GEOTECHNICAL INVESTIGATION - MCTEER ROAD
FROM COUNTY ROAD 17 TO CITY BOUNDARY
F18-QT-2019-023
CITY OF CLARENCE-ROCKLAND

Prepared for:

The City of Clarence-Rockland
Attn: Mr. Charles Bonneau, Coordinator, Capital Projects
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By:

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LASCELLES
ENGINEERING & ASSOCIATES

Lascelles File No: 190181

July 2019

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1 INTRODUCTION

The City of Clarence-Rockland (The City) retained the services of Lascelles Engineering & Associates Ltd. (Lascelles) to conduct a geotechnical investigation on a section of McTeer Road that will be subjected to upcoming rehabilitation.

The purpose of the investigation was to identify the subsurface soil conditions within specific sections of roads by means of a limited number of boreholes, and based on the factual information obtained, provide guidelines on the geotechnical engineering aspects of the rehabilitation of the road.

Should there be any changes in the design features, which may relate to the guidelines provided in the report, Lascelles Engineering & Associates Ltd. should be advised in order to review the report recommendations.

2 PROJECT AND SITE

As outlined in the request of proposal (RFP) provided by the City of Clarence-Rockland, a section of about 220m of McTeer Road is slated for rehabilitation. The section starts at the intersection with County Road 17 and extends westerly to the City's boundary with the City of Ottawa. There are no municipal services on McTeer Road, and none are proposed to be installed.

McTeer Road is a rural road located on the western boundary of the City of Clarence-Rockland and subject to low traffic volumes. It is bordered by a few residential dwellings to the north and by County Road 17 to the south. This road has no municipal services but does have some public utilities such as natural gas, communication, and hydro. McTeer Road is a two-lane rural road that has an approximated paved width of 5.0 to 6.0m and contains roadside shoulders (approximately 1.0m wide) and shallow ditches on both sides.

This section of road is in very poor condition and exhibits numerous and frequent loss of sections with potholes and ravelling. In addition, extensive transversal and longitudinal wheel and edge cracking were observed as well as deformation of the surface.

3 PROCEDURE

The fieldwork for this investigation was carried out on June 25, 2019. The number of boreholes to be drilled was predetermined by the City of Clarence-Rockland's RFP, while the location of the boreholes was established by Lascelles' technical staff. A total of three (3) boreholes were evenly spaced along the section McTeer Road to characterise the pavement structure and subgrade condition. Prior to any fieldwork, the borehole locations were cleared for the presence of any underground services and utilities. Traffic control during the drilling of the borehole was maintained in accordance with the Ministry of Transportation's Book 7.

The boreholes were advanced using a truck mounted drill rig equipped with continuous flight hollow stem augers supplied and operated by George Downing Estate Drilling Inc. A "two-man" crew experienced with geotechnical drilling operated the drill rig and equipment. The boreholes were advanced by auguring through the pavement structure and overburden down to the minimum specified depth of 1.5m as outlined in the RFP.

