765 MONTREAL ROAD - GEOTECHNICAL REPORT

Project No.: CP-17-0480-01

Prepared for:

Shepherds of Good Hope
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April 2018

McINTOSH PERRY

TABLE OF CONTENTS

APPENDICES

GEOTECHNICAL INVESTIGATION and
FOUNDATION DESIGN RECOMMENDATION REPORT
765 Montreal Road, Ottawa, Ontario

1.0 INTRODUCTION

This report presents the factual findings obtained from a geotechnical investigation performed at the above-mentioned site, for the proposed construction of a low-rise apartment building, expected to be four-storey above ground level and a walk-out basement, in the neighborhood of Vanier in Ottawa, Ontario. It is understood the existing residential home will be removed as part of the proposed construction. The field work was carried out between February 5, 2018 and February 8, 2018, it was comprised of five boreholes advanced to a maximum depth of 7.9 m below existing ground surface.

The purpose of the investigation was to explore the subsurface conditions at this site and to provide anticipated geotechnical conditions influencing the design and construction of the proposed building.

McIntosh Perry Consulting Engineers Ltd (McIntosh Perry) carried out the investigation at the request of Shepard's of Good Hope.

2.0 SITE DESCRIPTION

The property under consideration for proposed development is located at 765 Montreal Road east of the Vanier neighbourhood of Ottawa. Access to the property is granted via Lang's Road, a low density access to residential properties North of Montreal Road. Entry to the front door of the property is gained via a stone stairway which ascends to the East from the driveway off of Lang's Road. A significant grade difference exists between the top of fill at the South West corner of the property to the elevation at the intersection of Montreal Road and Lang's Road. Top of fill grade in the yard is relatively flat generally matching the grade at the front step, however within 0.75 m out from the East and North walls of the building, a grade change of 0.75 m is observed relative to the general yard grade. General grade around the property rises to the North East significantly and gradually to the South and West. Fill thickness on the property drops significantly to the South and West to match the grade of the surrounding roads. Vegetation is dense with a mix of large to medium trees and brush.

It is understood the proposed structure will be a four-storey building. Location of the property is shown on Figure 1, included in Appendix B.

3.0 FIELD PROCEDURES

Staff of McIntosh Perry Consulting Engineers (McIntosh Perry) visited the site before the drilling investigation to mark out the proposed borehole locations. Utility clearance was carried out by 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 OGS INC Geotechnical/Environmental Drilling of Ottawa, Ontario. Boreholes were advanced using portable drilling equipment. Boreholes were advanced to a maximum depth of 7.9 m below the ground level. Soil samples were obtained at 0.6 m intervals of depth in boreholes using a 50 mm outside diameter split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. In boreholes BH18-1 and 18-2, were refusal was met boreholes were advanced through diamond coring. Rock cores were sealed with bentonite, and boreholes were backfilled with auger cuttings. All boreholes were restored to match the original surface. Borehole locations are shown on Figure 2, included in Appendix B.

No topographic information was provided at the time of the investigation. Ground surface elevations shown in the borehole logs, used a local benchmark assumed to be El. 100.0 m, at the top of the front step by the entrance to the existing house.

4.0 LABORATORY TEST PROCEDURES

Laboratory testing on representative SPT samples was performed at McIntosh Perry geotechnical lab included moisture content. Sieve grain-size analysis, and rock core compression tests of retrieved samples, was tested by LRL Ltd. The laboratory tests to determine index properties were performed in accordance with Ministry of Transportation Ontario (MTO) test procedures, which follow American Society for Testing Materials (ASTM) test procedures.

The rest of the soil and rock 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 after this period of time unless otherwise requested in writing by the Client.

Laboratory tests are included in Appendix C.

5.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Site Geology

Based on published physiography maps of the area (Ontario Geological Survey) the site is located within the Ottawa Valley Clay Plains. Surficial geology maps of southern Ontario identify the property as fine-textured glaciomarine deposits.

The Ottawa Valley between Pembroke and Hawkesbury, Ontario consists of clay plains interrupted by ridges of rock or sand. It is naturally divided into two parts, above and below Ottawa, Ontario. Within the valley, the bedrock is further faulted so that some of the uplifted blocks appear above the clay beds. The sediments

themselves in the valley are deep silty clay. Although the clay deposits are grey in color like the lime stones that underlies them in part, they are only mildly calcareous and likely derived from the more acidic rock of the Canadian Shield.

5.2 Subsurface Conditions

In general, the site stratigraphy consists of a topsoil, underlain by fill material, followed by a mudstone which transitioned to a shale bedrock. The soils encountered at this site can be divided into two different zones.

a) Fill
b) Bedrock

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

5.2.1 Fill

A layer of topsoil was found at the surface of all boreholes with the exception of BH18-4. The topsoil was found to range in thickness from 0.2 m to 0.6 m. below the topsoil was observed to be a sand fill with varying portions of silt and gravel. The fill was observed to be compact to very dense, brown and moist to wet. SPT 'N' values were observed to range from 13 to 50 blows/300mm. One representative sample of the fill underwent sieve grain-size analysis and was found to contain 29% gravel, 47% sand, and 24% silt and clay. The results of the fill were compared with OPSS requirements for fill and conformed to SSM requirements. Below the topsoil in borehole BH18-4 the material was observed to transition to mudstone. Total depth of overburden material was observed to range from 0.9 m to 3.8 m (El. 99.1 m to 95.4 m), before transitioning to mudstone.

5.2.2 Bedrock

Refusal was met in all boreholes, indicating a transitioning between the topsoil and fill to bedrock. The top of the bedrock was observed to be a weathered mudstone, which in some boreholes SPT samplers and augers were capable of penetrating. In BH18-1 and 18-2, boreholes were advanced beyond auger refusal through diamond coring to confirm bedrock. The cores were measured and logged both on site and in the office, and were observed to be mud stone transitioning to shale. The rock was observed to be dark grey to black, highly to moderately weathered and highly fractured near the surface. Within the mudstone recovery was limited, core recovery measured from the retrieved shale rock cores varied between 49% and 98%. RQD measured from the retrieved shale rock cores varied between 0% and 68%, increasing with depth. Based on the RQD values, the bedrock quality may be classified as very poor to fair.

