

APPENDIX 'G'

Geotechnical Report



Quality Engineering | Valued Relationships

Morrison Hershfield

2018 Local Streets Package (PW File #: 18-R-03)

Prepared for:

Morrison Hershfield
25 Scurfield Blvd, Unit 1
Winnipeg, MB R3Y 1G4
Attention: Ron Bruce

Distribution:

Ron Bruce, P.Eng.

Project Number:

0035 058 00

Date:

January 31, 2018
Final Report



Quality Engineering | Valued Relationships

January 31, 2018

Our File No. 0035 058 00

Ron Bruce, P.Eng.
Morrison Hershfield
25 Scurfield Blvd, Unit 1
Winnipeg, MB R3Y 1G4

**RE: Sub-Surface Investigation Report for
2018 Local Streets Package (PW File #: 15-R-03)**

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 2018 Local Streets Package (PW File #: 15-R-03).

Please contact the undersigned if you have any questions. Thank you for the opportunity to serve you on this assignment.

Sincerely,

TREK Geotechnical Inc.
Per:

A handwritten signature in blue ink, appearing to read "N. Ferreira".

Nelson John Ferreira, Ph.D., P. Eng.
Geotechnical Engineer, Principal
Tel: 204.975.9433 ext. 103

cc: Angela Fidler-Kliewer C.Tech. (TREK Geotechnical)

Revision History

Revision No.	Author	Issue Date	Description
0	AFK	January 31, 2018	Final Report

Authorization Signatures

Prepared By:



Angela Fidler-Kliewer C.Tech.



Reviewed By:

Nelson John Ferreira, Ph.D., P.Eng.
Geotechnical Engineer

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- Appendix D Test Hole Logs, Summary Table & Lab Data – Killarney Avenue

1.0 Introduction

This report summarizes the results of the sub-surface investigation completed for the 2018 Local Streets Package 18-R-03 project. The streets included Queenston Street, Oxford Street, Donnelly Street and Killarney Avenue. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure.

2.0 Sub-Surface Investigation and Laboratory Program

For each street test holes were drilled approximately every 50m of street length with specific locations shown on Figure 01 to Figure 04. The test holes were drilled to determine sub-surface conditions for the reconstruction of the road segment.

The sub-surface investigation was conducted between December 11, 2017 and December 13, 2017. The test holes were drilled to a depth of 3.0 m below road surface by Maple Leaf Drilling Ltd. using their B40 Mobile truck mounted drill rig equipped with 125 mm diameter solid stem augers. The pavement structure (asphalt or concrete) was cored by Harsimran Singh of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. The sub-surface conditions were observed during drilling and visually classified by Devon Adamson of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples retrieved during the sub-surface investigation were transported to TREK's material testing laboratory for further testing. Core samples were also retrieved and logged at TREK's material testing laboratory.

The laboratory testing program consisted of moisture content determination, Atterberg limits, and grain size analysis (mechanical sieve and hydrometer methods) on select samples between 0.5 and 1.0 m below pavement. Information gathered for each street is included in separate appendices (Appendix A to D). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, and photos of the concrete cores.

Test hole locations noted on the test hole logs and shown on Figure 01 to Figure 04 are based on their location relative to the nearest address, and measured distances from the edge of pavement or other permanent features.

3.0 Closure

The information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information provided (field investigation, laboratory testing, geometries). Soil conditions are natural deposits that can be highly variable across a site. If sub-surface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and you are not

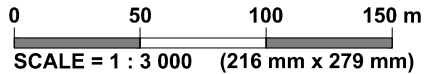
already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of Morrison Hershfield (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be used or relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.

Figures

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-01-22 Test Hole Plan(QUEENSTON ST).0_A_SL_0035.058.00.dwg_1/26/2018 8:09:01 AM



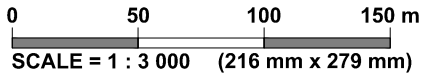
LEGEND:  TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM GOOGLE EARTH MAY 2ND, 2013

Figure 01
Test Hole Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-01-22 Test Hole Plan(OXFORD ST).0_A_S1_0035 058 00.dwg_1/26/2018 12:39:28 PM



LEGEND:  TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM GOOGLE EARTH MAY 2ND, 2013

Figure 02
Test Hole Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-01-25 Test Hole Plan(DONNELLY ST).0_A_SL_0035_058.00.dwg, 1/26/2018 12:40:40 PM



0 50 100 150 200 m
SCALE = 1 : 4 500 (216 mm x 279 mm)

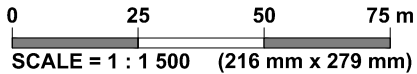
LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM GOOGLE EARTH AUGUST 24, 2015

Figure 03
Test Hole Plan

ANSI full bleed A (11.00" x 8.50 inches)

FIG.001 2018-01-25 Test Hole Plan(KILLARNEY ST) 0_A_SL_0035 058 00.dwg, 1/26/2018 12:37:47 PM



LEGEND:  TEST HOLE (TREK, 2018)

NOTES: 1. IMAGE FROM GOOGLE EARTH AUGUST 24, 2015

Figure 04
Test Hole Plan

Appendix A

Queenston St., between Corydon Ave. and Grosvenor Ave.

**Test Hole Logs, Summary Table, Lab
Data and Photographs of Pavement
Core Samples**

GENERAL NOTES

- Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size			
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	ASTM Sieve sizes			
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW		#10 to #4 #40 to #10 #200 to #40		
		GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	mm		
		GC	Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7				
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean gravel (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm		
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW		2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	Material	
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7			
			Silt and Clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	<div style="text-align: center;"> Plasticity Chart Plasticity chart for silt fraction with particles smaller than 0.425 mm </div>		
					CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
OL	Organic silts and organic silty clays of low plasticity								
Silt and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts							
	CH	Inorganic clays of high plasticity, fat clays							
	OH	Organic clays of medium to high plasticity, organic silts							
Highly Organic Soils	Pt	Peat and other highly organic soils	Von Post Classification Limit	Strong colour or odour, and often fibrous texture	Material				
						Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19			
						Material Sand Coarse Medium Fine Silt or Clay			

* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)	▽ Water Level at Time of Drilling
PL - Plastic Limit (%)	▼ Water Level at End of Drilling
PI - Plasticity Index (%)	▽ Water Level After Drilling as Indicated on Test Hole Logs
MC - Moisture Content (%)	
SPT - Standard Penetration Test	
RQD- Rock Quality Designation	
Qu - Unconfined Compression	
Su - Undrained Shear Strength	
VW - Vibrating Wire Piezometer	
SI - Slope Incliner	

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>Undrained Shear Strength (kPa)</u>
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200



Sub-Surface Log

Test Hole TH17-01

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525053, E-630277
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
0.00 - 0.076		ASPHALT - 76 mm thick														
0.076 - 0.143		CONCRETE - 127 mm thick														
0.143 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist, compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G09													
0.45 - 1.0		SILT - some clay - light brown - frozen to 0.6 m, moist and soft when thawed - low plasticity	G10													
1.0 - 3.0		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, firm to stiff - high plasticity	G11													
			G12													
			G13													
			G14													
			G15													
			G16													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #492, 1.8 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-02

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525123, E-630278
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL MC LL											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 76 mm thick														
		CONCRETE - 127 mm thick														
		SAND (Fill)- silty, gravelly, some clay, light brown to grey, frozen, moist, compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	▲	G01												
		CLAY - silty, trace sand - brown - frozen to 0.6 m, moist and stiff when thawed - high plasticity	▲	G02												
			▲	G03												
			▲	G04												⊕ Δ
			▲	G05												⊕ Δ
		- firm to stiff below 1.5 m	▲	G06												⊕ Δ
			▲	G07												⊕ Δ
			▲	G08												⊕ Δ

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located between house #477 and #473, 1.8 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-03

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525174, E-630280
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)										
					16	17	18	19	20	21	0	50	100	150	200	250			
0.00 - 0.03		ASPHALT - 76 mm thick																	
0.03 - 0.06		CONCRETE - 127 mm thick																	
0.06 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist, compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G17																
0.45 - 0.65		SILT - clayey - light brown - frozen to 0.5 m, moist and soft when thawed - low plasticity	G18																
0.65 - 0.95			G19																
0.95 - 1.25			G20																
1.25 - 1.55			G21																
1.55 - 1.85			G22																
1.85 - 2.15		CLAY - silty - brown - moist, firm - high plasticity	G23																
2.15 - 2.45																			
2.45 - 2.75																			
2.75 - 3.00			G24																

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #458, 1.3 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-04

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525234, E-630277
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.03	ASPHALT	ASPHALT - 76 mm thick															
0.03 - 0.06	CONCRETE	CONCRETE - 127 mm thick															
0.06 - 0.30	SAND	SAND (Fill) - silty, some clay, trace gravel, light brown to grey, frozen to 0.6 m, moist, compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity - some clay, wet, dark grey below 0.3 m	G25														
0.30 - 0.45	SAND		G26														
0.45 - 0.60	SAND		G27														
0.60 - 1.10	CLAY	CLAY - silty, trace silt inclusions (<10 mm diameter) - brown - moist, very stiff - high plasticity	G28														
1.10 - 1.30	CLAY		G29														
1.30 - 1.50	CLAY		G30														
1.50 - 1.70	CLAY		G31														
1.70 - 1.90	CLAY		G32														
1.90 - 3.00	CLAY	- stiff below 2.0 m															

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located between house #443 and #449, 1.8 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-05

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525278, E-630282
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 76 mm thick															
0.05 - 0.10		CONCRETE - 127 mm thick															
0.10 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist, compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G33														
0.45 - 0.75		CLAY AND SILT - light brown - frozen to 0.6 m, moist and soft when thawed - low plasticity	G34														
0.75 - 1.00		SILT - trace clay - light brown - moist, soft - low plasticity	G35														
1.00 - 1.50		CLAY - silty, trace silt inclusions (<5 mm diameter), trace oxidation - brown - moist, very stiff - high plasticity	G36														
1.50 - 2.00			G37														
2.00 - 2.50			G38														
2.50 - 3.00		- stiff below 2.0 m	G39														
3.00			G40														

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #432, 1.7 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-06

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525338, E-630280
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 76 mm thick														
		CONCRETE - 127 mm thick														
		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G41													
0.5		CLAY - silty, silt inclusions (<5 mm diameter), trace rootlets - dark brown - frozen to 0.9 m, moist and firm to stiff when thawed - high plasticity	G42													
		- very stiff at 0.8 m	G43													
1.0			G44													
1.5		SILT - some clay - light brown - moist, soft - low plasticity	G45													
			G46													
2.0		CLAY - silty, trace silt inclusions (<5 mm diameter), trace oxidation - brown - moist, firm to stiff - high plasticity	G47													
			G48													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #421, 1.3 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-07

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525364, E-630287
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 51 mm thick															
0.05 - 0.10		CONCRETE - 127 mm thick															
0.10 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	<input checked="" type="checkbox"/>	G49													
0.45 - 1.00		CLAY - silty - dark brown - frozen to 0.9 m, moist and firm to stiff when thawed - high plasticity	<input checked="" type="checkbox"/>	G50													
1.00 - 1.50		CLAY - silty - dark brown - frozen to 0.9 m, moist and firm to stiff when thawed - high plasticity	<input checked="" type="checkbox"/>	G51													
1.50 - 2.00		SILT - trace to some clay - light brown - moist, soft - low plasticity	<input checked="" type="checkbox"/>	G52													
2.00 - 2.50		SILT - trace to some clay - light brown - moist, soft - low plasticity	<input checked="" type="checkbox"/>	G53													
2.50 - 3.00		SILT - trace to some clay - light brown - moist, soft - low plasticity	<input checked="" type="checkbox"/>	G54													
3.00 - 3.30		CLAY - silty - brown - moist, firm to stiff - high plasticity	<input checked="" type="checkbox"/>	G55													
3.30 - 3.60		CLAY - silty - brown - moist, firm to stiff - high plasticity	<input checked="" type="checkbox"/>	G56													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #412, 1.3 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-08

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Queenston St Location: UTM N-5525392, E-630282
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 11

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 76 mm thick															
0.05 - 0.10		CONCRETE - 178 mm thick															
0.10 - 0.45		CLAY - silty, trace sand - mottled light brown to brown - frozen to 0.6 m, moist and soft when thawed - high plasticity	G	G57													
0.45 - 0.85		SILT - some clay - light brown - moist, soft - low plasticity	G	G58													
0.85 - 1.35		SILT - some clay - light brown - moist, soft - low plasticity	G	G59													
1.35 - 1.65		CLAY AND SILT - light brown - moist, firm - intermediate to high plasticity	G	G60													
1.65 - 2.15		CLAY AND SILT - light brown - moist, firm - intermediate to high plasticity	G	G61													
2.15 - 2.65		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, firm to stiff - high plasticity	G	G62													
2.65 - 3.00		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, firm to stiff - high plasticity	G	G63													
3.00 - 3.30		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, firm to stiff - high plasticity	G	G64													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #401, 1.5 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 QUEENSTON 0035-058-00 0 B NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-02	TH17-02	TH17-02	TH17-02	TH17-02	TH17-02
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1
Sample #	G02	G03	G04	G05	G06	G07
Tare ID	Z39	Z83	AB73	H22	W48	Z64
Mass of tare	8.5	8.4	6.6	8.6	8.4	8.3
Mass wet + tare	301.3	304.1	304.8	303.7	301.8	302.3
Mass dry + tare	248.1	250.7	245.4	244.3	219.9	217.6
Mass water	53.2	53.4	59.4	59.4	81.9	84.7
Mass dry soil	239.6	242.3	238.8	235.7	211.5	209.3
Moisture %	22.2%	22.0%	24.9%	25.2%	38.7%	40.5%

Test Pit	TH17-02	TH17-01	TH17-01	TH17-01	TH17-01	TH17-01
Depth (m)	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G08	G09	G10	G11	G12	G13
Tare ID	Z130	N115	F57	W63	AC10	E78
Mass of tare	8.4	8.6	8.4	8.4	6.6	8.4
Mass wet + tare	301.7	339.2	307.8	318.4	350.8	288.8
Mass dry + tare	207.5	290.8	267.0	272.4	268.8	218.2
Mass water	94.2	48.4	40.8	46.0	82.0	70.6
Mass dry soil	199.1	282.2	258.6	264.0	262.2	209.8
Moisture %	47.3%	17.2%	15.8%	17.4%	31.3%	33.7%

Test Pit	TH17-01	TH17-01	TH17-01	TH17-03	TH17-03	TH17-03
Depth (m)	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G14	G15	G16	G18	G19	G20
Tare ID	K19	AB95	AC31	Z21	AC02	AA12
Mass of tare	8.4	6.6	6.6	8.5	6.8	6.7
Mass wet + tare	276.6	342.0	279.0	304.7	419.6	326.2
Mass dry + tare	199.6	235.2	185.4	236.5	343.6	270.5
Mass water	77.0	106.8	93.6	68.2	76.0	55.7
Mass dry soil	191.2	228.6	178.8	228.0	336.8	263.8
Moisture %	40.3%	46.7%	52.3%	29.9%	22.6%	21.1%



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-03	TH17-03	TH17-03	TH17-03	TH17-04	TH17-04
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6
Sample #	G21	G22	G23	G24	G25	G26
Tare ID	N22	F153	E133	E90	K23	F72
Mass of tare	8.5	8.7	8.5	8.7	8.4	8.6
Mass wet + tare	327.8	336.4	313.3	313.8	385.2	375.8
Mass dry + tare	267.2	277.1	253.6	217.5	349.4	265.4
Mass water	60.6	59.3	59.7	96.3	35.8	110.4
Mass dry soil	258.7	268.4	245.1	208.8	341.0	256.8
Moisture %	23.4%	22.1%	24.4%	46.1%	10.5%	43.0%

Test Pit	TH17-04	TH17-04	TH17-04	TH17-04	TH17-04	TH17-04
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9
Sample #	G27	G28	G29	G30	G31	G32
Tare ID	K17	AB14	AB26	AC07	A28	N05
Mass of tare	8.4	6.8	6.6	7.0	8.6	8.6
Mass wet + tare	291.4	380.8	352.6	309.2	304.6	300.8
Mass dry + tare	215.8	300.2	267.0	227.8	211.0	206.6
Mass water	75.6	80.6	85.6	81.4	93.6	94.2
Mass dry soil	207.4	293.4	260.4	220.8	202.4	198.0
Moisture %	36.5%	27.5%	32.9%	36.9%	46.2%	47.6%

Test Pit	TH17-05	TH17-05	TH17-05	TH17-05	TH17-05	TH17-05
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1
Sample #	G34	G35	G36	G37	G38	G39
Tare ID	Z65	W09	AA24	AC12	AC26	F3
Mass of tare	8.4	8.6	7.2	6.6	6.8	8.6
Mass wet + tare	292.0	309.4	345.4	352.6	312.0	323.6
Mass dry + tare	245.0	262.8	298.0	281.8	226.8	226.4
Mass water	47.0	46.6	47.4	70.8	85.2	97.2
Mass dry soil	236.6	254.2	290.8	275.2	220.0	217.8
Moisture %	19.9%	18.3%	16.3%	25.7%	38.7%	44.6%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-05	TH17-06	TH17-06	TH17-06	TH17-06	TH17-06
Depth (m)	2.7 - 2.9	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G40	G42	G43	G44	G45	G46
Tare ID	K26	AA14	N23	C13	Z42	C20
Mass of tare	8.4	6.8	8.6	8.4	8.8	8.4
Mass wet + tare	313.2	333.2	325.4	350.0	369.0	292.4
Mass dry + tare	210.8	259.8	260.8	291.2	302.2	214.2
Mass water	102.4	73.4	64.6	58.8	66.8	78.2
Mass dry soil	202.4	253.0	252.2	282.8	293.4	205.8
Moisture %	50.6%	29.0%	25.6%	20.8%	22.8%	38.0%

Test Pit	TH17-06	TH17-06	TH17-07	TH17-07	TH17-07	TH17-07
Depth (m)	2.0 - 2.1	2.7 - 2.9	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G47	G48	G50	G51	G52	G53
Tare ID	AA19	AC24	H9	K1	AB40	H41
Mass of tare	6.8	6.6	8.8	8.4	6.6	8.6
Mass wet + tare	302.2	304.8	282.8	306.2	364.2	338.2
Mass dry + tare	212.4	203.8	226.8	243.2	305.6	285.4
Mass water	89.8	101.0	56.0	63.0	58.6	52.8
Mass dry soil	205.6	197.2	218.0	234.8	299.0	276.8
Moisture %	43.7%	51.2%	25.7%	26.8%	19.6%	19.1%

