAVE BEEN DERIVED INFORMATION SUPPLIED BY (OR SHOWN ON) **FAIRHALLL MOFFATT & WOODLAND LTD. DATED DECEMBER 18, 2018** AND CANNOT BE RELIED UPON TO BE ACCURATE OR COMPLETE. THE PRECISE LOCATION OF THE CURRENT PROPERTY BOUNDARIES AND EASEMENTS CAN ONLY BE DETERMINED BY AN UP-TO-DATE LAND TITLES SEARCH AND A SUBSEQUENT CADASTRAL SURVEY PERFORMED AND CERTIFIED BY AN ONTARIO LAND SURVEYOR.
3. THE CONTRACTOR IS TO OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS FROM THE **CITY OF OTTAWA** BEFORE COMMENCING CONSTRUCTION.
4. THE CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT.
5. THE CONTRACTOR IS TO DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME ALL RESPONSIBILITY FOR EXISTING UTILITIES WHETHER OR NOT SHOWN ON THESE DRAWINGS. IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
6. RESTORE ALL TRENCHES AND SURFACES OF PUBLIC ROAD ALLOWANCES TO CONDITION EQUAL OR BETTER THAN ORIGINAL CONDITION AND TO THE SATISFACTION OF THE **CITY OF OTTAWA**.
7. EXCAVATE AND DISPOSE OF ALL EXCESS EXCAVATED MATERIAL, SUCH AS ASPHALT, CURBING AND DEBRIS, OFF SITE AS DIRECTED BY THE ENGINEER AND THE **CITY OF OTTAWA**.
8. TOPSOIL TO BE STRIPPED AND STOCKPILED FOR REHABILITATION. CLEAN FILL TO BE PLACED IN FILL AREAS AND COMPACTED TO 95% STANDARD PROCTOR DENSITY.
9. ALL DISTURBED AREAS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER UNLESS OTHERWISE SPECIFIED.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TRAFFIC CONTROL AND SAFETY MEASURES DURING THE CONSTRUCTION PERIOD, INCLUDING THE SUPPLY, INSTALLATION, AND REMOVAL OF ALL NECESSARY SIGNAGE, DELINEATORS, MARKERS AND BARRIERS.
11. DO NOT ALTER GRADING OF THE SITE WITHOUT PRIOR APPROVAL OF THE **CITY OF OTTAWA**.
12. ALL ROADWAY, PARKING LOT, AND GRADING WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH **CITY OF OTTAWA** DETAILS AND SPECIFICATIONS. THE CONTRACTOR IS TO PROVIDE POSITIVE DRAINAGE AWAY FROM THE BUILDING.
13. CONTACT THE **CITY OF OTTAWA** FOR INSPECTION OF ROUGH GRADING OF PARKING LOTS, ROADWAYS AND LANDSCAPED AREAS PRIOR TO PLACEMENT OF ASPHALT AND TOPSOIL. ALL DEFICIENCIES NOTED SHALL BE RECTIFIED TO THE **CITY OF OTTAWA'S** SATISFACTION PRIOR TO PLACEMENT OF ANY ASPHALT, TOPSOIL, SEED & MULCH AND/OR SOD.
14. ALL DIMENSIONS AND INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION, IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
15. ELECTRICAL, GAS, TELEPHONE AND TELEVISION SERVICE LOCATIONS ARE SUBJECT TO THE INDIVIDUAL AGENCY:
    - ELECTRICAL SERVICE - **HYDRO ONE**
    - GAS SERVICE - ENBRIDGE
    - TELEPHONE SERVICE - BELL CANADA
    - TELEVISION SERVICE - ROGERS
16. INSTALLATION OF UTILITIES TO BE IN ACCORDANCE WITH CURRENT CODES AND STANDARDS OF INDIVIDUAL UTILITY APPROVAL AGENCIES AND THE **CITY OF OTTAWA**.
17. ALL PROPOSED CURB SHALL BE CONCRETE BARRIER CURB UNLESS SPECIFIED.
18. THIS PLAN MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT BY **McINTOSH PERRY #CP-19-0125 AND THE SERVICING & STORMWATER MANAGEMENT REPORT BY McINTOSH PERRY REPORT #CP-19-0125.**