Selected rock core samples were tested in the laboratory to determine the uniaxial compressive strength. The results show an average compressive strength of 23 MPa. The results of rock core samples are included in Table 5.1 below.

Table 5-1: Compressive Strength Test

Borehole	Run No	Depth (m)	L/D Ratio	Strength (MPa)	Description of Failure
BH18-1	RC-11	5.61-5.77	2.13:1	**16.1**	Blocky, vertical and horizontal breaks
BH18-2	RC-09	4.69-4.83	2.11:1	**16.7**	Blocky, vertical and horizontal breaks
BH18-2	RC-09	5.26-5.49	2.05:1	**38.0**	Blocky, vertical and horizontal breaks

5.3 Groundwater

Water was observed in boreholes which were cored, water level elevations may be as a result of water used during coring process and not representative of groundwater elevation. Groundwater level may be expected to fluctuate due to seasonal changes.

5.4 Chemical Analysis

The chemical test results conducted by Paracel Laboratories in Ottawa, Ontario, to determine the resistivity, pH, sulphate and chloride content of representative soil sample are shown in Table 5-1 below:

Table 5-2: Soil Chemical Analysis Results

Borehole	Sample	Depth / El. (m)	pH	Sulphate (%)	Chloride (%)	Resistivity (Ohm-cm)
BH18-1	SS-4	1.8-2.4	7.51	0.0217	0.0039	2,880

6.0 DISCUSSIONS AND RECOMMENDATIONS

6.1 General

This section of the report provides recommendations for the design of the proposed construction of a low-rise apartment building, expected to be four-storey above ground level above a walk-out basement, at 765 Montreal Road in the neighborhood of Vanier in Ottawa, Ontario. The recommendations are based on interpretation of the factual information obtained from the boreholes advanced during the subsurface investigation. The discussions and recommendations presented are intended to provide sufficient information to the designer of the proposed building to select the suitable types of foundation to support the structure.

The comments made on the construction are intended to highlight aspects which could have impact or affect the detailed design of the building, for which special provisions may be required in the Contract Documents. Those who requiring information on construction aspects should make their own interpretation of the factual

data presented in the report. Interpretation of the data presented may affect equipment selection, proposed construction methods, and scheduling of construction activities.

6.2 Project Design

6.2.1 Existing Site Condition

Detailed site condition is provided in Section 2. At the time of investigation the property contained an existing building at the north of the property and a densely vegetated yard at the south.

A significant grade difference exists between the top of the yard fill at the South West corner of the property to the elevation at the intersection of Montreal Road and Lang's Road. Top of fill grade in the yard is relatively flat generally matching the grade at the front step, however within 0.75 m out from the East and North walls of the building, a grade change of 0.75 m is observed relative to the general yard grade. General grade around the property rises to the North East significantly and gradually to the South and West. Vegetation is dense with a mix of large to medium trees and brush. The height difference is supported by a retaining wall with cobblestone face.

6.2.2 Proposed Development

It is understood the proposed structure will be a four-storey building above a walk-out basement. Location of the property is shown on Figure 1, included in Appendix B. The existing building is proposed to be demolished. Ground elevation is currently sloping about 0.8 m from north to south.

6.3 Frost Protection

Based on applicable building codes, a minimum earth cover of 1.8 m, or the thermal equivalent of insulation, should be provided for all exterior footings to reduce the effects of frost action.

6.4 Site Classification for Seismic Site Response

Selected spectral responses in the general vicinity of the site for 10% chance of exceedance in 50 years (475 years return period) are as indicated in Table 6-1, shown below and in Appendix E;

Table 6-1: Selected Seismic Spectral Responses (10% in 50 Yrs)

Sa(0.2)	Sa(0.5)	Sa(2.0)	PGA	PGV
0.164	0.089	0.021	0.104	0.069

The above noted spectral responses are for reference only and it may not indicate the critical spectrum for the proposed structure. The structural engineer shall consider deriving design specific spectral responses. The PGA for 2% probability of exceedance in 50 years is 0.284 g.

The site can be classified as a Site Class "C" based on the encountered elevation of the rock surface for the purposes of site-specific seismic response to earthquakes based on Table 4.1.8.4.A OBC 2012.

6.5 Shallow Foundations

Considering the order of structural loads and the subgrade capacity expected at the foundation level, provision of conventional strip footings and isolated pad footings may be adequate. Footings are expected to be buried to resist overturning and sliding and also to provide protection against frost action.

The encountered shale bedrock slopes from north to south. Top of shale at the southeast is approximately 2 m lower than the north and at the southwest is approximately 4 m lower than the north. The walk-out basement as indicated on the preliminary architectural sketches is only proposed for the southern half of the building which seems to be in agreement with the inferred rock slope.

In any case to minimize the risk of differential settlement, it is important to found all footings on a subgrade of similar properties. For the proposed structure, all footings shall be extended to a competent layer of shale.

The shale in some areas is overlain by a layer of mudstone which is an unstable rock of low strength. Mudstone has to be removed from the influence zone of all footings where encountered, unless otherwise approved by a geotechnical engineer. Shale at the top is also extremely weathered. All weathered and broken pieces shall be removed from the influence zone of the footings or to be stabilized by grout where considered possible. A geotechnical engineer shall review the subgrade upon excavation and provide directions to the contractor. If the rock had to be over-excavated due to unsuitable shale quality, and within the influence zone of the footings, the grade can be raised to the designated founding level by lean concrete with compressive strength not less than the bearing capacity of good quality shale as indicated in this report.

In areas outside of footings' influence zone the grade can be raised with engineered fill. The influence zone of footings are defined by a 1H:2V slope drawn downward and outward from the edge of the footing.

It should be noted that shale is typically prone to weathering and the subgrade once approved shall be covered as soon as possible to reduce the risk of shale degradation.