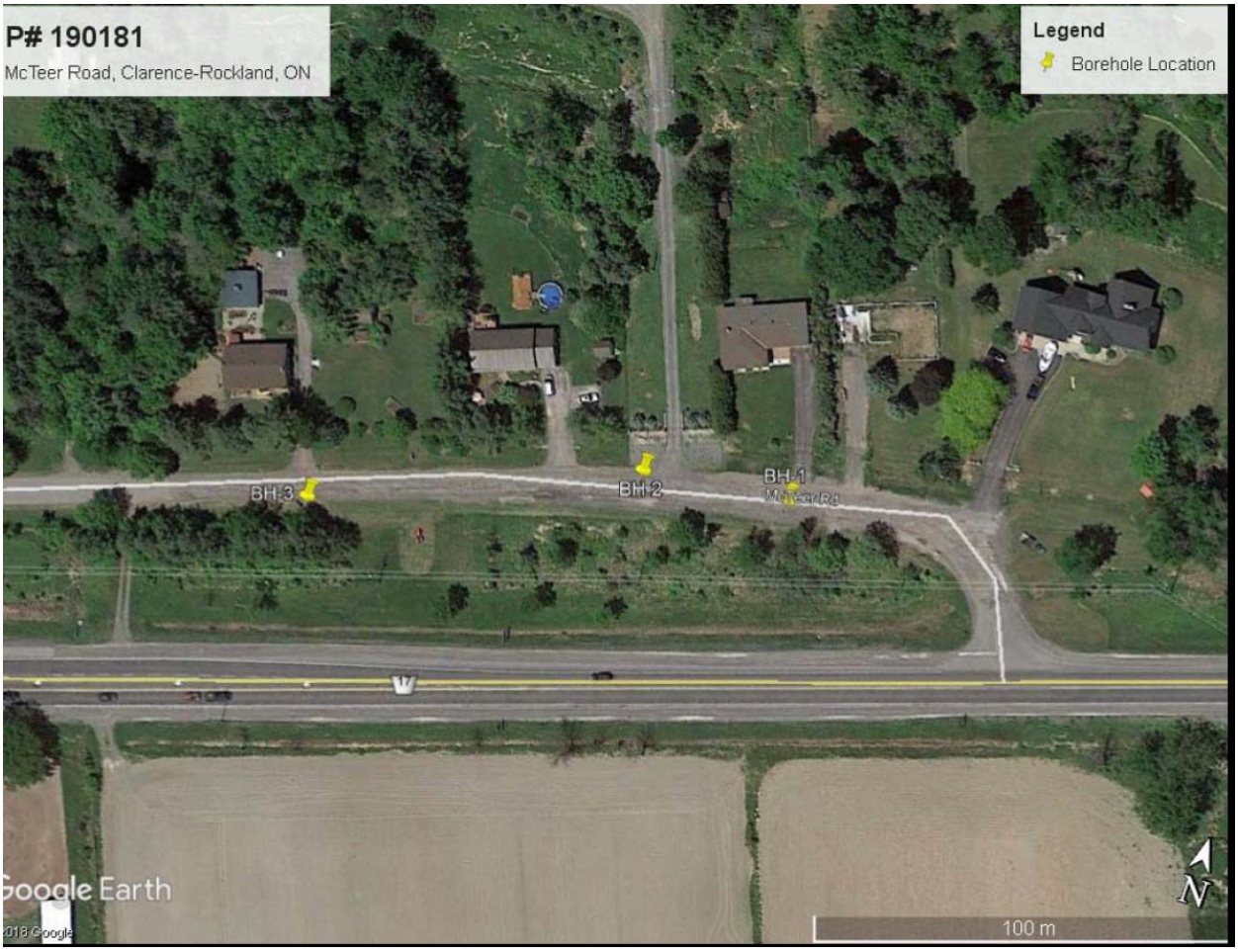
Sampling of the pavement structure was carried out using 140mm diameter drive open "PW" split spoon sampler. The overburden material encountered in the boreholes was carried out using a 50mm diameter drive open conventional split spoon sampler in conjunction with standard penetration testing ("N" value). All soil samples collected from the split spoons were placed and sealed in plastic bags to prevent the evaporation of their moisture content. All soil samples were visually examined, described, logged and stored before being transported to our office for further examination by our geotechnical engineer.

The fieldwork was supervised throughout by a member of our engineering staff who supervised the drilling of the boreholes, coordinated the testing of the materials, cared for the samples collected and logged the subsurface conditions encountered at each location. All samples collected during this project will be kept in storage for a period of six (6) months at which time, they will be disposed of, unless a written or verbal notice is received, requesting otherwise.

Upon completion, the boreholes were backfilled with soil cuttings brought up by the augers and compacted; additional sand soil was also added where needed. The boreholes were topped with a minimum of 125mm of cold patch asphalt.

All boreholes were located using a GPS (Global Positioning System) receiver using NAD 83 (North American Datum). Using these GPS coordinates, the borehole locations were plotted on a Google Earth aerial image. The location of the boreholes is presented as part of **Figure 1** below.

Figure 1: Borehole Location



4 SUBSURFACE SOIL CONDITIONS

A review of the surficial geology maps for this area suggests that McTeer Road would be underlain by Erosional Terraces, which are generally composed of silt and clay.

The subsurface conditions encountered in the boreholes were classified based on visual and tactile examination of the materials recovered from the boreholes and the results of the in-situ testing and field observations. The soil descriptions presented in this report are based on

commonly accepted methods of classification and identification of soil employed in geotechnical practice. Classification and identification of soil involves judgement and Lascelles does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The subsurface soil conditions encountered at each borehole location is given in the Borehole Logs presented in **Appendix A**. These logs indicate the subsurface conditions encountered at specific test locations only. Boundaries between zones on the logs are often not distinct, but are rather transitional and have been interpreted. The following table provides a summary of the boreholes.