Test Pit	TH17-07	TH17-07	TH17-07	TH17-08	TH17-08	TH17-08
Depth (m)	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9
Sample #	G54	G55	G56	G57	G58	G59
Tare ID	C2	W14	E117	F67	AA20	F128
Mass of tare	8.4	8.4	8.4	8.6	6.7	8.6
Mass wet + tare	350.0	327.8	313.8	323.7	302.7	321.6
Mass dry + tare	287.2	234.6	211.8	215.7	227.4	271.3
Mass water	62.8	93.2	102.0	108.0	75.3	50.3
Mass dry soil	278.8	226.2	203.4	207.1	220.7	262.7
Moisture %	22.5%	41.2%	50.1%	52.1%	34.1%	19.1%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-08	TH17-08	TH17-08	TH17-08	TH17-08
Depth (m)	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9
Sample #	G60	G61	G62	G63	G64
Tare ID	A108	E39	E55	Z89	W92
Mass of tare	8.4	8.8	8.6	8.5	8.5
Mass wet + tare	325.0	306.1	322.1	314.1	302.3
Mass dry + tare	277.2	230.0	262.3	223.2	203.4
Mass water	47.8	76.1	59.8	90.9	98.9
Mass dry soil	268.8	221.2	253.7	214.7	194.9
Moisture %	17.8%	34.4%	23.6%	42.3%	50.7%

Test Pit					
Depth (m)					
Sample #					
Tare ID					
Mass of tare					
Mass wet + tare					
Mass dry + tare					
Mass water					
Mass dry soil					
Moisture %					

Test Pit					
Depth (m)					
Sample #					
Tare ID					
Mass of tare					
Mass wet + tare					
Mass dry + tare					
Mass water					
Mass dry soil					
Moisture %					



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Atterberg Limits
ASTM D4318-10e1

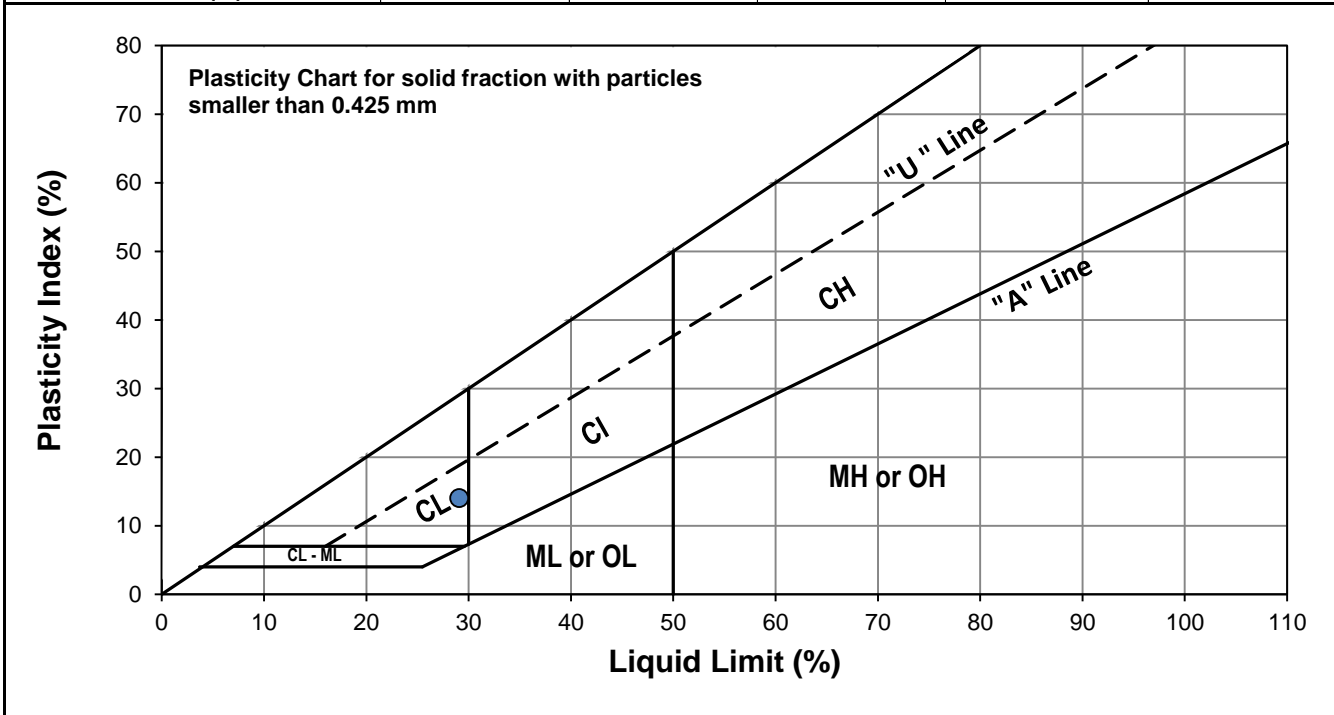
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Test Hole TH17-03
Sample # G19
Depth (m) 0.8 - 0.9
Sample Date 11-Dec-17
Test Date 03-Jan-18
Technician DS

Liquid Limit	29
Plastic Limit	15
Plasticity Index	14

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	15	21	29
Mass Wet Soil + Tare (g)	26.088	24.177	24.115
Mass Dry Soil + Tare (g)	23.312	21.868	21.813
Mass Tare (g)	14.203	14.057	13.787
Mass Water (g)	2.776	2.309	2.302
Mass Dry Soil (g)	9.109	7.811	8.026
Moisture Content (%)	30.475	29.561	28.682



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.770	20.632			
Mass Wet Soil + Tare (g)	19.932	19.782			
Mass Dry Soil + Tare (g)	14.289	14.229			
Mass Water (g)	0.838	0.850			
Mass Dry Soil (g)	5.643	5.553			
Moisture Content (%)	14.850	15.307			



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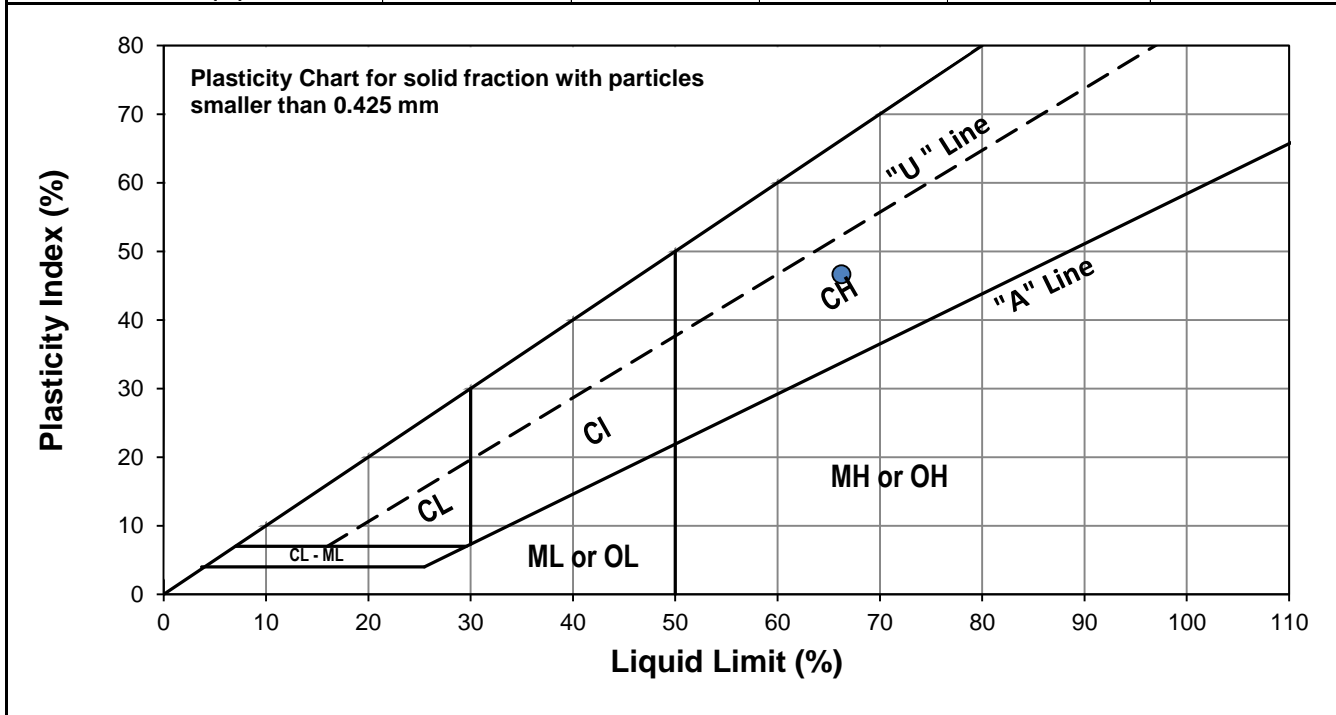
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Test Hole TH17-06
Sample # G42
Depth (m) 0.5 - 0.6
Sample Date 11-Dec-17
Test Date 07-Jan-18
Technician JB

Liquid Limit	66
Plastic Limit	20
Plasticity Index	47

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	18	26	36
Mass Wet Soil + Tare (g)	22.123	21.016	21.560
Mass Dry Soil + Tare (g)	18.997	18.371	18.654
Mass Tare (g)	14.439	14.395	14.042
Mass Water (g)	3.126	2.645	2.906
Mass Dry Soil (g)	4.558	3.976	4.612
Moisture Content (%)	68.583	66.524	63.010



Plastic Limit

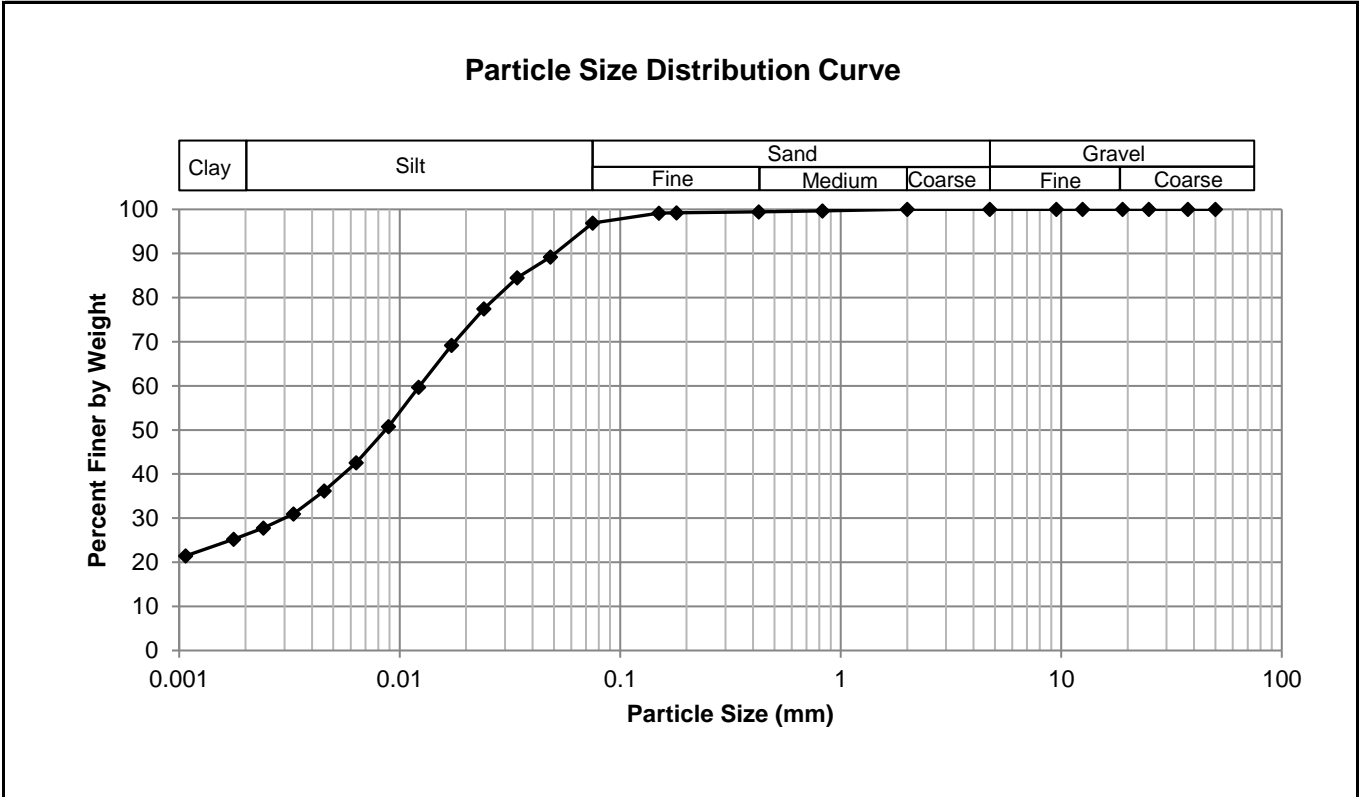
Trial #	1	2	3	4	5
Mass Tare (g)	20.454	18.573			
Mass Wet Soil + Tare (g)	19.399	17.835			
Mass Dry Soil + Tare (g)	14.073	14.028			
Mass Water (g)	1.055	0.738			
Mass Dry Soil (g)	5.326	3.807			
Moisture Content (%)	19.808	19.385			



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Test Hole TH17-03
Sample # G19
Depth (m) 0.8 - 0.9
Sample Date 11-Dec-17
Test Date 2-Jan-18
Technician LI/DS

Gravel	0.0%
Sand	3.1%
Silt	70.7%
Clay	26.2%



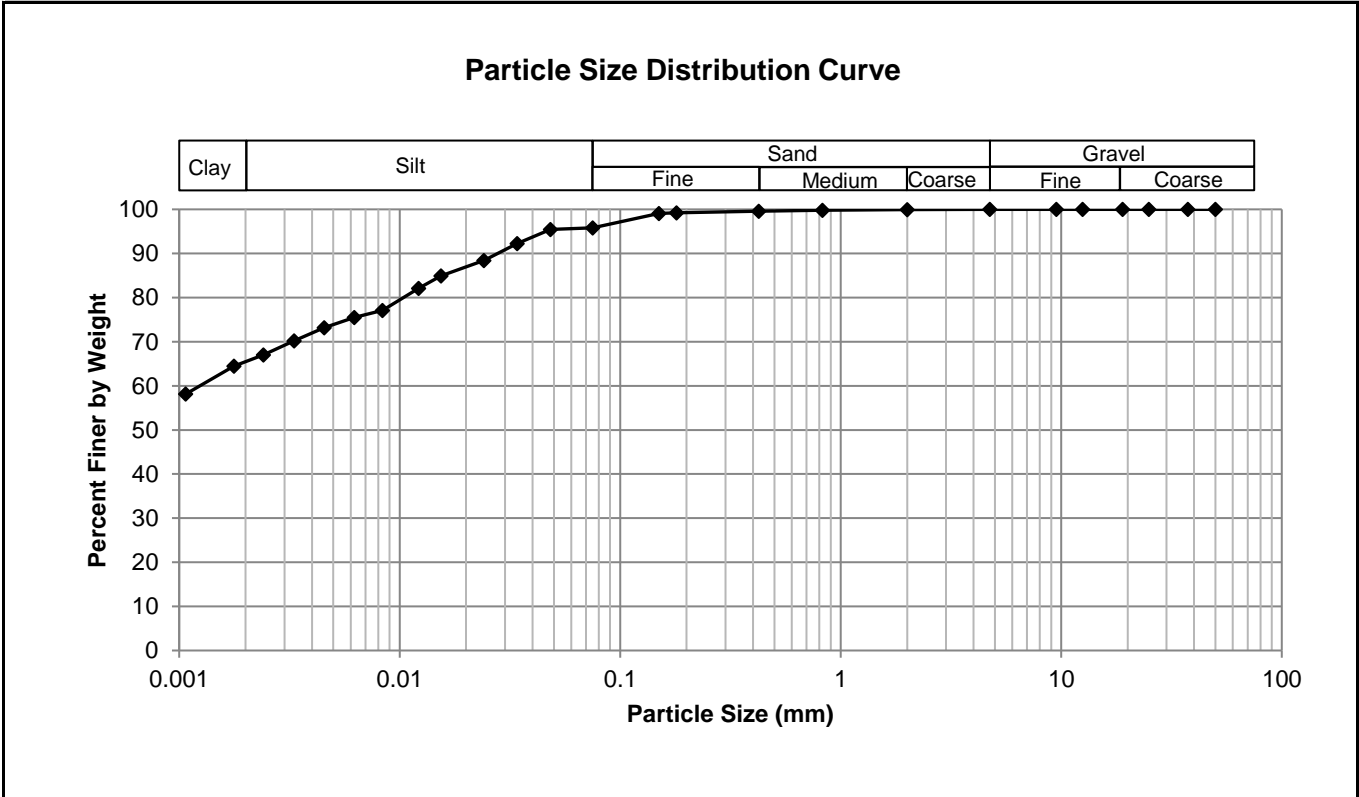
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	96.91
37.5	100.00	2.00	99.99	0.0482	89.23
25.0	100.00	0.825	99.63	0.0341	84.46
19.0	100.00	0.425	99.44	0.0241	77.48
12.5	100.00	0.180	99.20	0.0172	69.22
9.50	100.00	0.150	99.14	0.0122	59.69
4.75	100.00	0.075	96.91	0.0089	50.80
				0.0063	42.54
				0.0046	36.16
				0.0033	30.97
				0.0024	27.80
				0.0018	25.26
				0.0011	21.45



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Queenston

Test Hole TH17-06
Sample # G42
Depth (m) 0.5 - 0.6
Sample Date 11-Dec-17
Test Date 2-Jan-18
Technician LI