If adequate frost cover is not provided, the deficit of earth cover should be compensated by application of synthetic insulation material adequately projecting beyond foundation walls.

The engineered fill shall be placed in horizontal lifts of uniform thickness of no more than 300 mm before compaction. It should be placed at appropriate moisture content and compacted to a 100% standard Proctor density. The requirements for fill material and compaction may be addressed with a note on the structural drawing for foundation or grading drawing and/or with a Non-Standard Special Provision (NSSP).

6.5.1 Bearing Capacity

Bearing capacity calculations are prepared based on the assumption that all footings are extended to the shale substrate. Factored capacities for Ultimate Limit State (ULS) are provided for two different footing shapes, for strip footings and isolated pad footings. Foundations resting on rock usually experience relatively small serviceability deformations for the conventional building loads, therefore Serviceability Limit State (SLS) capacities are not relevant.

ULS bearing capacities for intact shale with estimated Rock Mass Rating (RMR) of 44;

- Strip footings with minimum 1 m width; ULS= 450 kPa
- Pad footing with minimum 1 m in shorter dimension and aspect ratio of less than 2; ULS=600 kPa

ULS bearing capacities for weathered shale with estimated Rock Mass Rating (RMR) of 29 are also provided. The weathered shale has to be approved by a geotechnical engineer to ensure the rock integrity is acceptable;

- Strip footings with minimum 1 m width; ULS= 150 kPa
- Pad footing with minimum 1 m in shorter dimension and aspect ratio of less than 2; ULS=200 kPa

6.6 Slabs-on-Grade

Free-floating Slabs-on-grade should be supported on minimum 200 mm of Granular A compacted to 100% SPMDD. In case the subgrade needs to be raised, Granular B type II or granular A needs to be compacted to minimum 96% SPMDD. If the slab-on-grade is designed to support internal columns, the fill used for the grade raise shall be compacted to minimum 100% SPMDD.

All subgrades should be approved under the supervision of a geotechnical representative prior to placement of the Granular "A" and slab-on-grade.

6.7 Lateral Earth Pressure

Free draining material shall be used as backfill material for foundation walls. If the 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 6-1: Backfill Material Properties

Borehole	Granular "A"	Granular "B"
Effective Internal Friction Angle, ϕ'	35°	30°
Unit Weight, γ (kN/m^3)	22.8	22.8

7.0 CONSTRUCTION CONSIDERATIONS

Any organic material and existing fill material of any kind, should be removed from the footprint of the footings and all structurally load bearing elements. If grade raise above the native shale subgrade is required, suitable fill material to conform to specifications of OPSS Granular criteria shall be used. Grade raise above intact shale, and within the influence zone of the footing, shall be done using lean concrete with compression strength not less than the shale bearing capacity. The Structural Fill, if directly supporting the load of the structure, should be free from any recycled or deleterious material, it should not be placed in lifts thicker than 300 mm and should be compacted to 100% Standard Proctor Maximum Dry Density (SPMDD).

Based on the construction season the founding level may fall below the groundwater table. The existing weathered rock is considered permissive. Hydraulic conductivity of the intact or weathered rock was not measured as part of the scope of work. For high level estimations a hydraulic conductivity of 10^(-5) cm/s can be considered for weathered shale. The contractor shall examine the water table at a given excavation time and calculate the exposed area under groundwater table and apply for a Permit to Take Water if the extracted groundwater is suspect to exceed the allowable threshold as indicated by environmental regulations.

A geotechnical engineer or technician should attend the site to confirm the subgrade and footing preparation, as well as the type of the material and level of compaction.

Foundation walls should be backfilled with free-draining material such as OPSS Granular types A or B. The native fill might be a suitable material for backfilling (see Figure 3 in Appendix B). However the scope of work was done through limited sampling and the contractor shall examine/test bulk sample upon excavation if material re-sue is considered. Sub-drains with positive of drainage to the City sewer should be provided at foundation level.

8.0 SITE SERVICES

At the subject site, the burial depth of water-bearing utility lines is typically 2.4 m below ground surface. If this depth is not achievable due to design restrictions, 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.

Utilities should be supported on minimum of 150 mm bedding of Granular A compacted to minimum 96% 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 intersecting structural elements. The engineer designing utilities shall ensure the proposed utility pipes can tolerate compaction loads.

9.0 CEMENT TYPE AND CORROSION POTENTIAL

A soil sample was 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 element. Test results are presented in Tables 5-1.

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

The corrosion potential for buried steel elements was determined as 'non-aggressive'.

10.0 CLOSURE

We trust this geotechnical investigation and foundation design report meets requirements of your project. The "Limitations of Report" presented in Appendix A are an integral part of this report. Please do not hesitate to contact the undersigned should you have any questions or concerns.

McIntosh Perry Consulting Engineers Ltd.

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Geotechnical Engineering Intern

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

11.0 REFERENCES

Canadian Geotechnical Society, “Canadian Foundation Engineering Manual”, 4th Edition, 2006.

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

Ontario Building Code - 2012

Google Earth, Google, 2015.