4.1 Pavement Structure

The following Table 1 presences a summary of the pavement structure measured on McTeer Road.

Table 1: Pavement Structure Summary – McTeer Road

Item	Depth of soil interface (mm)		
	BH-1	BH-2	BH-3
Northing	474047	474013	473941
Easting	5041421	5041417	5041387
Asphaltic Concrete	NE	30	125
Granular Crushed Stone	480	430	450
Subgrade Condition	Clay	Clay	Clay

NE: Not encountered

The asphalt layer was measured to be non-existing at the location of BH-1, 30mm at the location of BH-2 and 125mm at location of BH-3. As noted previously, the pavement structure is in very poor condition and has completely disintegrated in some areas. The granular base was measured to range from 430mm to 480mm with an average of 453mm. It is noted that the bottom portion of the granular based (approx. 150mm) is contaminated with clay.

One (1) sample collected from BH-3 of the granular base layer was submitted to Stantec Laboratory for a gradation analysis. It is noted that the portion contaminated with clay was omitted from the sample. The results of the gradation show that the granular crushed stone is well graded but would be too fine in its upper gradation to meet the requirements of an OPSS Granular A but nevertheless meets those of a Granular B Type II. The laboratory report is included as part of **Appendix B**.

4.2 Subgrade Condition

The subgrade soil underlying the pavement structure consists of clay. The clay is described as being olive brown, having a very stiff consistency and moist. All boreholes were terminated within this clay layer at depths of 2.13 to 2.26m bgs. No standing water was observed in the borehole upon completion.

5 GEOTECHNICAL CONSIDERATIONS

5.1 General

This section of the report provides general engineering guidelines on the geotechnical design aspects of the project based on our interpretation and review of the information obtained from the boreholes as well as the project requirements.

As outlined in the request of proposal (RFP) provided by the City of Clarence-Rockland, a section of about 220m of McTeer Road is slated for rehabilitation. The section starts at the intersection with County Road 17 and extends westerly to the City's boundary with the City of Ottawa. There are no municipal services along McTeer Road and none are proposed.

5.2 Pavement Design

Two (2) options are provided with regards to the rehabilitation of the road and will depend on if the road can be raised or not. The boreholes established the average thickness of the existing granular base to be 453mm. However, it was revealed that the first 150mm portion of the existing pavement structure has been contaminated with fines (clay) and, consequently, can no longer be considered part of the pavement structure. Therefore, the actual effective thickness of the pavement structure would be 300mm.

If the road can be raised by about 340mm, it would be recommended to pulverise the existing concrete asphalt with the existing granular base, or simply remove it. Once the existing granular based is shaped, crowned and compacted, a minimum 250mm layer of OPSS Granular A should be added, followed by 40mm of HL8 and followed by 40mm of HL3 concrete asphalt as outlined hereafter.

If the McTeer Road cannot be raised, it is recommended that the road be fully rehabilitated in accordance to the City of Clarence-Rockland's rural cross section standard (rural retrofit 20m metre R.O.W – dated May 2018). The subgrade soil underlying this municipal road consists of silty clay. Considering that the road is subjected to very low traffic and very little heavy traffic, the minimum pavement structure required as part of the City of Clarence-Rockland's rural cross section standard is considered adequate and would consist of the following;

40 millimetres of hot mix asphaltic concrete surface layer (HL3) over
40 millimetres of hot mix asphaltic concrete binder layer (HL8) over
150 millimetres of OPSS Granular A base over
400 millimetres of OPSS Granular B, Type II subbase
Non-woven geotextile.

For predictable performance of the pavement areas, any objectionable fill, organic, soft or deleterious materials should be removed from the proposed pavement areas to expose native undisturbed subgrade soil or properly compacted select subgrade material. The exposed subgrade should be inspected and approved by geotechnical personnel and any evidently loose and unstable areas should be sub-excavated and replaced with suitable earth borrow approved by the geotechnical engineer. Following approval of the preparation of the subgrade, the granular subbase may be placed.

The base and subbase granular materials should conform to OPSS Form 1010 material specifications. Prior to importing any granular material onto the site, it should be tested and approved by a geotechnical engineer prior to delivery to the site and should be compacted to 100% SPMDD. Compaction of the granular pavement materials should be carried out in maximum 200 mm thick loose lifts to 100% of its SPMDD using suitable vibratory compaction equipment.