Gravel	0.0%
Sand	4.2%
Silt	30.4%
Clay	65.4%



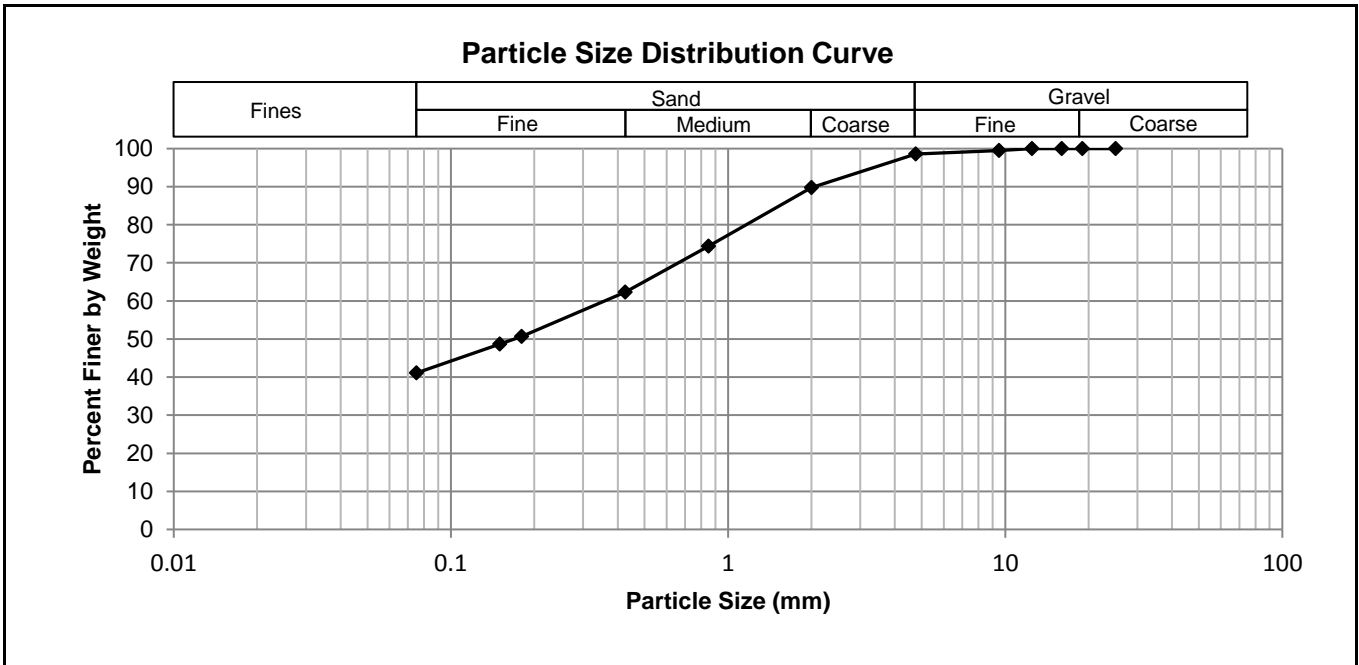
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	95.80
37.5	100.00	2.00	99.96	0.0482	95.42
25.0	100.00	0.825	99.80	0.0341	92.25
19.0	100.00	0.425	99.56	0.0241	88.44
12.5	100.00	0.180	99.20	0.0154	84.94
9.50	100.00	0.150	99.11	0.0122	82.09
4.75	100.00	0.075	95.80	0.0083	77.10
				0.0062	75.51
				0.0046	73.17
				0.0033	70.21
				0.0024	67.03
				0.0018	64.49
				0.0011	58.14



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets - 18-R-03 - Queenston

Test Hole TH17-04
Sample # G26
Depth (m) 0.5 - 0.6
Date Sampled 11-Dec-17
Date Tested 6-Jan-18
Technician DS/SX

Total Weight (g)	252.6
Gravel %	1.4
Sand %	57.5
Fines %	41.1



Sieve Number	Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
6"	150		
5"	125		
4"	100		
3"	75.0		
2"	50.0		
1 1/2"	37.5		
1"	25.0	100	
3/4"	19.0	100	
5/8"	16.0	100	
1/2"	12.5	100	
3/8"	9.50	99	
no. 4	4.75	99	
no. 10	2.00	90	
no. 20	0.850	74	
no. 40	0.425	62	
no. 80	0.180	51	
no. 100	0.150	49	
no. 200	0.075	41	



Photo 1: Pavement Core Sample at Test Hole TH17-01



Photo 2: Pavement Core Sample at Test Hole TH17-02



Photo 3: Pavement Core Sample at Test Hole TH17-03



Photo 4: Pavement Core Sample at Test Hole TH17-04



Photo 5: Pavement Core Sample at Test Hole TH17-05



Photo 6: Pavement Core Sample at Test Hole TH17-06



Photo 7: Pavement Core Sample at Test Hole TH17-07



Photo 8: Pavement Core Sample at Test Hole TH17-08

Appendix B

Oxford St., between Corydon Ave. and Fleet Ave.

**Test Hole Logs, Summary Table, Lab
Data and Photographs of Pavement
Core Samples**

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)	▽ Water Level at Time of Drilling
PL - Plastic Limit (%)	▼ Water Level at End of Drilling
PI - Plasticity Index (%)	▽ Water Level After Drilling as Indicated on Test Hole Logs
MC - Moisture Content (%)	
SPT - Standard Penetration Test	
RQD- Rock Quality Designation	
Qu - Unconfined Compression	
Su - Undrained Shear Strength	
VW - Vibrating Wire Piezometer	
SI - Slope Inclinometer	

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>Undrained Shear Strength (kPa)</u>
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200



Sub-Surface Log

Test Hole TH17-09

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524637, E-631051
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)							
					16	17	18	19	20	21	0	50	100	150	200	250
0.0		ASPHALT - 51 mm thick														
0.0		CONCRETE - 178 mm thick														
0.0		CLAY - silty - dark brown - frozen, moist and soft when thawed - high plasticity	G65													
0.5		CLAY - silty - dark brown - frozen, moist and soft when thawed - high plasticity	G66													
0.5		SILT - some clay to clayey, trace sand - light brown - moist, firm - low plasticity	G67													
1.0		SILT - some clay to clayey, trace sand - light brown - moist, firm - low plasticity	G68													
1.5		CLAY - silty, trace silt inclusions (<10 mm diameter) - brown - moist, firm to stiff - high plasticity	G69													
2.0		CLAY - silty, trace silt inclusions (<10 mm diameter) - brown - moist, firm to stiff - high plasticity	G70													
2.5		CLAY - silty, trace silt inclusions (<10 mm diameter) - brown - moist, firm to stiff - high plasticity	G71													
3.0		CLAY - silty, trace silt inclusions (<10 mm diameter) - brown - moist, firm to stiff - high plasticity	G72													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #599, 1.2 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL_GDT_18-130



Sub-Surface Log

Test Hole TH17-10

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524684, E-631058
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 51 mm thick															
0.05 - 0.10		CONCRETE - 229 mm thick															
0.10 - 1.10		CLAY - silty, trace rootlets - mottled light grey to brown - frozen, moist and very stiff when thawed - intermediate to high plasticity	<input checked="" type="checkbox"/>	G73													
0.50			<input checked="" type="checkbox"/>	G74													
0.75			<input checked="" type="checkbox"/>	G75													
1.10 - 1.50		SILT - some clay - light brown - moist, firm - low to intermediate plasticity	<input checked="" type="checkbox"/>	G76													
1.50 - 2.00		CLAY - silty, trace silt inclusions (<10 mm diameter) - mottled grey and brown - moist, stiff - high plasticity	<input checked="" type="checkbox"/>	G77													
1.75			<input checked="" type="checkbox"/>	G78													
2.00 - 2.50			<input checked="" type="checkbox"/>	G79													
2.50 - 3.00			<input checked="" type="checkbox"/>	G80													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #586, 1.1 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL_GDT_18-130



Sub-Surface Log

Test Hole TH17-11

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524743, E-631056
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.0		ASPHALT - 51 mm thick															
0.0		CONCRETE - 203 mm thick															
0.0		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G81														
0.0		CLAY - silty - brown - moist, firm to very stiff - intermediate plasticity	G82														
0.0		SILT - trace clay - light brown - moist, soft - low plasticity	G83														
0.0		CLAY - silty, trace silt inclusions (<10 mm diameter) - mottled brown and grey - moist, stiff - high plasticity	G84														
0.0		CLAY AND SILT - mottled brown and grey - moist, soft - intermediate to high plasticity	G85														
0.0		CLAY - silty - mottled brown and grey - moist, stiff - high plasticity	G86														
0.0		CLAY - silty - mottled brown and grey - moist, stiff - high plasticity	G87														
0.0			G88														

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #565, 1.4 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL.GDT_18-130



Sub-Surface Log

Test Hole TH17-12

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524786, E-631061
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 51 mm thick															
0.05 - 0.10		CONCRETE - 203 mm thick															
0.10 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity		G89													
0.45 - 1.00		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff to very stiff - high plasticity		G90													
1.00 - 2.25		SILT - trace clay, trace sand - light brown - moist, soft to firm - low plasticity		G91													
2.25 - 2.75		CLAY - silty, trace silt inclusions (<5 mm diameter), trace sand - mottled brown and grey - moist, stiff - high plasticity		G92													
2.75 - 3.00		CLAY - silty, trace silt inclusions (<5 mm diameter), trace sand - mottled brown and grey - moist, stiff - high plasticity		G93													
3.00		CLAY - silty, trace silt inclusions (<5 mm diameter), trace sand - mottled brown and grey - moist, stiff - high plasticity		G94													
3.00		CLAY - silty, trace silt inclusions (<5 mm diameter), trace sand - mottled brown and grey - moist, stiff - high plasticity		G95													
3.00		CLAY - silty, trace silt inclusions (<5 mm diameter), trace sand - mottled brown and grey - moist, stiff - high plasticity		G96													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #554, 1.2 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL GDT 18-130



Sub-Surface Log

Test Hole TH17-13

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524841, E-631054
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL MC LL											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 51 mm thick														
		CONCRETE - 127 mm thick														
		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G97													
		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff to very stiff - high plasticity	G98													
		SILT - some clay - light brown - moist, firm - low plasticity	G99													
			G100													
			G101													
		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff - high plasticity	G102													
			G103													
			G104													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #537, 1.1 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL_GDT_18-130



Sub-Surface Log

Test Hole TH17-14

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524888, E-631065
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
0.00 - 0.05		ASPHALT - 51 mm thick														
0.05 - 0.10		CONCRETE - 229 mm thick														
0.10 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	<input checked="" type="checkbox"/>	G105												
0.45 - 1.00		CLAY - silty, trace to some organics, trace silt inclusions (<5 mm diameter), trace rootlets - dark grey to black - moist, stiff to very stiff - high plasticity	<input checked="" type="checkbox"/>	G106		●						△	+			
			<input checked="" type="checkbox"/>	G107		●						△	+			
1.00 - 1.50		SILT - trace sand - light brown - moist, soft - low plasticity	<input checked="" type="checkbox"/>	G108		●										
1.50 - 2.00		CLAY - silty, some silt inclusions (<20 mm diameter) - brown - moist, stiff to very stiff - high plasticity	<input checked="" type="checkbox"/>	G109		●							+			
			<input checked="" type="checkbox"/>	G110		●							+			
			<input checked="" type="checkbox"/>	G111		●							+			
			<input checked="" type="checkbox"/>	G112		●							+			

END OF HOLE AT DEPTH 3.0 m IN CLAY
 1) No seepage or sloughing.
 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
 3) Test hole located at house #528, 1.9 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL GDT 18-130



Sub-Surface Log

Test Hole TH17-15

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524928, E-631061
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)						
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 51 mm thick														
		CONCRETE - 102 mm thick														
		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity		G113												
		CLAY - silty, trace to some organics, trace silt inclusions (<5 mm diameter), trace rootlets - dark grey to black - moist, stiff to very stiff - intermediate to high plasticity		G114												
		CLAY AND SILT - trace sand - light brown - moist, stiff - intermediate plasticity		G115												
		CLAY - silty, trace silt inclusions (<10mm diameter) - brown - moist, stiff - high plasticity		G116												
				G117												
				G118												
				G119												
				G120												

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located between house #492 and #494, 1.1 m East from Southbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL.GDT 18-130



Sub-Surface Log

Test Hole TH17-16

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Oxford St Location: UTM N-5524977, E-631065
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)	
					16	17	18	19	20	21
0.0		ASPHALT - 38 mm thick								
0.0		CONCRETE - 89 mm thick								
0.0		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G121							
0.0		CLAY - silty, trace silt inclusions (<5 mm diameter), trace rootlets - brown - moist, stiff to very stiff - intermediate to high plasticity	G122							△ +
0.8		CLAY AND SILT - trace sand - mottled light brown and grey - moist, stiff - low plasticity	G123							△ +
1.2			G124							△ +
1.5		CLAY - silty, trace silt inclusions (<10 mm diameter) - brown - moist, stiff - high plasticity	G125							△ +
1.8			G126							△ +
2.1			G127							△ +
2.5			G128							△ +

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #505, 1.0 m West from Northbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-22 LOCAL STREETS 18-R-03 OXFORD 0035-058-00 0_B_NM_GPJ_TREK GEOTECHNICAL.GDT_18-130



Local Streets Package 18-R-03
 Sub-Surface Investigation
 Oxford Street

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic	Liquid	Plasticity Index
TH17-13	UTM: 5524841 N, 631054 E At house #537, & 1.1 m East from West curb	Asphalt	51	Concrete	127					Fines (%)						
						SAND (FILL)	0.2	0.3	27	3	63	34				
						CLAY	0.5	0.6	32	0	4	27	69	22	61	39
						CLAY	0.9	1.1	28							
						SILT	1.1	1.2	20							
						SILT	1.4	1.5	19							
						CLAY	1.7	1.8	36							
						CLAY	2.1	2.3	45							
				CLAY	2.7	2.9	44									
TH17-14	UTM: 5524888 N, 631065 E Located at House #528, & 1.9 m West from East curb	Asphalt	51	Concrete	229											
						SAND (FILL)	0.2	0.3	N/A							
						CLAY	0.5	0.6	30							
						CLAY	0.8	0.9	24							
						SILT	1.1	1.2	12							
						CLAY	1.2	1.4	33							
						CLAY	1.7	1.8	39							
						CLAY	2.0	2.1	41							
				CLAY	2.7	2.9	48									
TH17-15	UTM: 5524928 N, 631061 E Located between House #492 and #494, & 1.1 m East from West curb	Asphalt	51	Concrete	102											
						SAND (FILL)	0.2	0.3	19							
						CLAY	0.5	0.6	32							
						CLAY AND SILT	0.9	1.1	21							
						CLAY AND SILT	1.2	1.4	30							
						CLAY	1.5	1.7	38							
						CLAY	1.8	2.0	38							
						CLAY	2.1	2.3	42							
				CLAY	2.9	3.2	48									
TH17-16	UTM: 5524977 N, 631065 E Located at House #505, & 1.0m West from East curb	Asphalt	38	Concrete	89											
						SAND (FILL)	0.2	0.3	20							
						CLAY (FILL)	0.5	0.6	31							
						CLAY AND SILT	0.8	0.9	26	0	7	55	38	17	38	21
						CLAY AND SILT	1.1	1.2	21							
						CLAY	1.4	1.5	39							
						CLAY	1.7	1.8	42							
						CLAY	2.0	2.1	41							
				CLAY	2.4	2.6	45									



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Moisture Content Report ASTM D2216-10

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-09	TH17-09	TH17-09	TH17-09	TH17-09	TH17-09
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G65	G66	G67	G68	G69	G70
Tare ID	E3	P37	AB51	N62	Z94	E6
Mass of tare	8.9	8.3	6.7	8.6	8.4	8.3
Mass wet + tare	319.6	317.6	403.6	313.0	303.0	319.0
Mass dry + tare	279.0	261.3	347.4	263.9	222.9	233.0
Mass water	40.6	56.3	56.2	49.1	80.1	86.0
Mass dry soil	270.1	253.0	340.7	255.3	214.5	224.7
Moisture %	15.0%	22.3%	16.5%	19.2%	37.3%	38.3%

Test Pit	TH17-09	TH17-09	TH17-10	TH17-10	TH17-10	TH17-10
Depth (m)	2.0 - 2.1	2.4 - 2.6	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.5 - 1.7
Sample #	G71	G72	G74	G75	G76	G77
Tare ID	Z120	N59	AA15	AA03	A3	E138
Mass of tare	8.4	8.5	6.8	7.0	8.6	8.4
Mass wet + tare	303.3	308.3	327	335.8	337.2	320.8
Mass dry + tare	217.4	220.9	263.6	269.6	281.0	241.4
Mass water	85.9	87.4	63.4	66.2	56.2	79.4
Mass dry soil	209.0	212.4	256.8	262.6	272.4	233.0
Moisture %	41.1%	41.1%	24.7%	25.2%	20.6%	34.1%

Test Pit	TH17-10	TH17-10	TH17-10	TH17-11	TH17-11	TH17-11
Depth (m)	1.7 - 1.8	2.0 - 2.1	2.4 - 2.6	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9
Sample #	G78	G79	G80	G81	G82	G83
Tare ID	Z57	D27	H4	Z73	F7	H99
Mass of tare	8.4	8.2	8.4	8.4	8.4	8.4
Mass wet + tare	304.0	311.4	316.6	333.6	277.8	312.0
Mass dry + tare	222.2	225.2	218.4	286.0	207.8	239.4
Mass water	81.8	86.2	98.2	47.6	70.0	72.6
Mass dry soil	213.8	217.0	210.0	277.6	199.4	231.0
Moisture %	38.3%	39.7%	46.8%	17.1%	35.1%	31.4%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-11	TH17-11	TH17-11	TH17-11	TH17-11	TH17-12
Depth (m)	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3
Sample #	G84	G85	G86	G87	G88	G89
Tare ID	Z87	F124	W55	AB38	E107	W76
Mass of tare	8.4	8.4	8.4	6.6	8.4	8.4
Mass wet + tare	349.8	344.2	362.8	370.2	331.8	385.8
Mass dry + tare	292.8	255.8	283.0	248.4	224.2	305.4
Mass water	57.0	88.4	79.8	121.8	107.6	80.4
Mass dry soil	284.4	247.4	274.6	241.8	215.8	297.0
Moisture %	20.0%	35.7%	29.1%	50.4%	49.9%	27.1%

Test Pit	TH17-12	TH17-12	TH17-12	TH17-12	TH17-12	TH17-12
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.1 - 2.3
Sample #	G90	G91	G92	G93	G94	G95
Tare ID	N92	H57	F6	AB32	C4	H80
Mass of tare	8.4	8.6	8.6	6.8	8.4	8.4
Mass wet + tare	285.0	369.4	351.6	285.4	267.6	339.0
Mass dry + tare	216.2	300.6	297.2	248.6	234.8	275.0
Mass water	68.8	68.8	54.4	36.8	32.8	64.0
Mass dry soil	207.8	292.0	288.6	241.8	226.4	266.6
Moisture %	33.1%	23.6%	18.8%	15.2%	14.5%	24.0%