2015 National Building Code Seismic Hazard Calculation

765 MONTREAL 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.

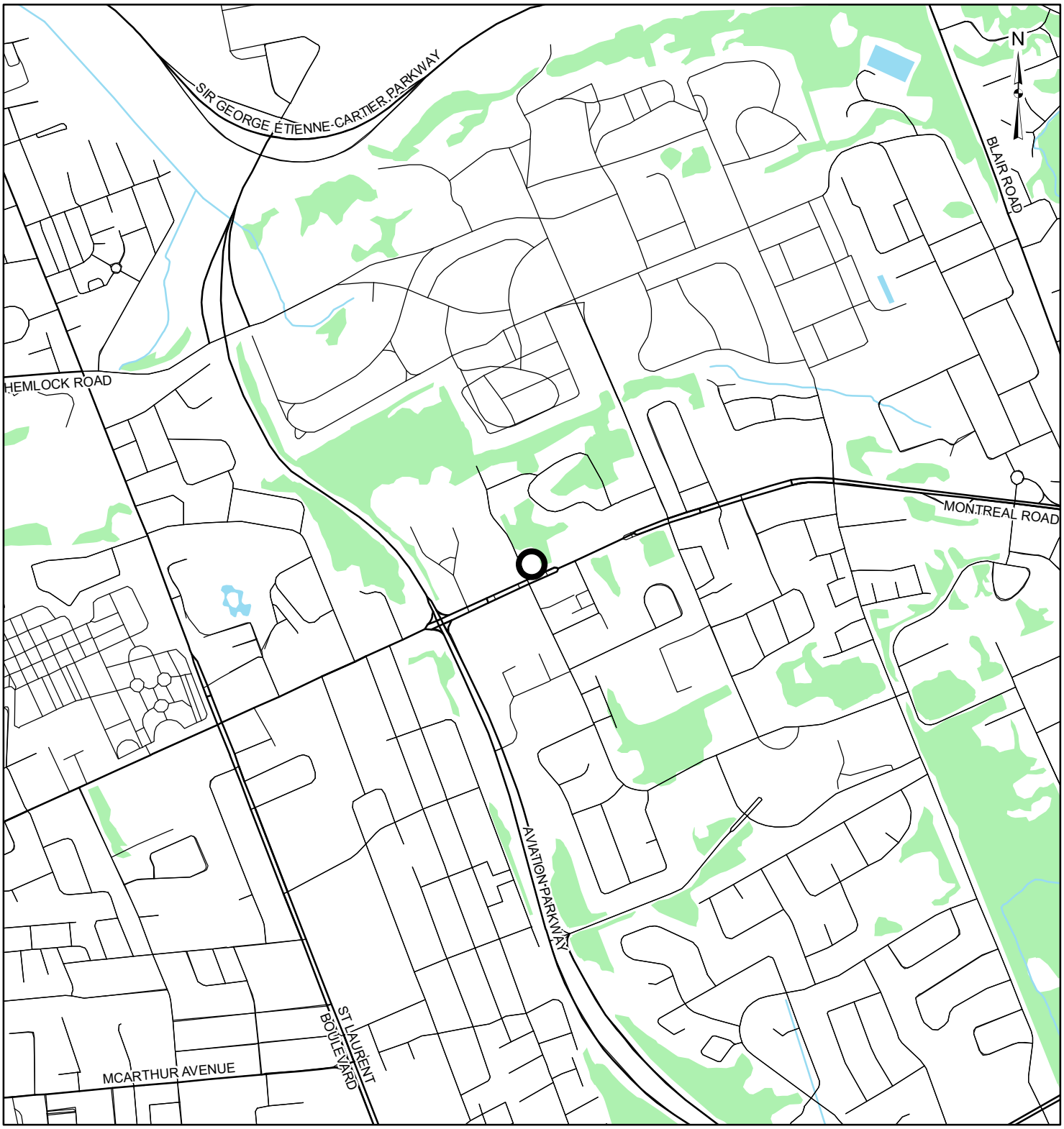
Under no circumstances shall the liability of McIntosh Perry for any claim in contract or in tort, related to the services provided and/or the content and recommendations in this report, exceed the extent that such liability is covered by such professional liability insurance from time to time in effect 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.

765 MONTREAL ROAD

APPENDIX B
FIGURES

McINTOSH PERRY



LEGEND

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

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.

CLIENT: SHEPHERDS OF GOOD HOPE

PROJECT: GEOTECHNICAL INVESTIGATION
765 MONTREAL ROAD

TITLE: SITE LOCATION

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PROJECT NO:	CP-17-0480
Date	Feb., 22, 2018
GIS	JD
Checked By	JU

FIGURE: 1

7 3.5 0 7

Scale 1:300 Metres

LEGEND

Borehole Location

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2018.