The Job Mix Formula (JMF) of the asphaltic concrete should be in accordance with OPSS 1150 for Material Specification for Hot Mix Asphalt. The asphaltic concrete should be placed in accordance to OPSS 310 for Construction Specification for Hot Mix Asphalt. The asphaltic concrete should compacted to a minimum of 92% of the Maximum Relative Density. The JMF and its constituents should be reviewed, tested and approved by a geotechnical engineer prior to delivery to the site.

5.3 Paved Areas and Subgrade Preparation

The subgrade of the municipal road should be stripped of vegetation, topsoil, debris and other obvious objectionable fill material. Following the backfilling and satisfactory compaction of any underground service trenches up to the subgrade level, the subgrade should be shaped, crowned and proof-rolled using heavy roller with any resulting soft areas sub-excavated down to an adequate bearing layer and replaced with approved backfill. Following approval of the preparation of the subgrade, the pavement structure may be placed.

For areas of the site that require the subgrade to be raised, the material should consist of OPSS Select Subgrade Material or approved equivalent. Any materials proposed for this use should be approved by the geotechnical engineer before placement. Materials used for raising the subgrade to the proposed roadway subgrade level should be placed in maximum 300 mm thick loose lifts and be compacted to at least 95% of the SPMDD using suitable compaction equipment.

The performance of the pavement structure is highly dependent on the subsurface groundwater conditions and maintaining the subgrade and pavement structure in a dry condition. To intercept excess subsurface water within the pavement structure granular materials, road side ditches with a suitable outlet should be dug along both sides of the road with its invert located below the pavement structure subgrade. The surface of the pavement should be properly graded to direct runoff water towards suitable drainage features.

The preparation of subgrade should be scheduled and carried out in such a manner that a protective cover of overlying granular material is placed as quickly as possible in order to avoid unnecessary circulation by heavy equipment over the subgrade. Frost protection of the surface should be implemented (i.e. insulated tarps, etc.), if works are carried out during the winter months.

Transitions should be constructed between new and existing pavement structures where new street/road section meet with existing paved areas. In areas where the new pavement will abut existing pavement, the depths of granular materials should be tapered up or down at 5 horizontal to 1 vertical, or flatter, to match the depths of the granular material(s) exposed in the existing pavement.

Where the existing asphaltic concrete surface of an existing street/road is affected by the excavating process, the damaged zones should be saw cut and any damaged or loose pieces of asphaltic concrete should be removed down to the binder course or its entire depth. Where only one layer exists, the existing base should be scarified and proof-rolled with any soft areas excavated and replaced to the proper level with OPSS Granular A. Where two layers of asphalt exist on an access lane, the surface course should be grinded over a width of 150mm to allow the new surface course to overlap the binder layer and not create one straight vertical joint. On existing streets, the overlap should be increased to 300mm.

6 CONSTRUCTION CONSIDERATION

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed construction do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

The subgrade for pavement areas should be inspected and approved by geotechnical personnel. In-situ density testing should be carried out on the pavement granular materials, pipe bedding and backfill to ensure the materials meet the specifications from a compaction point of view.

7 REPORT CONDITIONS AND LIMITATIONS

It is stressed that the information presented in this report is provided for the guidance of the designers and is intended for this project only. The use of this report as a construction document is neither intended nor authorized by Lascelles Engineering & Associates Ltd. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible subsurface contamination resulting from previous uses or activities at this site or adjacent properties, and/or

resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this report.

The recommendations provided in this report are based on subsurface data obtained at the specific test locations only. Experience indicates that the subsurface soil and groundwater conditions can vary significantly between and beyond the test locations. For this reason, the recommendations given in this report are subject to a field verification of the subsurface soil conditions at the time of construction.

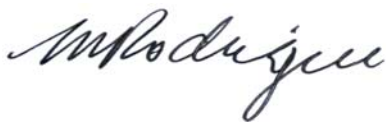
The report recommendations are applicable only to the project described in the report. Any changes to the project will require a review by Lascelles Engineering & Associates Ltd., to ensure compatibility with the recommendations contained in this project. Any changes to the project will require a review by Lascelles Engineering & Associates Ltd., to ensure compatibility with the recommendations contained in this report.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact our office.

Yours truly,
Lascelles Engineering & Associates Ltd.

Prepared by:

Shuang Chang, E.I.T.



Manon Rodrigue, P. Eng.