## EROSION AND SEDIMENT CONTROL

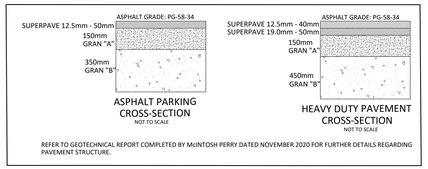
1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT OF EXPOSED SOIL, TEMPORARY SEDIMENT INLET CONTROL DEVICES TO BE IMPLEMENTED DURING CONSTRUCTION ON ALL PROPOSED ROAD CATCHBASINS, REARYARD CATCHBASINS AND CATCHBASIN MANHOLES AND OTHER SEDIMENT TRAPS. NO RECYCLED GEOSOCK MATERIAL SHALL BE PERMITTED FOR USE ON SITE.
2. AT THE DISCRETION OF THE PROJECT MANAGER OR **CITY OF OTTAWA INSPECTOR**, ADDITIONAL SILT CONTROL DEVICES SHALL BE INSTALLED AT DESIGNATED LOCATIONS.
3. FOR SILT FENCE BARRIER, USE OPSD 219.110.
   GEOTEXTILE FOR SILT FENCE PER OPSS 1860, TABLE 3.
4. EXCEPT AS PROVIDED IN PARAGRAPHS 4.1., and 4.2. BELOW, STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS FEASIBLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, BUT IN NO CASE MORE THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY HAS TEMPORARILY OR PERMANENTLY CEASED.
   4.1. WHERE THE INITIATION OF STABILIZATION MEASURES BY THE 14TH DAY AFTER CONSTRUCTION ACTIVITY TEMPORARILY OR PERMANENTLY CEASE IS PRECLUDED BY SNOW COVER, STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS FEASIBLE.
   4.2. WHERE CONSTRUCTION ACTIVITY WILL RESUME ON A PORTION OF THE SITE WITHIN 21 DAYS FROM WHEN ACTIVITIES CEASED, (E.G. THE TOTAL TIME PERIOD THAT CONSTRUCTION ACTIVITY IS TEMPORARILY CEASED IS LESS THAN 21 DAYS) THEN STABILIZATION MEASURES DO NOT HAVE TO BE INITIATED ON THAT PORTION OF SITE BY THE 14TH DAY AFTER CONSTRUCTION ACTIVITY TEMPORARILY CEASED.
5. SEDIMENT THAT IS ACCUMULATED BY THE TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED IN A MANNER THAT AVOIDS ESCAPE OF THE SEDIMENT TO THE DOWNSTREAM SIDE OF THE CONTROL MEASURE AND AVOIDS DAMAGE TO THE CONTROL MEASURE. SEDIMENT SHALL BE REMOVED TO THE LEVEL OF THE GRADE EXISTING AT THE TIME THE CONTROL MEASURE WAS CONSTRUCTED AND BE ACCORDING TO THE FOLLOWING:
   5.1. FOR LIGHT-DUTY SEDIMENT BARRIERS, ACCUMULATED SEDIMENT SHALL BE REMOVED ONCE IT REACHES THE LESSER OF THE FOLLOWING:
      5.1.1. A DEPTH OF ONE-HALF THE EFFECTIVE HEIGHT OF THE CONTROL MEASURE.
      5.1.2. A DEPTH OF 300 MM IMMEDIATELY UPSTREAM OF THE CONTROL MEASURE.
   5.2. FOR ALL CONTROL MEASURES, ACCUMULATED SEDIMENT SHALL BE REMOVED AS NECESSARY TO PERFORM MAINTENANCE REPAIRS.
   5.3. ACCUMULATED SEDIMENT SHALL BE REMOVED PRIOR TO THE REMOVAL OF THE CONTROL MEASURE.
   5.4. ACCUMULATED SEDIMENT IS TO BE REMOVED AND DISPOSED OF AS PER OPSS 180.
6. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MONITORED TO ENSURE THEY ARE IN EFFECTIVE WORKING ORDER. THE CONDITION OF THE CONTROL MEASURES SHALL BE MONITORED PRIOR TO ANY FORECAST STORM EVENT AND FOLLOWING A STORM EVENT.
7. DUST CONTROL MEASURES SHOULD BE CONSIDERED PRIOR TO CLEARING AND GRADING. THE USE OF WATER, CALCIUM CHLORIDE FLAKES/SOLUTION OR MAGNESIUM CHLORIDE FLAKES/SOLUTION SHALL BE USED AS DUST SUPPRESSANTS AS PER OPSS 506. THIS IS TO LIMIT WIND EROSION OF SOILS WHICH MAY TRANSPORT SEDIMENTS OFFSITE, WHERE THEY MAY BE WASHED INTO THE RECEIVING WATER BY THE NEXT RAINSTORM.
8. ALL 'GREEN AREAS' TO BE TREATED WITH 150mm TOPSOIL AND SOD AS SOON AS FEASIBLE, AS PER OPSS 570.
9. TOPSOIL TO BE STRIPPED AND STOCKPILED FOR REHABILITATION. CLEAN FILL TO BE PLACED IN FILL AREAS AND COMPACTED TO 95% STANDARD PROCTOR DENSITY.
10. ALL DISTURBED AREAS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER UNLESS OTHERWISE SPECIFIED.
11. STOCKPILED MATERIAL IS TO BE STORED AWAY FROM POTENTIAL RECEIVERS (E.G. STORM CATCHBASINS, MANHOLES), AND BE SURROUNDED BY EROSION CONTROL MEASURES WHERE MATERIAL IS LEFT IN PLACE IN EXCESS OF 14 DAYS.
12. IF REQUIRED, DEWATERING/SETTLING BASINS SHALL BE CONSTRUCTED AS PER OPSD 219.240 AND LOCATED ON FLAT GRADE UPSTREAM OF OTHER EXISTING MITIGATION MEASURES. WATERCOURSES SHALL NOT BE DIVERTED, OR BLOCKED, AND TEMPORARY WATERCOURSES CROSSINGS SHALL NOT BE CONSTRUCTED OR UTILIZED, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT. IF CLOSURE OF ANY PERMANENT WATER PASSAGE IS NECESSARY, THE CONTRACTOR SHALL RELEASE ANY STRANDED FISH TO THE OPEN PORTION OF THE WATERCOURSE WITHOUT HARM.
13. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL CONFORM TO OPSS 577
14. WHERE DEWATERING IS REQUIRED, THE DISCHARGED WATER SHALL BE CONTROLLED IN ACCORDANCE WITH OPSS 518.
15. ALL SETTLING/FILTRATION BASINS SHALL BE EQUIPPED WITH TERRAFIX 270R GEOTEXTILE (OR APPROVED EQUIVALENT) AND SHALL BE CLEANED AND REPLACED AS REQUIRED.