CLIENT: SHEPHERDS OF GOOD HOPE

PROJECT: GEOTECHNICAL INVESTIGATION
765 MONTREAL ROAD

TITLE: BOREHOLE LOCATIONS

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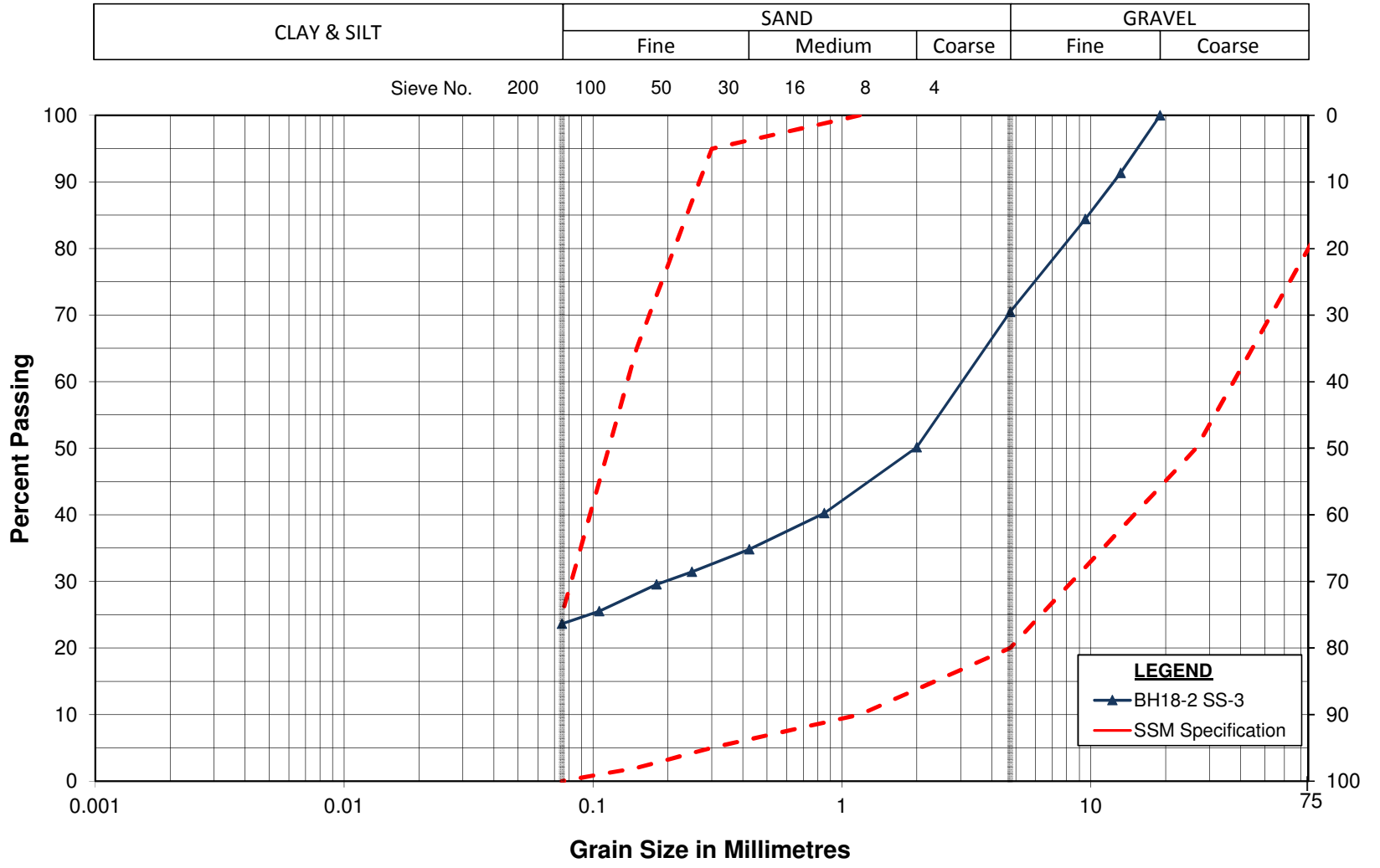
Date	Feb., 22, 2018
GIS	JD
Checked By	JU

FIGURE: 2

H:\01 Project - Proposals\2017 Jobs\CP\0CP-17-0480 - SGHope - Montreal Road\CP-17-0480-017 - GIS\mxd\0CP-17-0480_Geotechnical\02_BoreholeLocationsMontrealRd.mxd

Unified Soil Classification System



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Grain Size Distribution
FILL
765 Montreal Road

Figure No. 3

CP-17-0480-01

765 MONTREAL ROAD

APPENDIX C
BOREHOLE LOGS

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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
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ε	%	LINEAR STRAIN
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	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
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
Φ'	$^{-o}$	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
Φ_u	$^{-o}$	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = c_u / τ_r

PHYSICAL PROPERTIES OF SOIL

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

McINTOSH PERRY

RECORD OF BOREHOLE No 18-1

DATE:	05/02/2018 - 05/02/2018	**LOCATION:**	765 Montreal Road ()	**ORIGINATED BY:**	Phil Hulan
ID:	CP-17-0480-MONTREAL	**COORDINATES:**	Lat: 45.444943 , Lon: -75.635926	**COMPILED BY:**	Juli Ushey
CLIENT:	Sheperds of Good Hope	**DATUM:**	Geodetic	**CHECKED BY:**	Mary-Ellen Gleeson
ELEVATION:	93.5 m	**REMARK:**		**REPORT DATE:**	07/03/2018

DEPTH - feet	DEPTH - meters	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 (%)
		93.5	Natural ground surface									
		0.0 / 93.2	Topsoil.									
		0.3	Fill : Silty and gravelly sand, traces of clay, brown, dry, compact to very dense.		SS-01		25	30				
	1				SS-02		4	15				
5					SS-03		4	20				
	2				SS-04		21	31				
					SS-05		6	35				
10	3	90.3										
		3.2 / 89.8	Fill : Sand, traces of silt and gravel, brown, wet, loose.		SS-06		67	9				
		3.7 / 89.6	Fill : Silty sand, some gravel, traces of clay, brown, moist, compact.		SS-07			50				
	4	3.8 / 89.2	Mudstone.		RC-08		0		4 m			
		4.3	Shale Bedrock.		RC-09		9	50				
15					RC-10		91	*0*				
	5											
												16.1 MPa
20	6				RC-11		93	*55*				
	7											
					RC-12		98	*60*				
25		85.6										
	8	7.9	**END OF BOREHOLE**									
	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

McINTOSH PERRY

RECORD OF BOREHOLE No 18-2

DATE:	07/02/2018 - 08/02/2018	**LOCATION:**	765 Montreal Road ()	**ORIGINATED BY:**	Phil Hulan
ID:	CP-17-0480-MONTREAL	**COORDINATES:**	Lat: 45.444991 , Lon: -75.635773	**COMPILED BY:**	Juli Ushey
CLIENT:	Sheperds of Good Hope	**DATUM:**	Geodetic	**CHECKED BY:**	Mary-Ellen Gleeson
ELEVATION:	93.7 m	**REMARK:**		**REPORT DATE:**	07/03/2018

DEPTH - feet	DEPTH - meters	ELEVATION - m / DEPTH - m	DESCRIPTION	SYMBOL	TYPE AND NUMBER	STATE	RECOVERY	"N" or RQD	GROUNDWATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) G S M C
		93.7	Natural ground surface							
		0.0	Topsoil.							
		93.4 / 0.2	Fill : Sand, traces of clay and silt, brown, moist, loose.		SS-01		54	7		
		93.1 / 0.6	Fill : Silty and gravelly sand, traces of clay, brown, dry, compact to very dense.		SS-02		58	42		
5	1				SS-03		33	20		29 47 24
	2				SS-04		61	50		
			Presence of limestone fragments and gravel.		SS-05		28	25		
		90.9 / 2.7	Mudstone.		SS-06		50	100		
10	3	90.6 / 3.0	Shale Bedrock.		RC-07		67	*0*	3 m	
	4				RC-08		49	*2*		
15										
	5				RC-09		95	*68*		16.7 MPa
		88.2 / 5.5	**END OF BOREHOLE**							38.0 MPa
20	6									
	7									
25										
	8									
30	9									