Reviewed by:

Mario Elie, Project Manager

Appendix A

Borehole Logs

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RECORD OF BOREHOLE: BH-1

PROJECT: Geotechnical Investigation- McTeer Road Rehabilitation
CLIENT: City of Clarence-Rockland
LOCATION: McTeer Road, Clarence-Rockland, Ontario
DATE: June 25, 2019

PROJECT No.: 190181
LOGGED BY: S.C.
DRILLER: George Downing Estate Drilling Ltd.
DRILLING EQUIPMENT: Truck-mounted CME75
DRILLING METHOD: Hollow Stem Auger

DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VALUE / RQD	RECOVERY
0.0	Ground Surface					
0.0	**Pavement Structure:** 480mm granular crushed stone.	0.00	SS1		215 34	100%
0.48	**Clay:** Silty, olive brown to brown in colour, very still to hard in consistency, and moist.		SS2		9	100%
			SS3		9	100%
2.13	End of Borehole					

SHEAR STRENGTH (kPa) 25 50 75 100 125
STANDARD PENETRATION TEST RESISTANCE PLOT 20 40 60 80
WATER CONTENT (%) 20 40 60 80
WATER LEVEL

ft: 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0
m: 0.0 1.0 2.0 3.0

>100
34
9
9

Easting: 474047
Northing: 5041421
Site Datum: NA
Groundsurface Elev.: NA
Top of Casing Elev.: NA
Top of Riser Elev.: NA
Borehole Diameter: 200mm
Monitoring Well Diameter: NA

COMMENTS:

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RECORD OF BOREHOLE: BH-2

PROJECT: Geotechnical Investigation- McTeer Road Rehabilitation
CLIENT: City of Clarence-Rockland
LOCATION: McTeer Road, Clarence-Rockland, Ontario
DATE: June 25, 2019

PROJECT No.: 190181
LOGGED BY: S.C.
DRILLER: George Downing Estate Drilling Ltd.
DRILLING EQUIPMENT: Truck-mounted CME75
DRILLING METHOD: Hollow Stem Auger

SOIL PROFILE		SAMPLES					SHEAR STRENGTH (kPa) / STANDARD PENETRATION TEST RESISTANCE PLOT	WATER CONTENT (%)	WATER LEVEL
DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VALUE / RQD	RECOVERY	25 50 75 100 125 / 20 40 60 80	20 40 60 80	
ft m	Ground Surface								
0.0 0.0	**Pavement Structure:** 25mm asphaltic concrete over 430mm granular crushed stone.	0.00							
1.0	**Clay:** Silty, olive brown to brown in colour, very stiff to hard in consistency, and moist.	0.46	SS1		92 42	65%	92 42		
2.0									
3.0 1.0			SS2		20	100%	20		
4.0									
5.0			SS3		8	75%	8		
6.0 2.0									
7.0	End of Borehole	2.16							
8.0									
9.0									
3.0									

Easting: 474013
Site Datum: NA
Top of Casing Elev.: NA
Borehole Diameter: 200mm

Northing: 5041417
Groundsurface Elev.: NA
Top of Riser Elev.: NA
Monitoring Well Diameter: NA

COMMENTS:

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RECORD OF BOREHOLE: BH-3

PROJECT: Geotechnical Investigation- McTeer Road Rehabilitation
CLIENT: City of Clarence-Rockland
LOCATION: McTeer Road, Clarence-Rockland, Ontario
DATE: June 25, 2019

PROJECT No.: 190181
LOGGED BY: S.C.
DRILLER: George Downing Estate Drilling Ltd.
DRILLING EQUIPMENT: Truck-mounted CME75
DRILLING METHOD: Hollow Stem Auger

DEPTH (m)	DESCRIPTION	ELEV.	NUMBER	TYPE	N-VALUE / RQD	RECOVERY
0.0	Ground Surface					
	Pavement Structure: 125mm asphaltic concrete over 455mm granular crushed stone.	0.00				
	Clay: Silty, olive brown to brown in colour, very stiff to hard in consistency, and moist.	0.58	SS1		115 31	75%
1.0			SS2		10	100%
2.0			SS3		4	100%
	End of Borehole	2.26				
3.0						

SHEAR STRENGTH (kPa) 25 50 75 100 125
STANDARD PENETRATION TEST RESISTANCE PLOT 20 40 60 80
WATER CONTENT (%) 20 40 60 80
WATER LEVEL