## SEWER NOTES

1. CONSTRUCT ALL SEWERS AND APPURTENANCES TO CITY OR TOWNSHIP STANDARDS (IF AVAILABLE) OR AS PER OPSD STANDARDS.
2. SEWER TRENCHING AND BEDDING SHALL CONFORM TO OPSD 802.010 AND 802.013 UNLESS NOTED OTHERWISE.
3. BEDDING SHALL BE A MINIMUM 150mm OF GRANULAR "A", COMPACTED TO MINIMUM 95% STANDARD PROCTOR DRY DENSITY. CLEAR STONE BEDDING SHALL NOT BE PERMITTED.
4. SUB-BEDDING, IF REQUIRED SHALL BE AS PER THE DIRECTION OF A GEOTECHNICAL ENGINEER.
5. BACKFILL TO AT LEAST 300mm ABOVE TOP OF PIPE WITH GRANULAR "A" OR SAND.
6. TO MINIMIZE DIFFERENTIAL FROST HEAVING, TRENCH BACKFILL (FROM PAVEMENT SUBGRADE TO 2.0m BELOW FINISHED GRADE) SHALL MATCH EXISTING SOIL CONDITIONS.
7. SEWERS AND CONNECTIONS 150mm DIAMETER AND SMALLER TO BE PVC SDR 28 OR APPROVED EQUIVALENT. SEWERS AND CONNECTIONS 200mm DIAMETER AND LARGER TO BE PVC SDR 35 OR APPROVED EQUIVALENT.
8. INSULATE ALL SEWERS AND/OR SERVICES THAT HAVE LESS THAN 2.0m OF COVER WITH THERMAL INSULATION AS PER OPSD 1109.030.
9. SUPPLY AND INSTALL ALL PIPING AND APPURTENANCES AS SHOWN AND DETAILED TO WITHIN 1.0m OF BUILDING. ALL ENDS OF SERVICES TO BE PROPERLY CAPPED AND LOCATED WITH 2"x4"x8' LONG MARKER.
10. CONTRACTOR TO TELEVISE (CCTV) ALL PROPOSED SEWERS ONSITE, OUTLET CONNECTION TO THE MAIN AND PIPES 150mmØ OR GREATER PRIOR TO BASE COURSE ASPHALT. UPON COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES.
11. DYE TESTING IS TO BE COMPLETED ON SANITARY SERVICE TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN.
12. ALL CATCHBASIN AND CATHCBASIN MANHOLE LEADS ARE TO BE MINIMUM 200mmØ WITH MINIMUM 1.0% SLOPE UNLESS OTHERWISE NOTED.
13. ALL CATCHBASINS EXCLUDING LANDSCAPE CATCHBASINS ARE TO HAVE 150 mmØ PERFORATED PIPE FOR 3.0m ON ALL AVAILABLE SIDES AS PER **CITY OF OTTAWA STANDARD DRAWING 'R1'.**