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

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McINTOSH PERRY

RECORD OF BOREHOLE No 18-3

DATE:	08/02/2018 -	**LOCATION:**	765 Montreal Road ()	**ORIGINATED BY:**	Phil Hulan
ID:	CP-17-0480-MONTREAL	**COORDINATES:**	Lat: 45.445146 , Lon: -75.635674	**COMPILED BY:**	Juli Ushey
CLIENT:	Sheperds of Good Hope	**DATUM:**	Geodetic	**CHECKED BY:**	Mary-Ellen Gleeson
ELEVATION:	94.1 m	**REMARK:**	No water observed in open borehole.	**REPORT DATE:**	07/03/2018

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 (%)
		94.1	Natural ground surface									
		0.0	Topsoil.		SS-01		1	6				
		93.5										
	1	0.6	Mudstone.		SS-02		50	84				
		92.7			SS-03		62	100				
5		1.4	**END OF BOREHOLE. SPT refusal on probable bedrock.**									
	2											
10	3											
	4											
15												
	5											
20	6											
	7											
25												
	8											
30	9											

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

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McINTOSH PERRY

RECORD OF BOREHOLE No 18-4

DATE:	08/02/2018 -	**LOCATION:**	765 Montreal Road ()	**ORIGINATED BY:**	Phil Hulan
ID:	CP-17-0480-MONTREAL	**COORDINATES:**	Lat: 45.445021 , Lon: -75.635634	**COMPILED BY:**	Juli Ushey
CLIENT:	Sheperds of Good Hope	**DATUM:**	Geodetic	**CHECKED BY:**	Mary-Ellen Gleeson
ELEVATION:	93.3 m	**REMARK:**	No water observed in open borehole.	**REPORT DATE:**	07/03/2018

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 (%)
		93.3	Natural ground surface							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	W_P W W_L; 25 50 75	G S M C
		0.0	Fill : Silty sand, light brown, dry, compact. Presence of organic matter.		SS-01		17	10				
	1				SS-02		0	13				
5					SS-03		0	13				
		91.4										
		1.8	Mudstone.		SS-04		3	50				
	2	91.2										
		2.1	**END OF BOREHOLE. SPT refusal on probable bedrock.**									
10	3											
	4											
15												
	5											
20	6											
	7											
25												
	8											
30	9											

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McINTOSH PERRY

RECORD OF BOREHOLE No 18-5

DATE:	08/02/2018 -	**LOCATION:**	765 Montreal Road ()	**ORIGINATED BY:**	Phil Hulan
ID:	CP-17-0480-MONTREAL	**COORDINATES:**	Lat: 45.445218 , Lon: -75.635861	**COMPILED BY:**	Juli Ushey
CLIENT:	Sheperds of Good Hope	**DATUM:**	Geodetic	**CHECKED BY:**	Mary-Ellen Gleeson
ELEVATION:	94.5 m	**REMARK:**	No water observed in open borehole.	**REPORT DATE:**	07/03/2018

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 (%)
		94.5	Natural ground surface									
		0.0	Topsoil.									
		94.3 / 0.2	Fill: Silty sand, traces of clay and gravel, brown, moist, very dense.		SS-01		33	35				
		93.6			SS-02		60	50				
	1	0.9	**END OF BOREHOLE. SPT refusal on probable bedrock.**									
5	2											
10	3											
	4											
15	5											
20	6											
	7											
25	8											
30	9											

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

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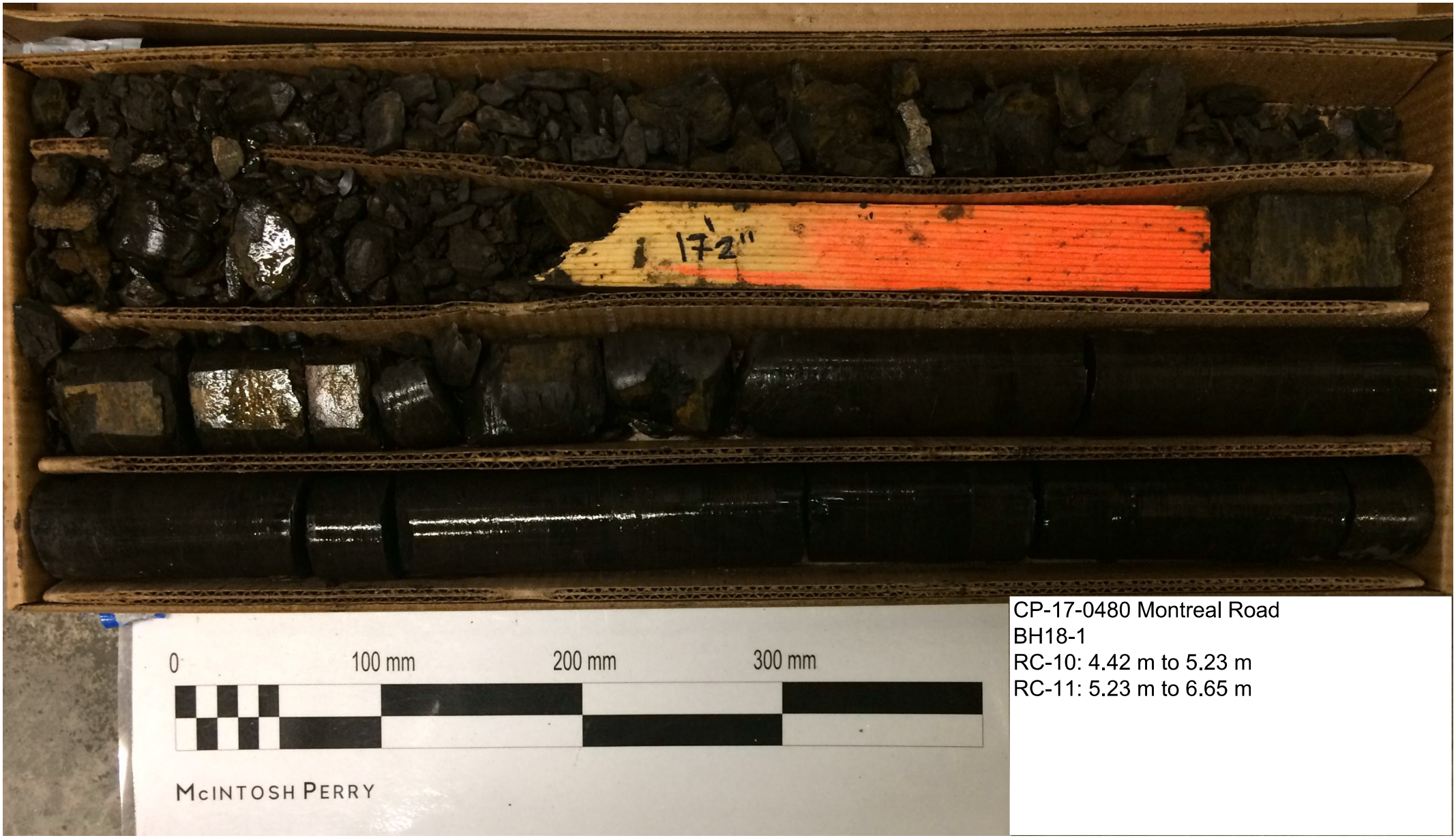