>100
31
10
4

Easting: 473941
Site Datum: NA
Top of Casing Elev.: NA
Borehole Diameter: 200mm

Northing: 5041387
Groundsurface Elev.: NA
Top of Riser Elev.: NA
Monitoring Well Diameter: NA

COMMENTS:

Appendix B

Laboratory Reports

Stantec 2781 Lancaster Road Ottawa ON, K1B 1A7

Sieve Analysis
LS 602
ASTM C136

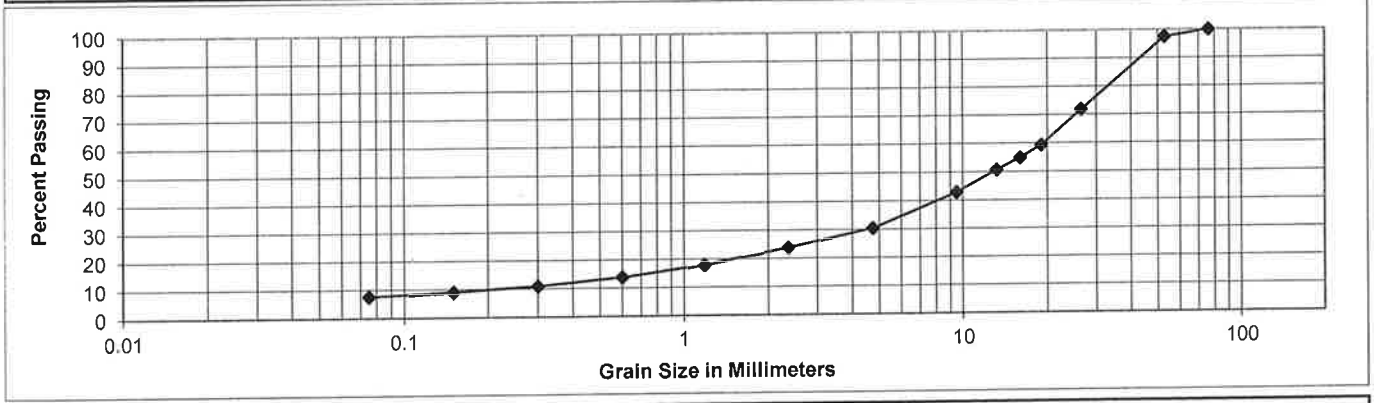
Client:	**Lascelles Engineering, File #190181**	Project Number:	**121621867**
Project:	**McTeer Road, Clarence-Rockland**		
Material Type:	**Soils / Aggregates:**		
Proposed Use:	**Fill/Granulars**		
Source:	**BH-3**		
Sample Number:	**SS1**		
Sampled Depth:	**0-1.5'**		
Sampled By:	**Lascelles Engineering**	Tested By:	**Brian Prevost**
Date Sampled:	**June 25, 2019**	Date Tested:	**July 5, 2019**

Sieve Test Data		Wash Test Data		
Sample Weight Before Sieve, (g):	7659.1	Sample Weight Before Wash, (g):	290.6	**Corrected**
Sample Weight After Sieve, (g):	7631.0	Sample Weight After Wash, (g):	225	
Percent Loss In Sieve, (%):	0.37	Percent Passing No. 200, (%):	22.6	6.9

Sieve Analysis

Sieve No.	Size of Opening		Weight Retained	Cumulative Weight Retained	Percent Passing	No Envelope	
	Inches	mm	g	g	%	Minimum	Maximum
	6	150					
	4	106					
	3	76.2	0.0	0.0	100.0		
	2	53.0	194.2	194.2	97.5		
	1.5	37.5					
	1	26.5	1962.1	2156.3	71.8		
	3/4	19.0	963.9	3120.2	59.3		
	5/8	16.0	342.7	3462.9	54.8		
	1/2	13.2	318.3	3781.2	50.6		
	3/8	9.5	592.9	4374.1	42.9		
+4	0.187	4.75	955.3	5329.4	30.4		
		- 4.75	2301.6	7631.0			
8	0.0937	2.36		63.5	23.8		
16	0.0469	1.18		118.4	18.0		
30	0.234	0.600		158.5	13.8		
50	0.0117	0.300		186.7	10.9		
100	0.0059	0.150		204.0	9.1		
200	0.0029	0.075		218.1	7.6		
		Pan		223.5			

Classification of Sample: % Gravel: **69.6** % Sand: **22.8** % Silt & Clay: **7.6**



Remarks:

Reviewed By: Brian Prevost **Date:** July 8/2019