Test Pit	TH17-12	TH17-13	TH17-13	TH17-13	TH17-13	TH17-13
Depth (m)	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6	0.9 - 1.1	1.1 - 1.2	1.4 - 1.5
Sample #	G96	G97	G98	G99	G100	G101
Tare ID	D1	WilsonDot	K13	H11	W16	W64
Mass of tare	8.6	355.4	8.6	8.5	8.6	8.4
Mass wet + tare	287.0	1176.7	400.3	342.6	309.2	316.3
Mass dry + tare	199.2	1003.7	305.7	269.7	259.7	266.8
Mass water	87.8	173.0	94.6	72.9	49.5	49.5
Mass dry soil	190.6	648.3	297.1	261.2	251.1	258.4
Moisture %	46.1%	26.7%	31.8%	27.9%	19.7%	19.2%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-13	TH17-13	TH17-13	TH17-14	TH17-14	TH17-14
Depth (m)	1.7 - 1.8	2.1 - 2.3	2.7 - 2.9	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G102	G103	G104	G106	G107	G108
Tare ID	E14	AB79	H65	F93	Z99	W77
Mass of tare	8.6	6.7	9.0	8.3	8.4	8.4
Mass wet + tare	305.0	311.3	333.5	307.2	303.8	335.5
Mass dry + tare	226.5	217.1	234.1	238.7	246.1	299.6
Mass water	78.5	94.2	99.4	68.5	57.7	35.9
Mass dry soil	217.9	210.4	225.1	230.4	237.7	291.2
Moisture %	36.0%	44.8%	44.2%	29.7%	24.3%	12.3%

Test Pit	TH17-14	TH17-14	TH17-14	TH17-14	TH17-15	TH17-15
Depth (m)	1.2 - 1.4	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6
Sample #	G109	G110	G111	G112	G113	G114
Tare ID	F2	Z27	AA05	E1	AA08	F64
Mass of tare	8.4	8.7	6.6	8.4	6.6	8.6
Mass wet + tare	332.3	315.9	324.9	331.4	385.8	280.6
Mass dry + tare	252.8	229.2	232.5	226.5	325.2	215.4
Mass water	79.5	86.7	92.4	104.9	60.6	65.2
Mass dry soil	244.4	220.5	225.9	218.1	318.6	206.8
Moisture %	32.5%	39.3%	40.9%	48.1%	19.0%	31.5%

Test Pit	TH17-15	TH17-15	TH17-15	TH17-15	TH17-15	TH17-15
Depth (m)	0.6 - 0.8	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	2.9 - 3.2
Sample #	G115	G116	G117	G118	G119	G120
Tare ID	Z110	K32	E27	H79	K7	C28
Mass of tare	8.6	8.6	8.8	8.8	8.8	8.6
Mass wet + tare	317.8	364.2	296.2	323.8	296.4	315.4
Mass dry + tare	264.6	282.0	217.8	237.8	210.8	215.6
Mass water	53.2	82.2	78.4	86.0	85.6	99.8
Mass dry soil	256.0	273.4	209.0	229.0	202.0	207.0
Moisture %	20.8%	30.1%	37.5%	37.6%	42.4%	48.2%



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Moisture Content Report ASTM D2216-10

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-16	TH17-16	TH17-16	TH17-16	TH17-16	TH17-16
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G121	G122	G123	G124	G125	G126
Tare ID	H69	F61	K20	AC06	Z45	A4
Mass of tare	8.6	8.6	8.4	6.6	8.4	8.4
Mass wet + tare	407.2	347.0	365.0	367.8	298.0	318.6
Mass dry + tare	341.4	268.0	291.6	305.0	217.2	227.2
Mass water	65.8	79.0	73.4	62.8	80.8	91.4
Mass dry soil	332.8	259.4	283.2	298.4	208.8	218.8
Moisture %	19.8%	30.5%	25.9%	21.0%	38.7%	41.8%

Test Pit	TH17-16	TH17-16	TH17-09	TH17-09	TH17-09	TH17-09
Depth (m)	2.0 - 2.1	2.4 - 2.6	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1
Sample #	G127	G128	G68	G69	G70	G71
Tare ID	AB22	AC37	N62	Z94	E6	Z120
Mass of tare	6.6	6.8	8.6	8.4	8.3	8.4
Mass wet + tare	355.0	344.0	313.0	303.0	319.0	303.3
Mass dry + tare	253.0	239.2	263.9	222.9	233.0	217.4
Mass water	102.0	104.8	49.1	80.1	86.0	85.9
Mass dry soil	246.4	232.4	255.3	214.5	224.7	209.0
Moisture %	41.4%	45.1%	19.2%	37.3%	38.3%	41.1%

Test Pit	TH17-09	TH17-10	TH17-10	TH17-10	TH17-10	TH17-10
Depth (m)	2.4 - 2.6	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.5 - 1.7	1.7 - 1.8
Sample #	G72	G74	G75	G76	G77	G78
Tare ID	N59	AA15	AA03	A3	E138	Z57
Mass of tare	8.5	6.8	7	8.6	8.4	8.4
Mass wet + tare	308.3	327.0	335.8	337.2	320.8	304.0
Mass dry + tare	220.9	263.6	269.6	281.0	241.4	222.2
Mass water	87.4	63.4	66.2	56.2	79.4	81.8
Mass dry soil	212.4	256.8	262.6	272.4	233.0	213.8
Moisture %	41.1%	24.7%	25.2%	20.6%	34.1%	38.3%



Project No. 0035-058-00
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Sample Date 11-Dec-17
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Test Pit	TH17-10	TH17-10	TH17-11	TH17-11	TH17-11	TH17-11
Depth (m)	2.0 - 2.1	2.4 - 2.6	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.2 - 1.4
Sample #	G79	G80	G81	G82	G83	G84
Tare ID	D27	H4	Z73	F7	H99	Z87
Mass of tare	8.2	8.4	8.4	8.4	8.4	8.4
Mass wet + tare	311.4	316.6	333.6	277.8	312.0	349.8
Mass dry + tare	225.2	218.4	286.0	207.8	239.4	292.8
Mass water	86.2	98.2	47.6	70.0	72.6	57.0
Mass dry soil	217.0	210.0	277.6	199.4	231.0	284.4
Moisture %	39.7%	46.8%	17.1%	35.1%	31.4%	20.0%

Test Pit	TH17-11	TH17-11	TH17-11	TH17-11	TH17-12	TH17-12
Depth (m)	1.5 - 1.7	1.8 - 2.0	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6
Sample #	G85	G86	G87	G88	G89	G90
Tare ID	F124	W55	AB38	E107	W76	N92
Mass of tare	8.4	8.4	6.6	8.4	8.4	8.4
Mass wet + tare	344.2	362.8	370.2	331.8	385.8	285.0
Mass dry + tare	255.8	283.0	248.4	224.2	305.4	216.2
Mass water	88.4	79.8	121.8	107.6	80.4	68.8
Mass dry soil	247.4	274.6	241.8	215.8	297.0	207.8
Moisture %	35.7%	29.1%	50.4%	49.9%	27.1%	33.1%

Test Pit	TH17-12	TH17-12	TH17-12	TH17-12	TH17-12	TH17-12
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.1 - 2.3	2.9 - 3.0
Sample #	G91	G92	G93	G94	G95	G96
Tare ID	H57	F6	AB32	C4	H80	D1
Mass of tare	8.6	8.6	6.8	8.4	8.4	8.6
Mass wet + tare	369.4	351.6	285.4	267.6	339.0	287.0
Mass dry + tare	300.6	297.2	248.6	234.8	275.0	199.2
Mass water	68.8	54.4	36.8	32.8	64.0	87.8
Mass dry soil	292.0	288.6	241.8	226.4	266.6	190.6
Moisture %	23.6%	18.8%	15.2%	14.5%	24.0%	46.1%



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**Moisture Content Report
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Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-13	TH17-13	TH17-13	TH17-13	TH17-13	TH17-13
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.9 - 1.1	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G97	G98	G99	G100	G101	G102
Tare ID	WilsonDot	K13	H11	W16	W64	E14
Mass of tare	355.4	8.6	8.5	8.6	8.4	8.6
Mass wet + tare	1176.7	400.3	342.6	309.2	316.3	305
Mass dry + tare	1003.7	305.7	269.7	259.7	266.8	226.5
Mass water	173.0	94.6	72.9	49.5	49.5	78.5
Mass dry soil	648.3	297.1	261.2	251.1	258.4	217.9
Moisture %	26.7%	31.8%	27.9%	19.7%	19.2%	36.0%

Test Pit	TH17-13	TH17-13	TH17-14	TH17-14	TH17-14	TH17-14
Depth (m)	2.1 - 2.3	2.7 - 2.9	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.2 - 1.4
Sample #	G103	G104	G106	G107	G108	G109
Tare ID	AB79	H65	F93	Z99	W77	F2
Mass of tare	6.7	9	8.3	8.4	8.4	8.4
Mass wet + tare	311.3	333.5	307.2	303.8	335.5	332.3
Mass dry + tare	217.1	234.1	238.7	246.1	299.6	252.8
Mass water	94.2	99.4	68.5	57.7	35.9	79.5
Mass dry soil	210.4	225.1	230.4	237.7	291.2	244.4
Moisture %	44.8%	44.2%	29.7%	24.3%	12.3%	32.5%

Test Pit	TH17-14	TH17-14	TH17-14	TH17-15	TH17-15	TH17-15
Depth (m)	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6	0.6 - 0.8
Sample #	G110	G111	G112	G113	G114	G115
Tare ID	Z27	AA05	E1	AA08	F64	Z110
Mass of tare	8.7	6.6	8.4	6.6	8.6	8.6
Mass wet + tare	315.9	324.9	331.4	385.8	280.6	317.8
Mass dry + tare	229.2	232.5	226.5	325.2	215.4	264.6
Mass water	86.7	92.4	104.9	60.6	65.2	53.2
Mass dry soil	220.5	225.9	218.1	318.6	206.8	256.0
Moisture %	39.3%	40.9%	48.1%	19.0%	31.5%	20.8%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-15	TH17-15	TH17-15	TH17-15	TH17-15	TH17-16
Depth (m)	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	2.9 - 3.2	0.2 - 0.3
Sample #	G116	G117	G118	G119	G120	G121
Tare ID	K32	E27	H79	K7	C28	H69
Mass of tare	8.6	8.8	8.8	8.8	8.6	8.6
Mass wet + tare	364.2	296.2	323.8	296.4	315.4	407.2
Mass dry + tare	282	217.8	237.8	210.8	215.6	341.4
Mass water	82.2	78.4	86.0	85.6	99.8	65.8
Mass dry soil	273.4	209.0	229.0	202.0	207.0	332.8
Moisture %	30.1%	37.5%	37.6%	42.4%	48.2%	19.8%

Test Pit	TH17-16	TH17-16	TH17-16	TH17-16	TH17-16	TH17-16
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1
Sample #	G122	G123	G124	G125	G126	G127
Tare ID	F61	K20	AC06	Z45	A4	AB22
Mass of tare	8.6	8.4	6.6	8.4	8.4	6.6
Mass wet + tare	347	365	367.8	298	318.6	355
Mass dry + tare	268	291.6	305	217.2	227.2	253
Mass water	79.0	73.4	62.8	80.8	91.4	102.0
Mass dry soil	259.4	283.2	298.4	208.8	218.8	246.4
Moisture %	30.5%	25.9%	21.0%	38.7%	41.8%	41.4%

Test Pit	TH17-16					
Depth (m)	2.4 - 2.6					
Sample #	G128					
Tare ID	AC37					
Mass of tare	6.8					
Mass wet + tare	344					
Mass dry + tare	239.2					
Mass water	104.8					
Mass dry soil	232.4					
Moisture %	45.1%					



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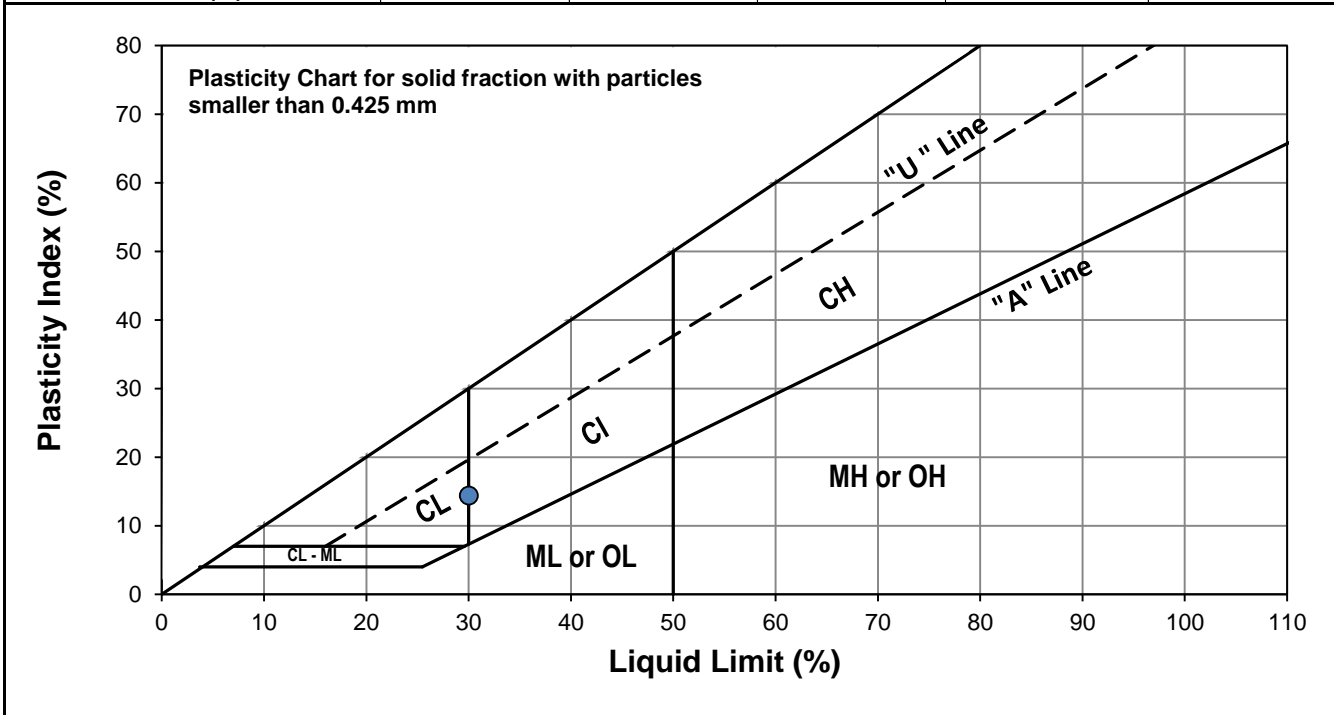
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Test Hole TH17-09
Sample # G67
Depth (m) 0.8 - 0.9
Sample Date 12-Dec-17
Test Date 05-Jan-18
Technician HS

Liquid Limit	30
Plastic Limit	16
Plasticity Index	14

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	15	25	30
Mass Wet Soil + Tare (g)	27.941	25.491	32.511
Mass Dry Soil + Tare (g)	24.370	22.923	28.474
Mass Tare (g)	14.193	14.297	14.260
Mass Water (g)	3.571	2.568	4.037
Mass Dry Soil (g)	10.177	8.626	14.214
Moisture Content (%)	35.089	29.770	28.402



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.669	20.469			
Mass Wet Soil + Tare (g)	20.612	19.623			
Mass Dry Soil + Tare (g)	13.825	14.225			
Mass Water (g)	1.057	0.846			
Mass Dry Soil (g)	6.787	5.398			
Moisture Content (%)	15.574	15.672			



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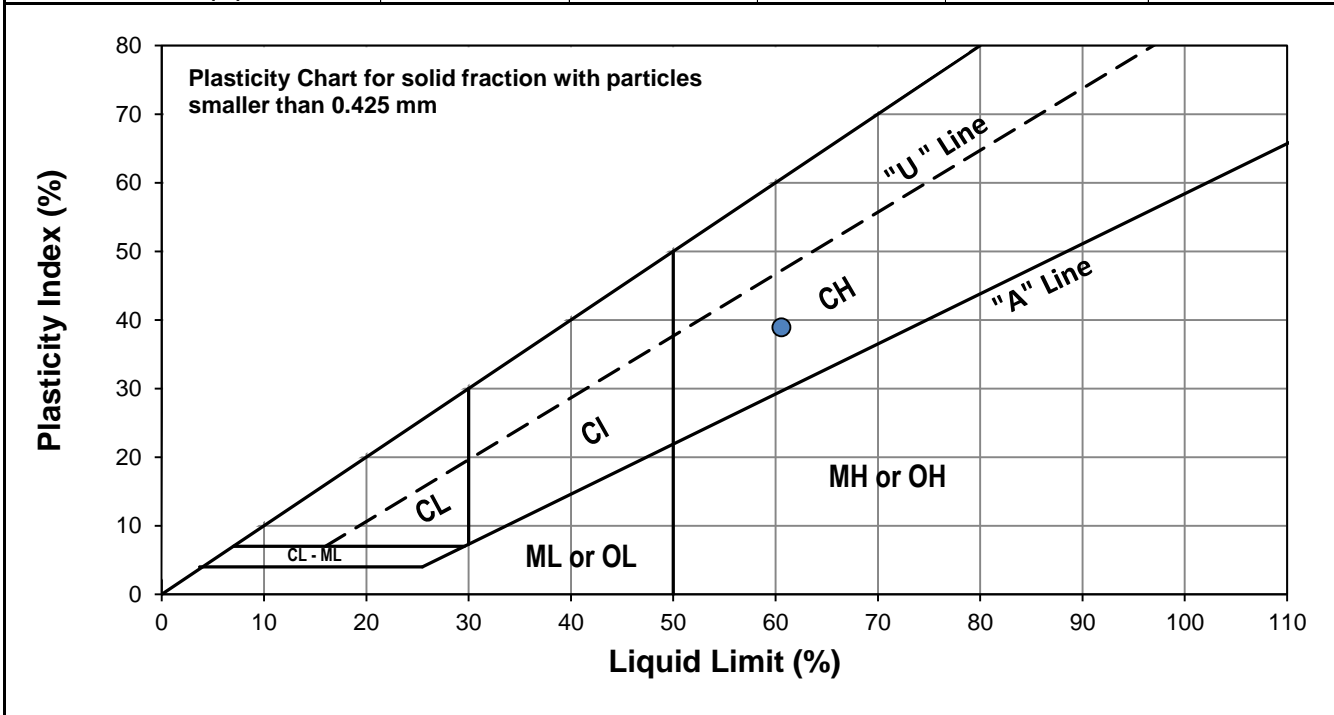
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Test Hole TH17-13
Sample # G98
Depth (m) 0.5 - 0.6
Sample Date 12-Dec-17
Test Date 07-Jan-18
Technician JB

Liquid Limit	61
Plastic Limit	22
Plasticity Index	39

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	26	35
Mass Wet Soil + Tare (g)	21.483	21.290	22.258
Mass Dry Soil + Tare (g)	18.702	18.580	19.238
Mass Tare (g)	14.259	14.100	14.093
Mass Water (g)	2.781	2.710	3.020
Mass Dry Soil (g)	4.443	4.480	5.145
Moisture Content (%)	62.593	60.491	58.698