CP-17-0480 Montreal Road
BH18-1
RC-10: 4.42 m to 5.23 m
RC-11: 5.23 m to 6.65 m

BH-17-0480 Montreal Road
BH18-1
RC-12: 6.65 m to 7.87 m

CP-17-0480 Montreal Road
BH18-2
RC-07: 3.00 m to 5.46 m
RC-08: 3.30 m to 4.34 m
RC-09: 4.34 m to 5.46 m

765 MONTREAL ROAD

APPENDIX D
LAB RESULTS

McINTOSH PERRY

LRL Associates Ltd.

Unconfined Compressive Strength of Intact Rock Core

ASTM D 7012: Method C

Client: McIntosh Perry Consulting Engineers
Project: Materials Testing
Location: Montreal Road

Reference No.: CP-17-0480
File No.: 170496-22
Report No.: 1

Drill Core Information

Date(s) Sampled: February 7 & 8, 2018
Sampled By: McIntosh Perry Consulting Engineers
Date Received: February 15, 2018

Laboratory Identification	Core No.	Field Identification	Borehole	Run	Depth	Location / Description
C0675	1		18-1	RC-11	5.61 m - 5.77 m	Montreal Road
C0676	2		18-2	RC-09	4.69 m - 4.83 m	Montreal Road
C0677	3		18-2	RC-09	5.26 m - 5.49 m	Montreal Road

Rock Core Unconfined Compressive Strength Test Data

Laboratory Identification	Core No.	Conditioning	Length, mm	Diameter, mm		MPa	Description of Failure
C0675	1	As received	104.0	48.9		16.1	Blocky, vertical and horizontal breaks
C0676	2	As received	102.8	48.7		16.7	Blocky, vertical and horizontal breaks
C0677	3	As received	98.8	48.2		38.0	Blocky, vertical and horizontal breaks

Comments:

Date Issued: February 16, 2018

Reviewed By: W.A. McLaughlin

W.A.McLaughlin, Geo.Tech., C.Tech.

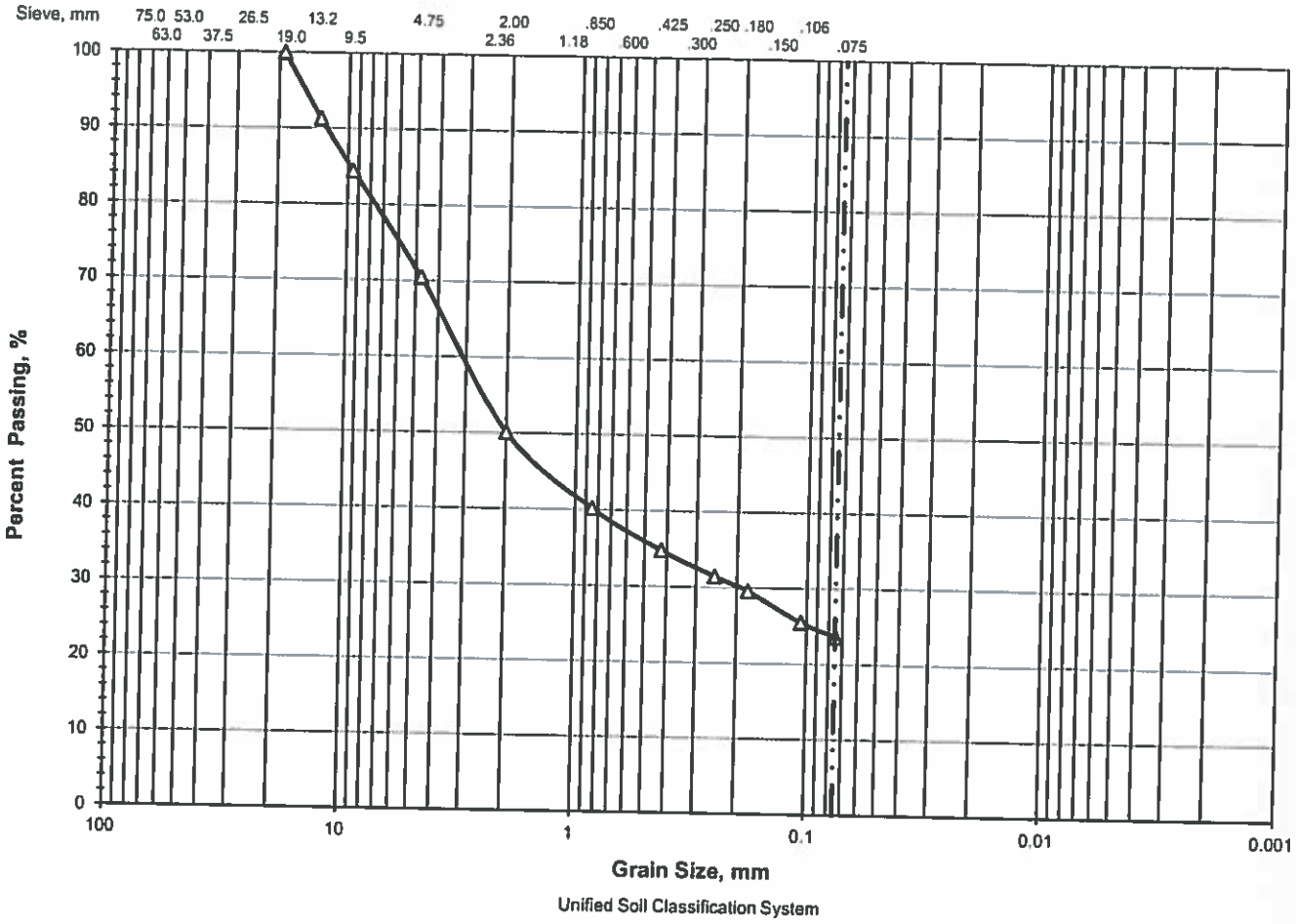
LRL Associates Ltd.