## WATERMAIN NOTES

1. CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH OPSD STANDARDS AND SPECIFICATIONS, AS WELL AS CITY OR TOWNSHIP STANDARDS.
2. INDUSTRIAL/COMMERCIAL SERVICE CONNECTIONS TO BE 50mm COPPER PIPING AND SHALL CONFORM TO ASTM B88 TYPE 'K' SOFT.
3. WATERMAINS AND/OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 2.4m, OTHERWISE THERMAL INSULATION IS REQUIRED AS PER CITY OR TOWNSHIP STANDARDS (IF AVAILABLE) OR OPSD 1109.030.
4. IF THE WATERMAIN MUST BE DEFLECTED TO MEET ALIGNMENT, ENSURE THAT THE AMOUNT OF DEFLECTION USED IS EQUAL TO OR LESS THAN THAT WHICH IS RECOMMENDED BY THE MANUFACTURER.
5. USE APPROVED SADDLE CONNECTION WITH MAIN (CORPORATION) STOP AS PER **CITY OF OTTAWA STANDARD DRAWING 'W26'.**
6. CONNECTION TO EXISTING BY CITY OR TOWNSHIP FORCES. EXCAVATION, BACKFILLING AND REINSTATEMENT IS TO BE COMPLETED BY THE CONTRACTOR.
7. THERMAL INSULATION OF WATERMAINS AT OPEN STRUCTURES AS PER CITY OR TOWNSHIP STANDARDS (IF AVAILABLE) OR OPSD 1109.030.
8. THERMAL INSULATION OF WATERMAINS UNDER ROAD SIDE DITCHES AS PER **CITY OF OTTAWA STANDARD DRAWING 'W21'.**
9. SWABING, CHLORINATION AND CONTINUITY TESTING FOR PROPOSED WATER SERVICES IS TO FOLLOW CITY OF OTTAWA SPECIAL PROVISIONS #SP-4491 & SP-4494.

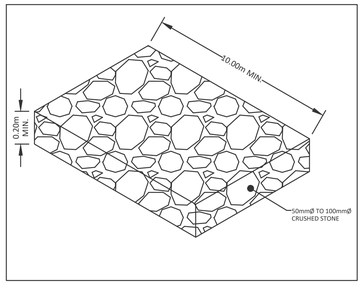



REFER TO GEOTECHNICAL REPORT COMPLETED BY McINTOSH PERRY DATED NOVEMBER 2020 FOR FURTHER DETAILS REGARDING PAVEMENT STRUCTURE.