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	17.958	17.499			
Mass Wet Soil + Tare (g)	17.302	16.887			
Mass Dry Soil + Tare (g)	14.253	14.080			
Mass Water (g)	0.656	0.612			
Mass Dry Soil (g)	3.049	2.807			
Moisture Content (%)	21.515	21.803			



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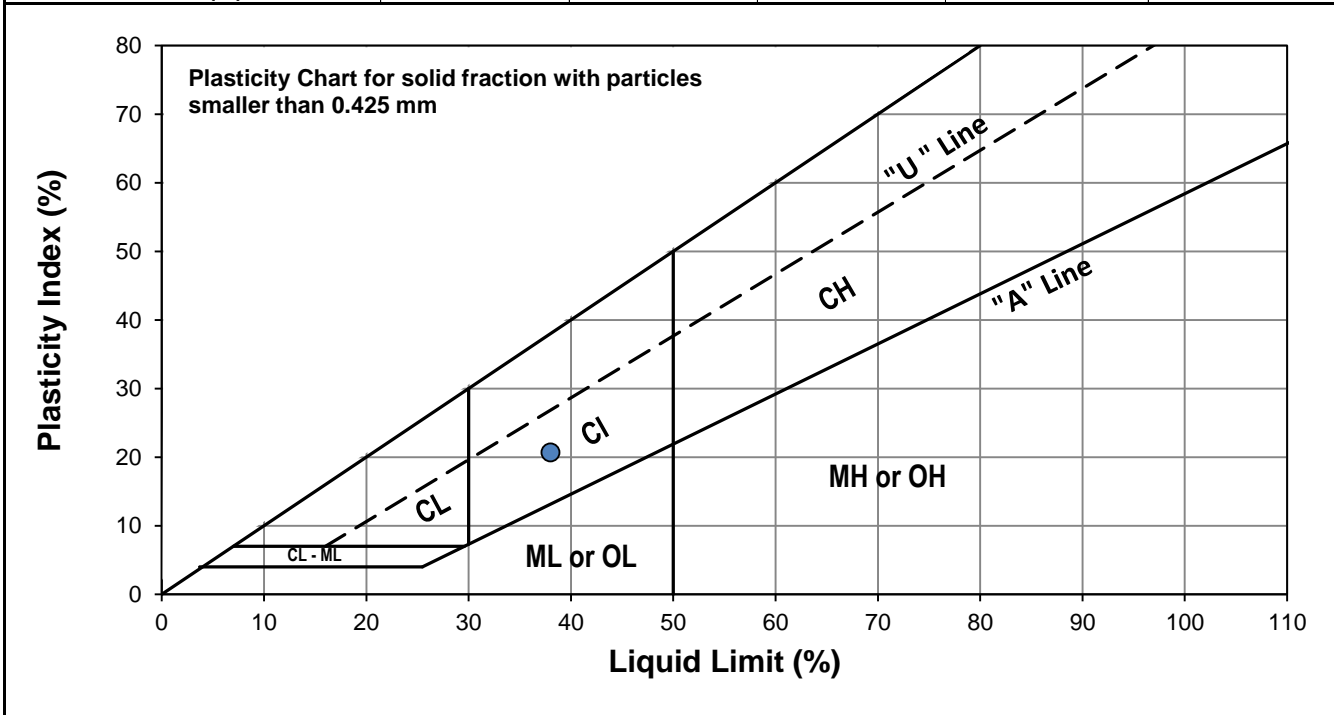
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Test Hole TH17-16
Sample # G123
Depth (m) 0.8 - 0.9
Sample Date 12-Dec-17
Test Date 07-Jan-18
Technician JB

Liquid Limit	38
Plastic Limit	17
Plasticity Index	21

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	20	33
Mass Wet Soil + Tare (g)	22.620	22.304	22.026
Mass Dry Soil + Tare (g)	20.281	19.999	19.950
Mass Tare (g)	14.354	14.098	14.316
Mass Water (g)	2.339	2.305	2.076
Mass Dry Soil (g)	5.927	5.901	5.634
Moisture Content (%)	39.463	39.061	36.848



Plastic Limit

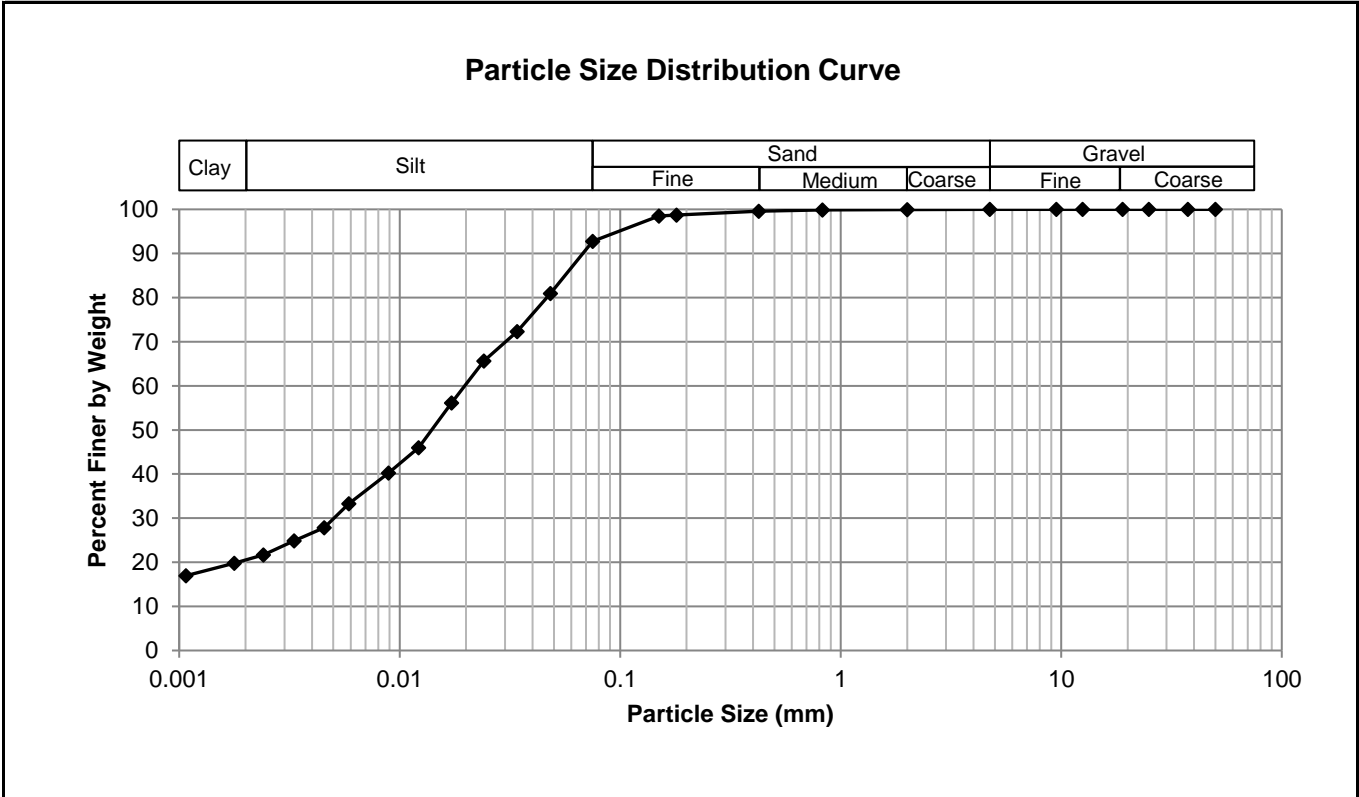
Trial #	1	2	3	4	5
Mass Tare (g)	20.124	20.410			
Mass Wet Soil + Tare (g)	19.216	19.523			
Mass Dry Soil + Tare (g)	14.075	14.314			
Mass Water (g)	0.908	0.887			
Mass Dry Soil (g)	5.141	5.209			
Moisture Content (%)	17.662	17.028			



Project No. 0035-058-00
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Project Local Streets 18-R-03 - Oxford

Test Hole TH17-09
Sample # G67
Depth (m) 0.8 - 0.9
Sample Date 12-Dec-17
Test Date 2-Jan-18
Technician LI

Gravel	0.0%
Sand	7.3%
Silt	72.3%
Clay	20.5%



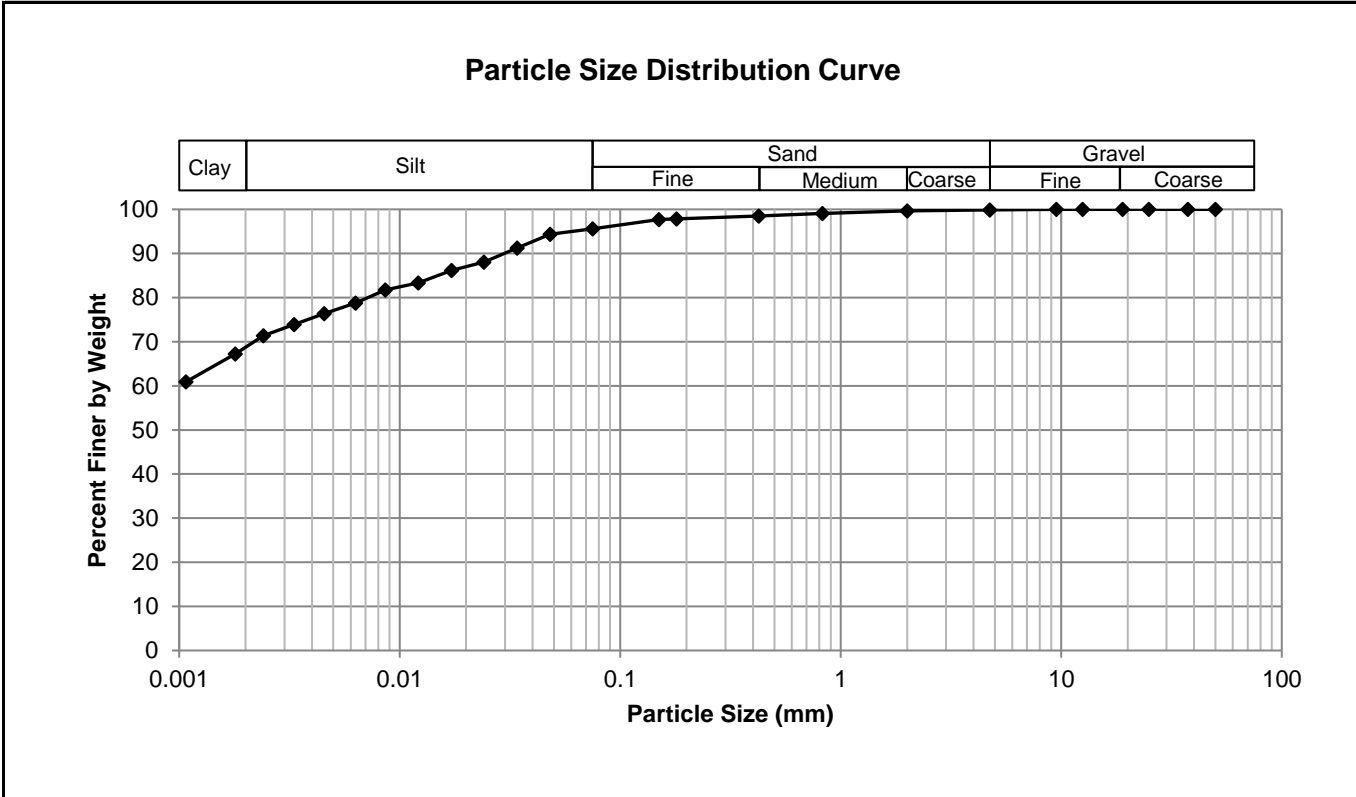
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	92.74
37.5	100.00	2.00	99.98	0.0482	80.91
25.0	100.00	0.825	99.86	0.0341	72.34
19.0	100.00	0.425	99.61	0.0241	65.67
12.5	100.00	0.180	98.69	0.0172	56.14
9.50	100.00	0.150	98.48	0.0122	45.98
4.75	100.00	0.075	92.74	0.0089	40.26
				0.0059	33.28
				0.0046	27.86
				0.0033	24.89
				0.0024	21.71
				0.0018	19.81
				0.0011	16.95



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Test Hole TH17-13
Sample # G98
Depth (m) 0.5 - 0.6
Sample Date 12-Dec-17
Test Date 2-Jan-18
Technician LI/DS

Gravel	0.1%
Sand	4.3%
Silt	26.9%
Clay	68.6%



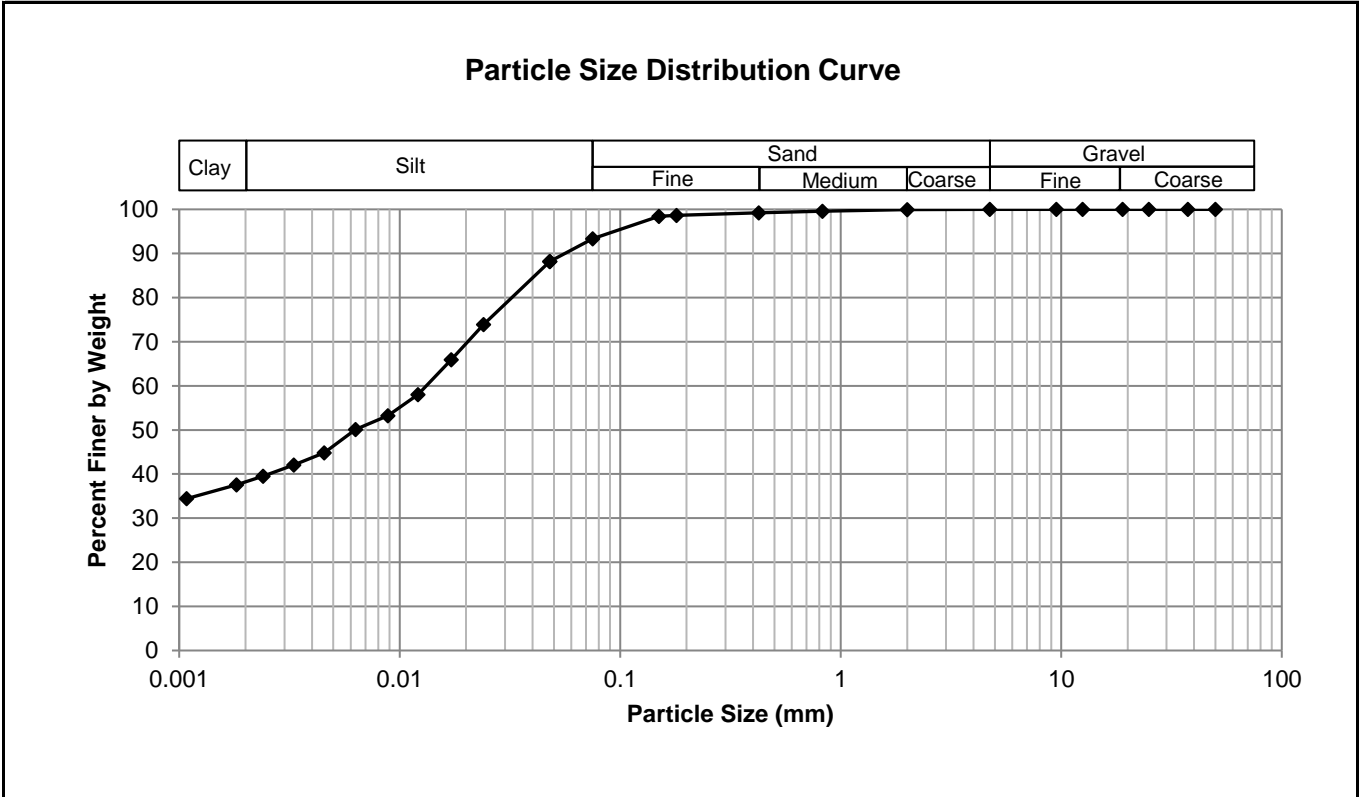
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	99.91	0.0750	95.58
37.5	100.00	2.00	99.64	0.0482	94.39
25.0	100.00	0.825	99.04	0.0340	91.23
19.0	100.00	0.425	98.51	0.0241	88.06
12.5	100.00	0.180	97.82	0.0172	86.16
9.50	100.00	0.150	97.68	0.0122	83.32
4.75	99.91	0.075	95.58	0.0086	81.73
				0.0063	78.77
				0.0045	76.34
				0.0033	73.91
				0.0024	71.38
				0.0018	67.26
				0.0011	60.93



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Oxford

Test Hole TH17-16
Sample # G123
Depth (m) 0.8 - 0.9
Sample Date 12-Dec-17
Test Date 2-Jan-18
Technician LI/DS

Gravel	0.0%
Sand	6.7%
Silt	55.2%
Clay	38.2%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	93.35
37.5	100.00	2.00	99.94	0.0480	88.18
25.0	100.00	0.825	99.58	0.0480	88.18
19.0	100.00	0.425	99.22	0.0240	73.89
12.5	100.00	0.180	98.61	0.0171	65.95
9.50	100.00	0.150	98.45	0.0121	58.02
4.75	100.00	0.075	93.35	0.0088	53.25
				0.0063	50.08
				0.0045	44.84
				0.0033	42.03
				0.0024	39.49
				0.0018	37.59
				0.0011	34.41