PARTICLE SIZE ANALYSIS

ASTM D 422 / LS-702

Client: McIntosh Perry Consulting Engineers
Project: Materials Testing
Location: Montreal Road

Reference No.: CP-17-0480
File No.: 170496-22
Report No.: 2



Unified Soil Classification System

	> 75 mm	% GRAVEL		% SAND			% FINES
		Coarse	Fine	Coarse	Medium	Fine	Silt & Clay
△	0.0	0.0	29.5	20.3	15.3	11.2	23.6

	Location	Sample	Depth, m	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
△	BH 18-2	SS-3	1.22 - 1.83	3.3348	1.9856	0.1964				

Date Issued: February 16, 2018

Reviewed By: W.A.McLaughlin

W.A.McLaughlin, Geo.Tech., C.Tech.

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Certificate of Analysis

McIntosh Perry Consulting Eng. (Carp)

115 Walgreen Road
RR#3 Carp, ON K0A 1L0
Attn: Mary Ellen Gleeson

Client PO: SGH- Montreal Rd
Project: CP-17-0480-01
Custody: 34163

Report Date: 12-Feb-2018
Order Date: 6-Feb-2018

Order #: 1806216

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

Paracel ID	Client ID
1806216-01	BH18-1 SS-4

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: McIntosh Perry Consulting Eng. (Carp)
Client PO: SGH- Montreal Rd

Report Date: 12-Feb-2018
Order Date: 6-Feb-2018
Project Description: CP-17-0480-01

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	9-Feb-18	9-Feb-18
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	6-Feb-18	7-Feb-18
Resistivity	EPA 120.1 - probe, water extraction	9-Feb-18	10-Feb-18
Solids, %	Gravimetric, calculation	9-Feb-18	9-Feb-18

Certificate of Analysis

Client: McIntosh Perry Consulting Eng. (Carp)

Client PO: SGH- Montreal Rd

Report Date: 12-Feb-2018

Order Date: 6-Feb-2018

Project Description: CP-17-0480-01

	Client ID:	BH18-1 SS-4	-	-	-
	Sample Date:	05-Feb-18	-	-	-
	Sample ID:	1806216-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	64.9	-	-	-
General Inorganics					
pH	0.05 pH Units	7.51	-	-	-
Resistivity	0.10 Ohm.m	28.8	-	-	-
Anions					
Chloride	5 ug/g dry	39	-	-	-
Sulphate	5 ug/g dry	217	-	-	-

Certificate of Analysis
Client: McIntosh Perry Consulting Eng. (Carp)
Client PO: SGH- Montreal Rd

Report Date: 12-Feb-2018
Order Date: 6-Feb-2018
Project Description: CP-17-0480-01

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
General Inorganics									
Resistivity	ND	0.10	Ohm.m						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	6.1	5	ug/g dry	6.2			1.0	20	
Sulphate	9.78	5	ug/g dry	22.9			80.3	20	QR-01
General Inorganics									
pH	7.84	0.05	pH Units	7.89			0.6	10	
Resistivity	401	0.10	Ohm.m	395			1.4	20	
Physical Characteristics									
% Solids	88.4	0.1	% by Wt.	86.3			2.4	25	

Certificate of Analysis
Client: McIntosh Perry Consulting Eng. (Carp)
Client PO: SGH- Montreal Rd

Report Date: 12-Feb-2018
Order Date: 6-Feb-2018
Project Description: CP-17-0480-01

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	105	5	ug/g	6.2	99.1	78-113			
Sulphate	116	5	ug/g	22.9	93.5	78-111			

Qualifier Notes:

QC Qualifiers :

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

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.

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.

765 MONTREAL ROAD

APPENDIX E
SEISMIC HAZARD CALCULATION

McINTOSH PERRY

2015 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

February 26, 2018

Site: 45.4448 N, 75.6358 W User File Reference: 765 Montreal Road

Requested by: , McIntosh Perry

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.456	0.532	**0.446**	0.339	**0.240**	**0.119**	**0.056**	**0.015**	**0.0054**	**0.285**	**0.199**

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" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. 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.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.045	0.152	0.253
Sa(0.1)	0.062	0.190	0.306
Sa(0.2)	0.056	0.164	0.259
Sa(0.3)	0.044	0.126	0.198
Sa(0.5)	0.031	0.089	0.140
Sa(1.0)	0.015	0.045	0.070
Sa(2.0)	0.0061	0.021	0.033
Sa(5.0)	0.0012	0.0047	0.0081
Sa(10.0)	0.0006	0.0019	0.0032
PGA	0.033	0.104	0.166
PGV	0.021	0.069	0.112

References

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

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
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

Aussi disponible en français