## WATER COVER TABLE

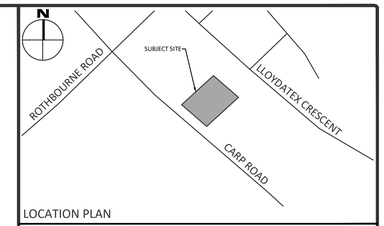
| LOCATION | FINISHED GRADE | TOP OF PIPE | COVER |
|---|---|---|---|
| CAP AT BUILDING | 124.82 | 122.42 | 2.40 |
| 45° Bend | 125.07 | 122.67 | 2.40 |
| 45° Bend | 125.07 | 122.67 | 2.40 |
| Water Valve | 125.29 | 122.89 | 2.40 |
| 500mm Culvert Crossing | 125.23 | 122.83 | 2.40 |
| Connection | 125.21 | 122.81 | 2.40 |

**REFER TO ATTACHED DETAIL SHEET (C100) FOR ADDITIONAL CROSS SECTIONS AND DETAILS.**










LOCATION PLAN

LEGEND

- PROPOSED / EXISTING PROPERTY LINE GRADES
- BARRIER CURB PER SC1.1
- MOUNTABLE CURB
- EASEMENT
- LIGHT DUTY ASPHALT
- HEAVY DUTY ASPHALT
- CONCRETE SIDEWALK
- PAVING STONE
- MH7 STORM MANHOLE
- CB6 DIG CATCHBASIN OR DITCH INLET
- ECB4 LANDSCAPE CATCHBASIN
- MH7A SANITARY MANHOLE
- PERFORATED PIPE IN SWALES
- WATER VALVE/CHAMBER
- FIRE HYDRANT
- CENTRELINE OF SWALE
- SLOPING AT 3:1 (UNLESS SPECIFIED)
- 95.94 / 95.20 PROPOSED ELEVATION EXISTING ELEVATION
- 95.94 / 0.0 SWALE ELEVATION
- T/W100.50 B/W90.50 TOP OF WALL ELEVATION BOTTOM OF WALL ELEVATION
- EMERGENCY OVERLAND FLOW ROUTE
- SILT FENCE (AS PER OPSD 219.130)
- ROCK CHECK DAM
- O/H BUILDING ENTRANCES (MAIN, SIDE, OVERHEAD)
- STRAW BALE CHECK DAM AS PER OPSD 219.180
- RETAINING WALL
- DEPRESSED CURB
- MUD MAT
- CLAY-SEAL

**FOR REVIEW ONLY**
***NOT FOR CONSTRUCTION***

| No. | Revisions | Date |
|---|---|---|
| 05 | ISSUED FOR MUNICIPAL REVIEW | MAR. 24, 2023 |
| 04 | ISSUED FOR MUNICIPAL REVIEW | NOV. 29, 2022 |
| 03 | ISSUED FOR COORDINATION | JULY 15, 2022 |
| 02 | ISSUED FOR MUNICIPAL REVIEW | SEP. 10, 2021 |
| 01 | ISSUED FOR COORDINATION | AUG. 27, 2021 |

Check and verify all dimensions before proceeding with the work — Do not scale drawings

SCALE 1 : 150
0 5 10 15 Metres


McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A 1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com


Stamp: LICENSED PROFESSIONAL ENGINEER R. D. FREEL 100163197 2023-03-24 PROVINCE OF ONTARIO

Client:
JIM BELL ARCHITECTURE DESIGN INC.
26 BERT G ARGUE DRIVE
STITTSVILLE, ON K2S 1X9

Project:
PHASE 1 - Office Building
1037 CARP ROAD, OTTAWA, ON

Drawing Title:
SITE GRADING, DRAINAGE AND SEDIMENT & EROSION CONTROL

| | |
|---|---|
| Scale: 1:150 | Project Number: CP-19-0125 |
| Drawn By: B.G.S | |
| Checked By: R.D.F. | Drawing Number: C101 |
| Designed By: B.G.S | |

D07-12-21-0168

18601

FILENAME: U:\Ottawa\01 Project - Proposals\2019 Jobs\CP\OCP Projects\OCP-19-0125 Jim Bell_Office Building_1037 Carp Road\Civil\12 - Drawing\OCP-19-0125_Presentation.dwg
LAST SAVED: Friday, March 24, 2023 LAST SAVED BY: F.Valenti
LAST PLOTTED: Friday, March 24, 2023 5:58 PM EDT