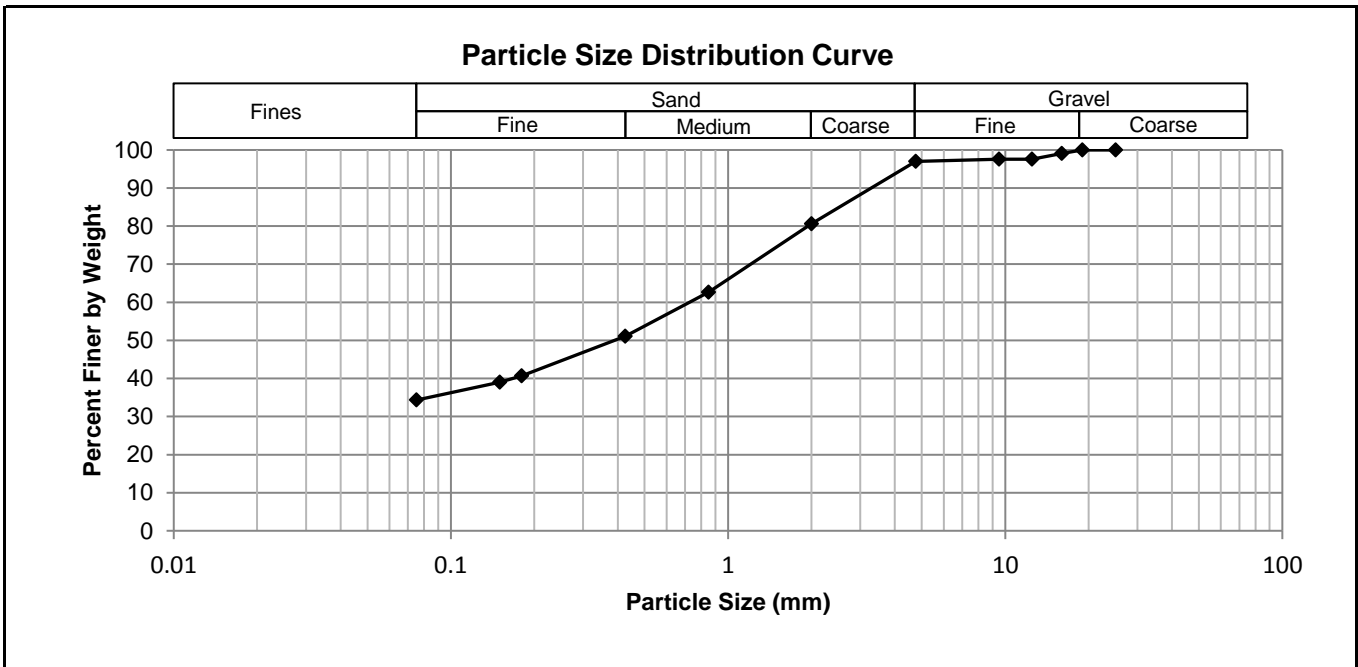
www.trekgeotechnical.ca
 1712 St. James Street
 Winnipeg, MB R3H 0L3
 Tel: 204.975.9433 Fax: 204.975.9435

Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets - 18-R-03 - Oxford

Test Hole TH17-13
Sample # G97
Depth (m) 0.2 - 0.3
Date Sampled 12-Dec-17
Date Tested 6-Jan-18
Technician DS/SX

Total Weight (g)	628.0
Gravel %	3.0
Sand %	62.7
Fines %	34.3



Sieve Number	Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
6"	150		
5"	125		
4"	100		
3"	75.0		
2"	50.0		
1 1/2"	37.5		
1"	25.0	100	
3/4"	19.0	100	
5/8"	16.0	99	
1/2"	12.5	98	
3/8"	9.50	98	
no. 4	4.75	97	
no. 10	2.00	81	
no. 20	0.850	63	
no. 40	0.425	51	
no. 80	0.180	41	
no. 100	0.150	39	
no. 200	0.075	34	



Photo 1: Pavement Core Sample at Test Hole TH17-09



Photo 2: Pavement Core Sample at Test Hole TH17-10



Photo 3: Pavement Core Sample at Test Hole TH17-11



Photo 4: Pavement Core Sample at Test Hole TH17-12



Photo 5: Pavement Core Sample at Test Hole TH17-13



Photo 6: Pavement Core Sample at Test Hole TH17-14



Photo 7: Pavement Core Sample at Test Hole TH17-16

Appendix C

Donnelly St., between Waller Ave. and Clarence Ave.

**Test Hole Logs, Summary Table, Lab
Data and Photographs of Pavement
Core Samples**

GENERAL NOTES

- Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size	Material					
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	ASTM Sieve sizes #10 to #4 #40 to #10 #200 to #40 < #200	Sand					
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW							
		GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4			Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols				
		GC	Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7			Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols				
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm 2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075	Coarse Medium Fine				
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW						
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4			Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols			
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7			Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols			
			Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)		Sils and Clays (Liquid limit less than 50)	ML			Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity		Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19 3 in. to 12 in. 3/4 in. to 3 in. #4 to 3/4 in.	Material Boulders Cobbles Gravel Coarse Fine
						CL			Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
OL	Organic silts and organic silty clays of low plasticity											
Sils and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts										
	CH	Inorganic clays of high plasticity, fat clays										
	OH	Organic clays of medium to high plasticity, organic silts										
	Pt	Peat and other highly organic soils		Von Post Classification Limit	Strong colour or odour, and often fibrous texture							

* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)	▽ Water Level at Time of Drilling
PL - Plastic Limit (%)	▼ Water Level at End of Drilling
PI - Plasticity Index (%)	▽ Water Level After Drilling as Indicated on Test Hole Logs
MC - Moisture Content (%)	
SPT - Standard Penetration Test	
RQD- Rock Quality Designation	
Qu - Unconfined Compression	
Su - Undrained Shear Strength	
VW - Vibrating Wire Piezometer	
SI - Slope Incliner	

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>Undrained Shear Strength (kPa)</u>
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200



Sub-Surface Log

Test Hole TH17-17

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Donnelly St Location: UTM N-5521828, E-632443
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type			
					PL _____ MC _____ LL _____ 0 20 40 60 80 100				0 50 100 150 200 250 △ Torvane △ ⊕ Pocket Pen. ⊕ ⊠ Qu ⊠ ○ Field Vane ○					
		ASPHALT - 76 mm thick												
		CONCRETE - 102 mm thick												
		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	▲	G129										
		CLAY - silty, trace sand - brown - moist, stiff - high plasticity	▲	G130										
			▲	G131										
			▲	G132										
			▲	G133										
			▲	G134										
			▲	G135										
			▲	G136										

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 23.0 m North-West of Clarence Ave and Donnelly Street intersection, and 1.7 m North-East from South-West curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2017-01-23 LOCAL STREETS 18-R-03 DONNELLY 0035-058-00 0 A NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-18

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Donnelly St Location: UTM N-5521878, E-632425
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 76 mm thick															
0.05 - 0.10		CONCRETE - 127 mm thick															
0.10 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G	G137													
0.45 - 0.75		CLAY - silty, trace silt inclusions (<5 mm diameter), trace sand - brown - moist, firm to stiff - intermediate to high plasticity	G	G138													
0.75 - 1.35		CLAY AND SILT - light brown - moist, soft to firm - low to intermediate plasticity	G	G139													
1.35 - 1.65		CLAY - silty, trace silt inclusions (<10 mm diameter) - brown - moist, firm to stiff - high plasticity	G	G140													
1.65 - 1.95			G	G141													
1.95 - 2.25			G	G142													
2.25 - 2.55			G	G143													
2.55 - 2.85			G	G144													
2.85 - 3.00																	

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 74.0 m North-West of Clarence Ave and Donnelly Street intersection, and 1.6 m South-West from North-East curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2017-01-23 LOCAL STREETS 18-R-03 DONNELLY 0035-058-00 0 A NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-19

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Donnelly St Location: UTM N-5521918, E-632097
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 12

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)							
					16	17	18	19	20	21	0	50	100	150	200	250
0.0		ASPHALT - 51 mm thick														
0.0		CONCRETE - 76 mm thick														
0.0		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G145													
0.0		CLAY (FILL) - silty, trace silt inclusions (<5 mm diameter), trace sand - brown - frozen, moist and soft when thawed - intermediate plasticity	G146													
0.0		CLAY AND SILT - trace sand - light brown - wet, soft - intermediate plasticity	G147													
0.0		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff - high plasticity	G148													
0.0		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff - high plasticity	G149													
0.0		SILT - some clay, light brown, moist, soft, low plasticity	G150													
0.0		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff - high plasticity	G151													
0.0		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff - high plasticity	G152													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 26.0 m North-West of Marshall Crescent and Donnelly Street intersection, and 1.4 m North-East from South-West curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2017-01-23 LOCAL STREETS 18-R-03 DONNELLY 0035-058-00 0 A NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-20

1 of 1

Client: Morrison Hershfield **Project Number:** 0035-058-00
Project Name: Local Streets 18-R-03 - Donnelly St **Location:** UTM N-5521967, E-632380
Contractor: Maple Leaf Drilling **Ground Elevation:** Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 51 mm thick														
		CONCRETE - 178 mm thick														
		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G	G153												
		CLAY - silty - brown - frozen to 0.6 m, moist and stiff when thawed - high plasticity	G	G154												
			G	G155												
			G	G156												
		SILT - some clay, light brown, moist, firm, low plasticity	G	G157												
		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, firm to stiff - high plasticity	G	G158												
			G	G159												
			G	G160												

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 75.0 m North-West of Marshall Crescent and Donnelly Street intersection, and 1.0 m South-West from North-East curb.

Logged By: Devon Adamson **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG - LOGS 2017-01-23 LOCAL STREETS 18-R-03 DONNELLY 0035-058-00 0 A NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-21

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Donnelly St Location: UTM N-5522008, E-632349
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 51 mm thick															
0.05 - 0.10		CONCRETE - 127 mm thick															
0.10 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G161														
0.45 - 0.75		CLAY (FILL) - silty, some sand - brown - moist, firm - high plasticity	G162														
0.75 - 1.10		CLAY - some silt to silty - brown - moist, very stiff - high plasticity -stiff below 1.1 m	G163														
1.10 - 1.45			G164														
1.45 - 1.80			G165														
1.80 - 2.10		CLAY AND SILT - mottled brown and light brown, moist, stiff, intermediate plasticity	G166														
2.10 - 2.50		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, firm to stiff - high plasticity	G167														
2.50 - 3.00			G168														

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 125.0 m North-West of Marshall Crescent and Donnelly Street intersection, and 1.8 m North-East from South-West curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS 2017-01-23 LOCAL STREETS 18-R-03 DONNELLY_0035-058-00_0_A_NM.GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-22

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Donnelly St Location: UTM N-5522061, E-632326
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.00 - 0.05		ASPHALT - 51 mm thick																
0.05 - 0.10		CONCRETE - 127 mm thick																
0.10 - 0.15		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G	G169														
0.15 - 0.20		CLAY AND SILT - brown to light brown - frozen to 0.9 m, moist and firm when thawed - low to intermediate plasticity	G	G170														
0.20 - 0.25			G	G171														
0.25 - 0.30			G	G172														
0.30 - 0.35			G	G173														
0.35 - 0.40			G	G174														
0.40 - 0.45			G	G175														
0.45 - 0.50			G	G176														

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 176.0 m North-West of Marshall Crescent and Donnelly Street intersection, and 1.9 m South-West from North-East curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2017-01-23 LOCAL STREETS 18-R-03 DONNELLY 0035-058-00 0 A NM GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-23

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Donnelly St Location: UTM N-5522104, E-632300
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 51 mm thick														
		CONCRETE - 127 mm thick														
		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	▲	G177												
		CLAY (FILL) - silty, trace organics - mottled black and grey - frozen, moist and firm when thawed - high plasticity	▲	G178												
			▲	G179												
		CLAY - silty, trace sand - brown - moist, stiff to very stiff - high plasticity	▲	G180												
			▲	G181												
			▲	G182												
			▲	G183												
			▲	G184												
			▲	G185												

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 235.0 m North-West of Marshall Crescent and Donnelly Street intersection, and 1.1 m North-East from South-West curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2017-01-23 LOCAL STREETS 18-R-03 DONNELLY 0035-058-00 0 A NM GPJ TREK GEOTECHNICAL GDT 18-1-30



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 -Donnelly

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-17	TH17-17	TH17-17	TH17-17	TH17-17	TH17-17
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 2.0
Sample #	G129	G130	G131	G132	G133	G134
Tare ID	F144	F44	AB83	AB81	F21	AB68
Mass of tare	8.5	8.7	6.7	6.7	8.5	6.7
Mass wet + tare	331.5	321.9	305.8	328.2	308.5	319.1
Mass dry + tare	275.1	244.9	222.4	240.6	227.3	227.3
Mass water	56.4	77.0	83.4	87.6	81.2	91.8
Mass dry soil	266.6	236.2	215.7	233.9	218.8	220.6
Moisture %	21.2%	32.6%	38.7%	37.5%	37.1%	41.6%

Test Pit	TH17-17	TH17-17	TH17-18	TH17-18	TH17-18	TH17-18
Depth (m)	2.1 - 2.3	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G135	G136	G137	G138	G139	G140
Tare ID	H45	N45	N111	F34	F63	W68
Mass of tare	8.5	8.6	8.6	8.5	8.5	8.5
Mass wet + tare	336.6	320.9	329.4	311.2	318.4	308
Mass dry + tare	237.0	213.3	258.9	238.0	250.1	247.0
Mass water	99.6	107.6	70.5	73.2	68.3	61.0
Mass dry soil	228.5	204.7	250.3	229.5	241.6	238.5
Moisture %	43.6%	52.6%	28.2%	31.9%	28.3%	25.6%

Test Pit	TH17-18	TH17-18	TH17-18	TH17-18	TH17-19	TH17-19
Depth (m)	1.4 - 1.5	1.8 - 2.0	2.1 - 2.3	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6
Sample #	G141	G142	G143	G144	G145	G146
Tare ID	H56	D10	F14	A8	F11	W107
Mass of tare	8.5	8.5	8.6	8.1	8.6	8.6
Mass wet + tare	362.9	320.9	320.1	301.0	430.4	274.4
Mass dry + tare	252.4	241.2	217.3	195.5	361.6	208.0
Mass water	110.5	79.7	102.8	105.5	68.8	66.4
Mass dry soil	243.9	232.7	208.7	187.4	353.0	199.4
Moisture %	45.3%	34.3%	49.3%	56.3%	19.5%	33.3%



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Moisture Content Report ASTM D2216-10

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 -Donnelly

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-19	TH17-19	TH17-19	TH17-19	TH17-19	TH17-19
Depth (m)	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.7 - 1.8	2.1 - 2.3	2.4 - 2.6
Sample #	G147	G148	G149	G150	G151	G152
Tare ID	Z97	N07	Z06	C10	E34	D29
Mass of tare	8.6	8.6	8.4	8.4	8.6	8.2
Mass wet + tare	384.0	322.4	328.4	373.6	324.6	300.0
Mass dry + tare	279.2	255.8	262.4	302.6	243.8	208.0
Mass water	104.8	66.6	66.0	71.0	80.8	92.0
Mass dry soil	270.6	247.2	254.0	294.2	235.2	199.8
Moisture %	38.7%	26.9%	26.0%	24.1%	34.4%	46.0%

Test Pit	TH17-20	TH17-20	TH17-20	TH17-20	TH17-20	TH17-20
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.5 - 1.7
Sample #	G153	G154	G155	G156	G157	G158
Tare ID	F112	N57	F121	F15	F86	AB16
Mass of tare	8.4	8.4	8.6	8.8	8.4	6.6
Mass wet + tare	391.2	244.4	270.6	330.0	345.8	323.0
Mass dry + tare	328.4	194.8	200.8	241.0	254.4	221.4
Mass water	62.8	49.6	69.8	89.0	91.4	101.6
Mass dry soil	320.0	186.4	192.2	232.2	246.0	214.8
Moisture %	19.6%	26.6%	36.3%	38.3%	37.2%	47.3%

Test Pit	TH17-20	TH17-20	TH17-21	TH17-21	TH17-21	TH17-21
Depth (m)	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G159	G160	G161	G162	G163	G164
Tare ID	A14	W99	N35	E118	H19	P28
Mass of tare	8.4	8.4	8.4	8.4	8.6	8.6
Mass wet + tare	301.0	327.2	350.0	408.9	411.3	312.5
Mass dry + tare	201.4	214.2	255.4	326.1	314.6	236.6
Mass water	99.6	113.0	94.6	82.8	96.7	75.9
Mass dry soil	193.0	205.8	247.0	317.7	306.0	228.0
Moisture %	51.6%	54.9%	38.3%	26.1%	31.6%	33.3%



Project No. 0035-058-00
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Project Local Streets 18-R-03 -Donnelly

Sample Date 11-Dec-17
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Test Pit	TH17-21	TH17-21	TH17-21	TH17-21	TH17-22	TH17-22
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.4 - 2.6	0.2 - 0.3	0.5 - 0.6
Sample #	G165	G166	G167	G168	G169	G170
Tare ID	N95	N93	F40	AB42	F142	Z34
Mass of tare	8.5	8.5	8.6	6.8	8.6	8.4
Mass wet + tare	310.0	315.8	307.2	303.2	331.4	314.5
Mass dry + tare	219.8	226.5	208.6	201.7	283.6	262.3
Mass water	90.2	89.3	98.6	101.5	47.8	52.2
Mass dry soil	211.3	218.0	200.0	194.9	275.0	253.9
Moisture %	42.7%	41.0%	49.3%	52.1%	17.4%	20.6%

Test Pit	TH17-22	TH17-22	TH17-22	TH17-22	TH17-22	TH17-22
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 2.0	2.1 - 2.3	2.9 - 3.0
Sample #	G171	G172	G173	G174	G175	G176
Tare ID	P08	E80	P36	AB59	W44	N27
Mass of tare	8.6	8.6	8.5	6.7	8.4	8.6
Mass wet + tare	312.0	310.9	307.2	311.5	316.1	330.9
Mass dry + tare	259.0	253.4	250.6	236.4	219.4	225.7
Mass water	53.0	57.5	56.6	75.1	96.7	105.2
Mass dry soil	250.4	244.8	242.1	229.7	211.0	217.1
Moisture %	21.2%	23.5%	23.4%	32.7%	45.8%	48.5%

Test Pit	TH17-23	TH17-23	TH17-23	TH17-23	TH17-23	TH17-23
Depth (m)	0.2 - 0.3	0.3 - 0.5	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G177	G178	G179	G180	G181	G182
Tare ID	E66	N02	K34	Z77	N21	Z59
Mass of tare	8.8	8.6	8.6	8.6	8.6	8.6
Mass wet + tare	346.8	261.8	322.8	358.8	330.4	337.6
Mass dry + tare	278.6	193.6	259.6	282.0	256.6	259.8
Mass water	68.2	68.2	63.2	76.8	73.8	77.8
Mass dry soil	269.8	185.0	251.0	273.4	248.0	251.2
Moisture %	25.3%	36.9%	25.2%	28.1%	29.8%	31.0%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 -Donnelly

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-23	TH17-23	TH17-23			
Depth (m)	1.7 - 1.8	2.0 - 2.1	2.4 - 2.6			
Sample #	G183	G184	G185			
Tare ID	W45	W79	F52			
Mass of tare	8.4	8.6	8.6			
Mass wet + tare	276.8	306.6	343.0			
Mass dry + tare	193.2	211.6	228.4			
Mass water	83.6	95.0	114.6			
Mass dry soil	184.8	203.0	219.8			
Moisture %	45.2%	46.8%	52.1%			

Test Pit						
Depth (m)						
Sample #						
Tare ID						
Mass of tare						
Mass wet + tare						
Mass dry + tare						
Mass water						
Mass dry soil						
Moisture %						

Test Pit						
Depth (m)						
Sample #						
Tare ID						
Mass of tare						
Mass wet + tare						
Mass dry + tare						
Mass water						
Mass dry soil						
Moisture %						



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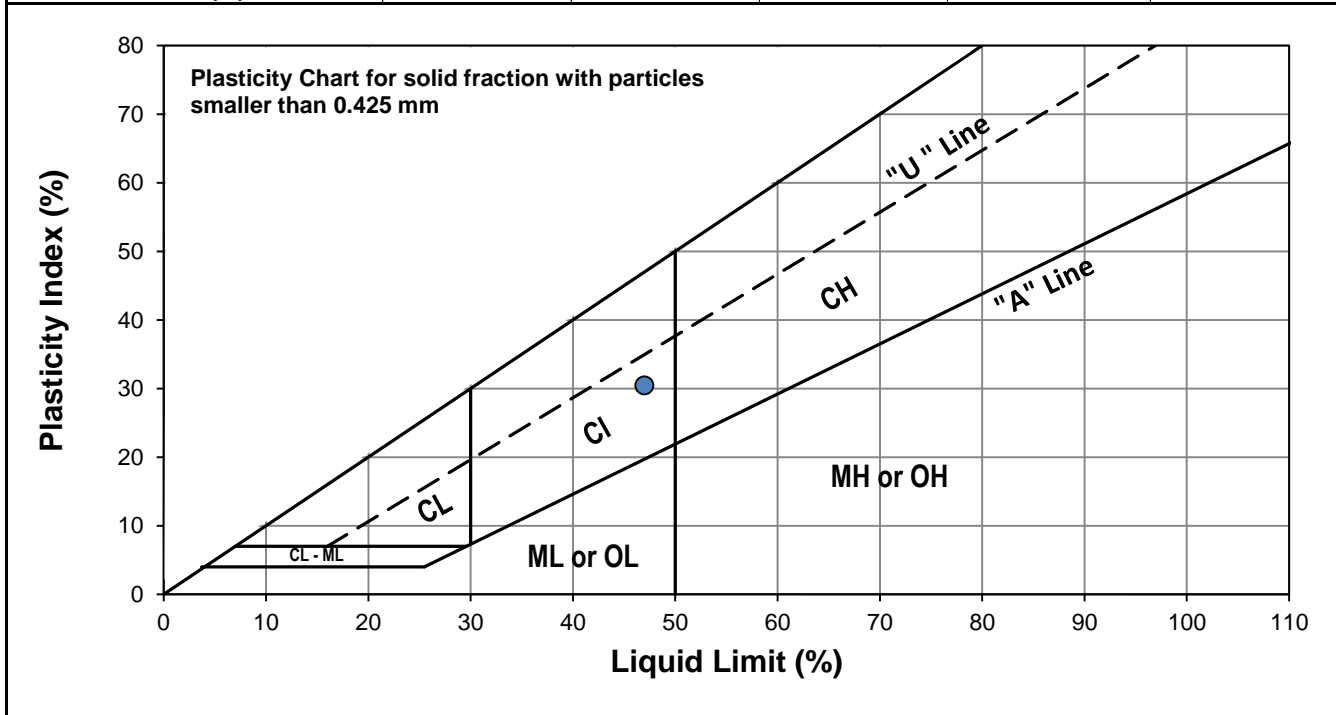
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Donnelly

Test Hole TH17-19
Sample # G147
Depth (m) 0.6 - 0.8
Sample Date 12-Dec-17
Test Date 07-Jan-18
Technician JB

Liquid Limit	47
Plastic Limit	17
Plasticity Index	30

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	18	25	30
Mass Wet Soil + Tare (g)	31.110	30.094	22.084
Mass Dry Soil + Tare (g)	25.675	25.000	19.527
Mass Tare (g)	14.122	14.155	14.081
Mass Water (g)	5.435	5.094	2.557
Mass Dry Soil (g)	11.553	10.845	5.446
Moisture Content (%)	47.044	46.971	46.952



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.338	20.228			
Mass Wet Soil + Tare (g)	19.419	19.380			
Mass Dry Soil + Tare (g)	13.898	14.213			
Mass Water (g)	0.919	0.848			
Mass Dry Soil (g)	5.521	5.167			
Moisture Content (%)	16.646	16.412			



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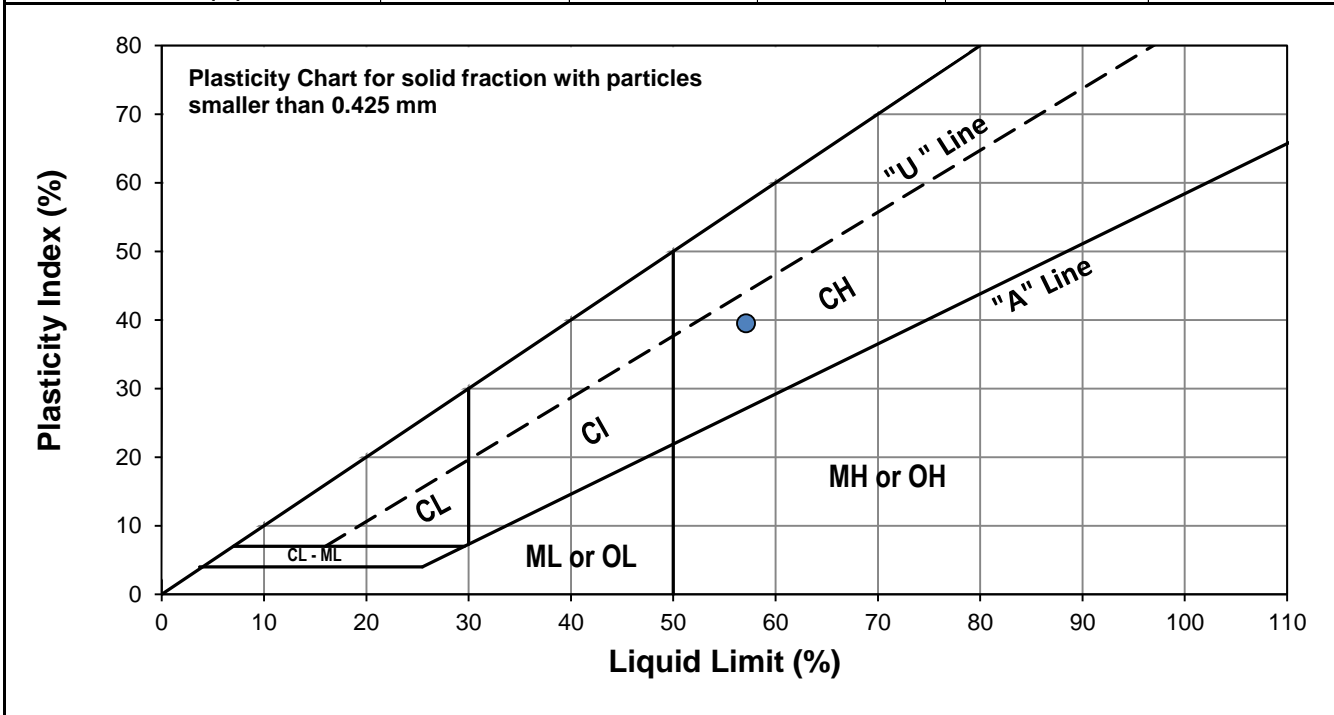
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Donnelly

Test Hole TH17-21
Sample # G162
Depth (m) 0.5 - 0.6
Sample Date 13-Dec-17
Test Date 06-Jan-18
Technician JB

Liquid Limit	57
Plastic Limit	18
Plasticity Index	39

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	19	23	28
Mass Wet Soil + Tare (g)	21.136	21.358	21.152
Mass Dry Soil + Tare (g)	18.530	18.742	18.653
Mass Tare (g)	14.074	14.197	14.233
Mass Water (g)	2.606	2.616	2.499
Mass Dry Soil (g)	4.456	4.545	4.420
Moisture Content (%)	58.483	57.558	56.538



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	19.049	19.000			
Mass Wet Soil + Tare (g)	18.274	18.261			
Mass Dry Soil + Tare (g)	13.883	14.076			
Mass Water (g)	0.775	0.739			
Mass Dry Soil (g)	4.391	4.185			
Moisture Content (%)	17.650	17.658			



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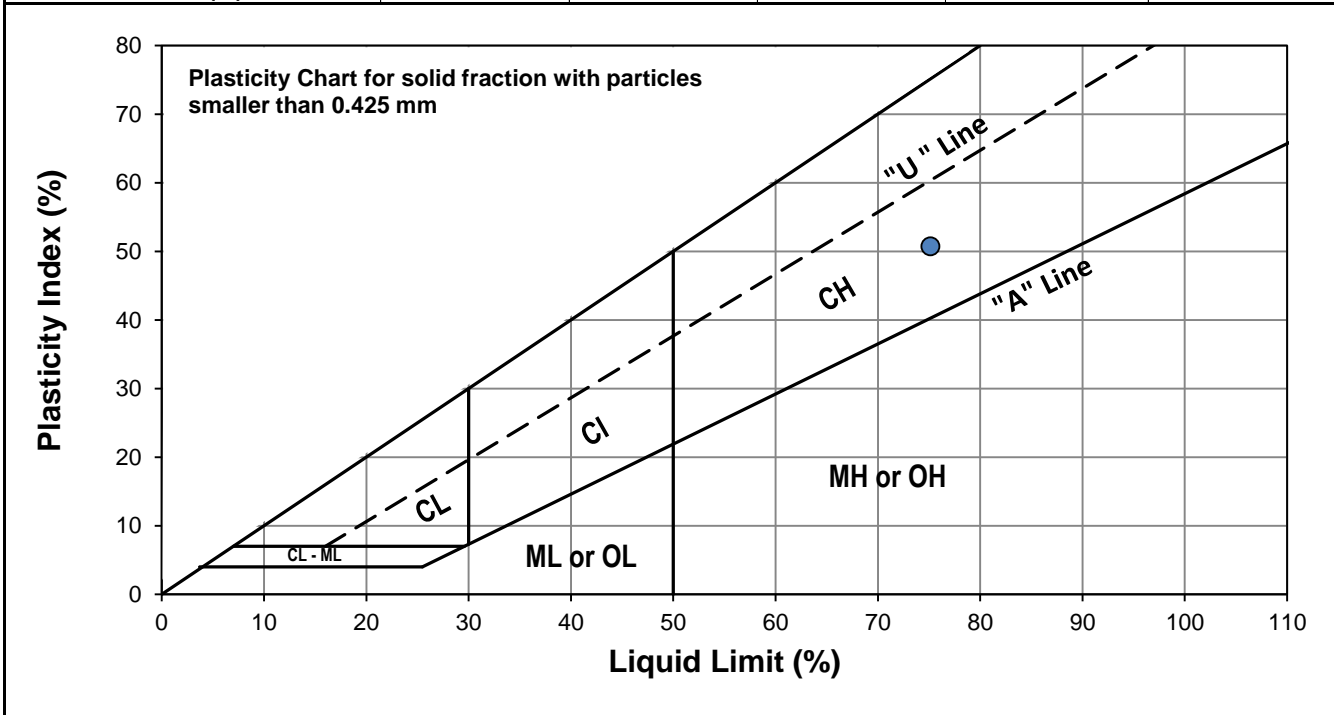
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Donnelly

Test Hole TH17-21
Sample # G163
Depth (m) 0.8 - 0.9
Sample Date 13-Dec-17
Test Date 06-Jan-18
Technician JB

Liquid Limit	75
Plastic Limit	24
Plasticity Index	51

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	16	22	29
Mass Wet Soil + Tare (g)	21.344	21.239	21.304
Mass Dry Soil + Tare (g)	18.196	18.244	18.305
Mass Tare (g)	14.185	14.316	14.248
Mass Water (g)	3.148	2.995	2.999
Mass Dry Soil (g)	4.011	3.928	4.057
Moisture Content (%)	78.484	76.247	73.922



Plastic Limit

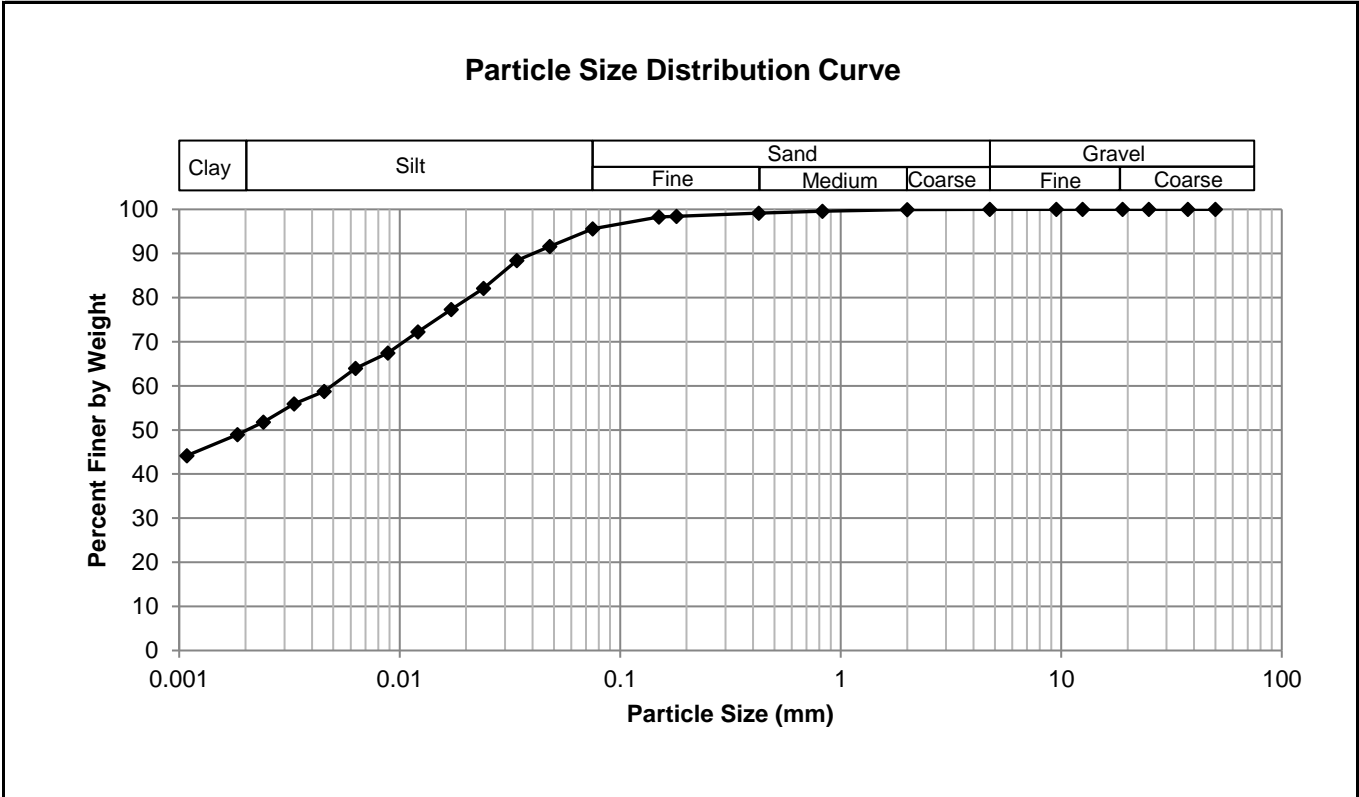
Trial #	1	2	3	4	5
Mass Tare (g)	17.690	17.846			
Mass Wet Soil + Tare (g)	17.016	17.141			
Mass Dry Soil + Tare (g)	14.245	14.263			
Mass Water (g)	0.674	0.705			
Mass Dry Soil (g)	2.771	2.878			
Moisture Content (%)	24.323	24.496			



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Project Local Streets 18-R-03 - Donnelly

Test Hole TH17-19
Sample # G147
Depth (m) 0.6 - 0.8
Sample Date 12-Dec-17
Test Date 2-Jan-18
Technician LI/DS

Gravel	0.0%
Sand	4.4%
Silt	45.9%
Clay	49.8%



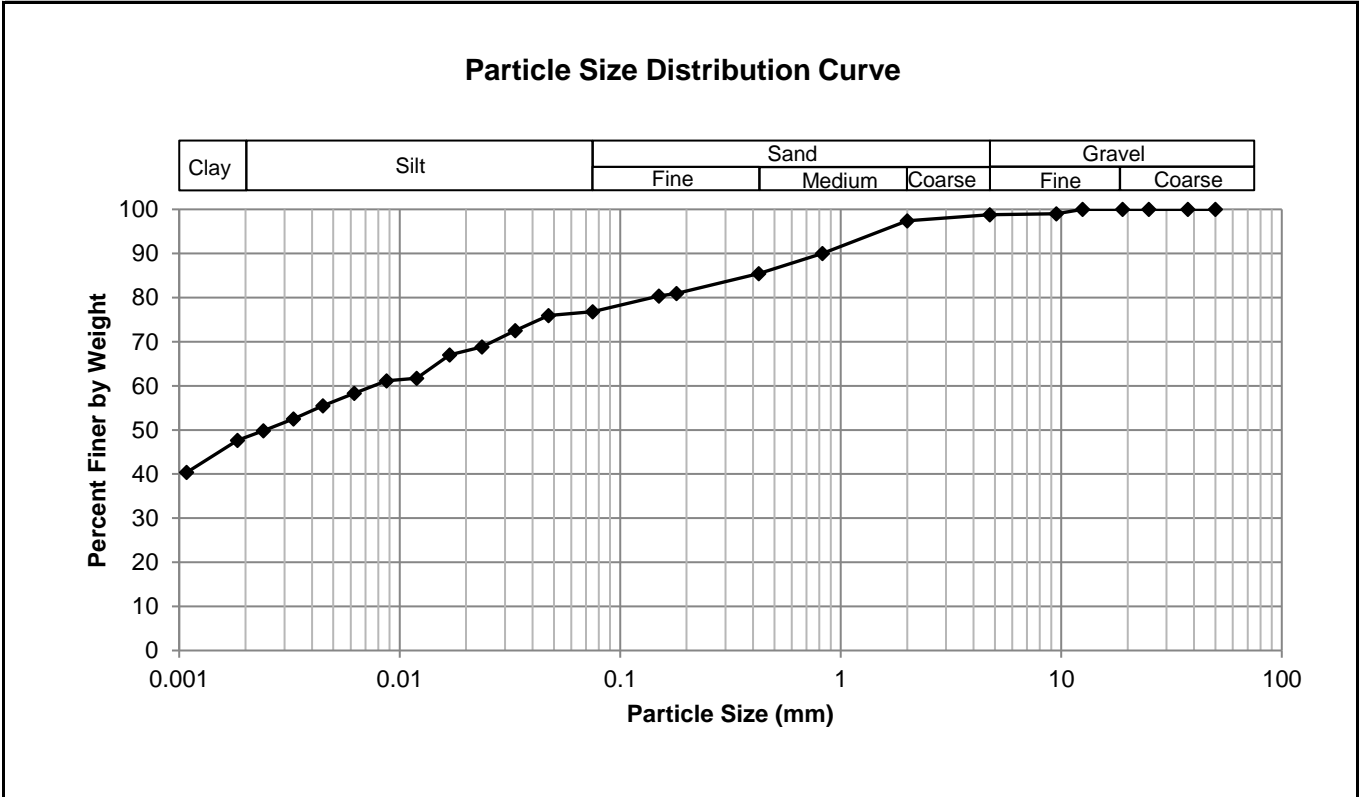
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	95.62
37.5	100.00	2.00	99.98	0.0480	91.61
25.0	100.00	0.825	99.57	0.0339	88.43
19.0	100.00	0.425	99.15	0.0240	82.08
12.5	100.00	0.180	98.45	0.0171	77.32
9.50	100.00	0.150	98.30	0.0121	72.24
4.75	100.00	0.075	95.62	0.0088	67.47
				0.0063	63.98
				0.0045	58.74
				0.0033	55.93
				0.0024	51.80
				0.0018	48.94
				0.0011	44.18



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Donnelly

Test Hole TH17-21
Sample # G162
Depth (m) 0.5 - 0.6
Sample Date 13-Dec-17
Test Date 3-Jan-18
Technician LI/DS

Gravel	1.2%
Sand	22.0%
Silt	27.0%
Clay	49.8%



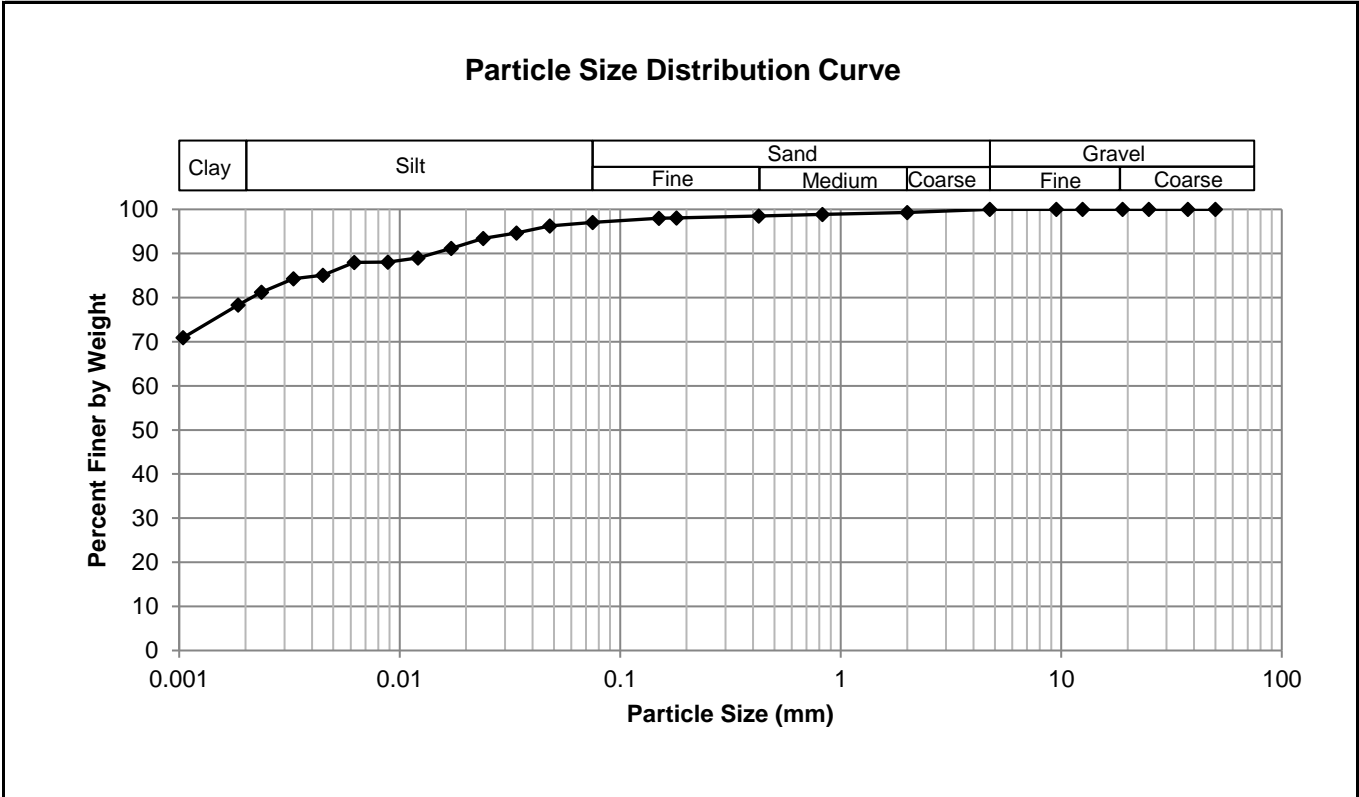
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	98.80	0.0750	76.81
37.5	100.00	2.00	97.39	0.0473	75.95
25.0	100.00	0.825	90.03	0.0334	72.55
19.0	100.00	0.425	85.41	0.0236	68.84
12.5	100.00	0.180	80.92	0.0169	66.98
9.50	99.01	0.150	80.33	0.0119	61.72
4.75	98.80	0.075	76.81	0.0087	61.10
				0.0062	58.32
				0.0045	55.48
				0.0033	52.53
				0.0024	49.84
				0.0018	47.68
				0.0011	40.36



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Donnelly

Test Hole TH17-21
Sample # G163
Depth (m) 0.8 - 0.9
Sample Date 13-Dec-17
Test Date 3-Jan-18
Technician LI/DS

Gravel	0.0%
Sand	2.9%
Silt	17.7%
Clay	79.4%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.07
37.5	100.00	2.00	99.32	0.0479	96.24
25.0	100.00	0.825	98.86	0.0339	94.67
19.0	100.00	0.425	98.53	0.0240	93.40
12.5	100.00	0.180	98.07	0.0171	91.19
9.50	100.00	0.150	97.99	0.0121	88.99
4.75	100.00	0.075	97.07	0.0088	88.04
				0.0062	87.96
				0.0045	85.06
				0.0033	84.26
				0.0024	81.20
				0.0019	78.37
				0.0010	70.90



Photo 1: Pavement Core Sample at Test Hole TH17-17



Photo 2: Pavement Core Sample at Test Hole TH17-18

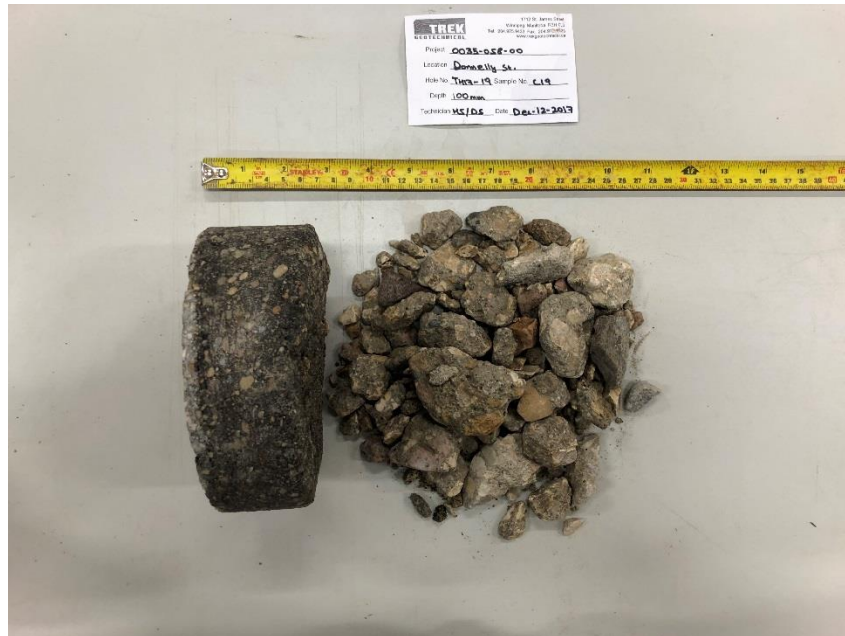


Photo 3: Pavement Core Sample at Test Hole TH17-19



Photo 4: Pavement Core Sample at Test Hole TH17-20



Photo 5: Pavement Core Sample at Test Hole TH17-21



Photo 6: Pavement Core Sample at Test Hole TH17-22



Photo 7: Pavement Core Sample at Test Hole TH17-23

Appendix D

Killarney Ave., between Pembina Hwy. and Baylor Ave.

**Test Hole Logs, Summary Table, Lab
Data and Photographs of Pavement
Core Samples**

GENERAL NOTES

- Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size		
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	ASTM Sieve sizes		
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW		#10 to #4 #40 to #10 #200 to #40	
		GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	mm	
		GC	Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7			
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean gravel (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm	
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW		2.00 to 4.75 0.425 to 2.00 0.075 to 0.425
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	Material
			SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7		
					Sand	Coarse Medium Fine		
					Silt or Clay			
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity		Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19			
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					
		OL	Organic silts and organic silty clays of low plasticity					
	Silts and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts					
		CH	Inorganic clays of high plasticity, fat clays					
		OH	Organic clays of medium to high plasticity, organic silts					
	Highly Organic Soils	Pt	Peat and other highly organic soils			Von Post Classification Limit	Strong colour or odour, and often fibrous texture	

* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)	▽ Water Level at Time of Drilling
PL - Plastic Limit (%)	▼ Water Level at End of Drilling
PI - Plasticity Index (%)	▽ Water Level After Drilling as Indicated on Test Hole Logs
MC - Moisture Content (%)	
SPT - Standard Penetration Test	
RQD- Rock Quality Designation	
Qu - Unconfined Compression	
Su - Undrained Shear Strength	
VW - Vibrating Wire Piezometer	
SI - Slope Incliner	

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>Undrained Shear Strength (kPa)</u>
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200



Sub-Surface Log

Test Hole TH17-24

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Killarney Ave Location: UTM N-5516912, E-632769
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)					Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	20	40	60	80	100	0	50	100	150
0.00 - 0.05		ASPHALT - 51 mm thick																		
0.05 - 0.10		CONCRETE - 178 mm thick																		
0.10 - 0.40		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G	G186																
0.40 - 0.90		CLAY (FILL) - silty, sandy, trace silt inclusions (<5mm diameter), trace gravel (<19mm diameter) - brown - frozen, moist and soft when thawed - intermediate plasticity	G	G187																
0.90 - 1.80		CLAY - silty, trace silt inclusions (<5mm diameter) - brown - moist, stiff - high plasticity	G	G188																
1.80 - 2.90		- firm below 1.8 m	G	G189																
			G	G190																
			G	G191																
			G	G192																
			G	G193																

END OF HOLE AT DEPTH 2.9 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 160.0 m East of Pembina Hwy and Killarney Ave intersection, 1.1 m South from Westbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS 2018-01-23 LOCAL STREETS 18-R-03 KILLARNEY 0035-058-00.0.B.NM.GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-25

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Killarney Ave Location: UTM N-5516863, E-632670
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.0 - 0.1	[Concrete Symbol]	CONCRETE - 203 mm thick																
0.1 - 0.5	[Sand Symbol]	SAND (Fill) - gravelly, trace silt, trace clay, - orange - frozen, moist and compact when thawed - poorly graded, fine sand to medium sand, - no to low plasticity	G194															
0.5 - 1.0	[Clay Symbol]	CLAY (Fill) - silty, trace silt inclusions (<5 mm diameter), trace sand, trace gravel (<10 mm diameter), trace organics - reddish brown - moist, stiff - high plasticity	G195															
1.0 - 1.5	[Clay Symbol]		G196															
1.5 - 2.0	[Clay Symbol]		G197															
2.0 - 2.5	[Clay Symbol]	- mottled brown and black, trace organics, hydrocarbon like odor at 1.8 m	G198															
2.5 - 3.0	[Clay Symbol]	CLAY - silty - mottled brown and grey - moist, firm - high plasticity - firm below 2.6 m	G199															
			G200															
			G201															

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 58.0 m East of Pembina Hwy and Killarney Ave intersection, 1.3 m South from Westbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-01-23 LOCAL STREETS 18-R-03 KILLARNEY 0035-058-00 0_B_NM.GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-26

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Killarney Ave Location: UTM N-5516874, E-632717
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL — MC — LL											
					0	20	40	60	80	100	0	50	100	150	200	250
											<input checked="" type="checkbox"/> Pocket Pen. <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> Torvane <input type="checkbox"/> <input checked="" type="checkbox"/> Qu <input checked="" type="checkbox"/> <input type="checkbox"/> Field Vane <input type="checkbox"/>					
0.00 - 0.05		ASPHALT - 51 mm thick														
0.05 - 0.10		CONCRETE - 203 mm thick														
0.10 - 0.40		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G202													
0.40 - 0.75		CLAY (FILL) - silty, trace silt inclusions (<5 mm diameter), trace sand, trace gravel (<10 mm diameter) - mottled brown, dark grey - frozen, moist and soft when thawed - intermediate plasticity	G203													
0.75 - 1.00		CLAY (FILL) - silty, trace silt inclusions (<5 mm diameter) - mottled brown, dark grey - frozen, moist and soft when thawed - intermediate plasticity	G204													
1.00 - 1.50		CLAY - silty, trace silt inclusions (<5 mm diameter) - brown - moist, stiff - high plasticity	G205													
1.50 - 2.00			G206													
2.00 - 2.50			G207													
2.50 - 3.00		- firm below 2.0 m	G208													
3.00			G209													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 110.0 m East of Pembina Hwy and Killarney Ave intersection, 1.8 m North from Eastbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS 2018-01-23 LOCAL STREETS 18-R-03 KILLARNEY 0035-058-00 0_B_NM.GPJ TREK GEOTECHNICAL GDT 18-1-30



Sub-Surface Log

Test Hole TH17-27

1 of 1

Client: Morrison Hershfield Project Number: 0035-058-00
 Project Name: Local Streets 18-R-03 - Killarney Ave Location: UTM N-5516920, E-632793
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 13

Sample Type: Grab (G) Shelby Tube (T) Split Spoon (SS) Split Barrel (SB) Core (C)

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					0	20	40	60	80	100	0	50	100	150	200	250
0.00 - 0.06		ASPHALT - 64 mm thick														
0.06 - 0.25		CONCRETE - 191 mm thick														
0.25 - 0.35		SAND (Fill) - silty, gravelly, some clay, light brown to grey, frozen, moist and compact when thawed, poorly graded, sub-angular to angular gravel, low plasticity	G210													
0.35 - 0.45		CLAY (FILL) - silty, trace sand - brown - frozen, moist and soft when thawed - intermediate plasticity	G211													
0.45 - 0.75		CLAY - silty, trace sand, trace silt inclusions (<5 mm diameter) - brown - moist, stiff to very stiff - high plasticity	G212													
0.75 - 1.00			G213													
1.00 - 1.25			G214													
1.25 - 1.50		SILT - some clay - light brown - moist, soft - low plasticity	G215													
1.50 - 2.00		CLAY - silty, trace silt inclusions (<5mm diameter) - brown - moist, stiff - high plasticity	G216													
2.00 - 2.50			G217													

END OF HOLE AT DEPTH 3.0 m IN CLAY

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 10.0 m West of Baylor Ave and Killarney Ave intersection, 2.2 m North from Eastbound curb.

Logged By: Devon Adamson Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

SUB-SURFACE LOG - LOGS 2018-01-23 LOCAL STREETS 18-R-03 KILLARNEY_0035-058-00_0_B_NM.GPJ TREK GEOTECHNICAL GDT 18-130



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Kilarney

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-24	TH17-24	TH17-24	TH17-24	TH17-24	TH17-24
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G186	G187	G188	G189	G190	G191
Tare ID	H17	E70	N82	D40	F74	F151
Mass of tare	8.4	8.8	8.4	8.2	8.8	8.6
Mass wet + tare	324.8	258.4	380.6	251.8	321.2	281.8
Mass dry + tare	276.2	176.6	298.0	180.8	223.6	191.6
Mass water	48.6	81.8	82.6	71.0	97.6	90.2
Mass dry soil	267.8	167.8	289.6	172.6	214.8	183.0
Moisture %	18.1%	48.7%	28.5%	41.1%	45.4%	49.3%

Test Pit	TH17-24	TH17-24	TH17-25	TH17-25	TH17-25	TH17-25
Depth (m)	2.0 - 2.1	2.7 - 2.9	0.2 - 0.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1
Sample #	G192	G193	G194	G195	G196	G197
Tare ID	AC35	AA11	E23	P03	AB39	Z22
Mass of tare	6.6	6.8	8.6	8.8	6.7	8.3
Mass wet + tare	301.8	287	335.9	557.1	310.7	323.1
Mass dry + tare	202.8	190.0	284.1	527.2	293.7	252.8
Mass water	99.0	97.0	51.8	29.9	17.0	70.3
Mass dry soil	196.2	183.2	275.5	518.4	287.0	244.5
Moisture %	50.5%	52.9%	18.8%	5.8%	5.9%	28.8%

Test Pit	TH17-25	TH17-25	TH17-25	TH17-25	TH17-26	TH17-26
Depth (m)	1.2 - 1.4	1.7 - 1.8	2.0 - 2.1	2.6 - 2.7	0.2 - 0.3	0.3 - 0.5
Sample #	G198	G199	G200	G201	G202	G203
Tare ID	N48	D45	W40	W80	N56	AB53
Mass of tare	8.5	8.4	8.4	8.5	8.7	6.7
Mass wet + tare	342.9	306.9	330.2	305.9	366.5	301.9
Mass dry + tare	254.9	228.2	232.2	212.5	315.9	208.0
Mass water	88.0	78.7	98.0	93.4	50.6	93.9
Mass dry soil	246.4	219.8	223.8	204.0	307.2	201.3
Moisture %	35.7%	35.8%	43.8%	45.8%	16.5%	46.6%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Kilarney

Sample Date 11-Dec-17
Test Date 28-Dec-17
Technician LI/DS

Test Pit	TH17-26	TH17-26	TH17-26	TH17-26	TH17-26	TH17-26
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	2.0 - 2.1	2.7 - 2.9
Sample #	G204	G205	G206	G207	G208	G209
Tare ID	AC33	W83	F91	F85	E11	AC38
Mass of tare	6.7	8.5	8.3	8.6	8.5	6.7
Mass wet + tare	307.4	320.4	321.2	308.6	339.2	328.5
Mass dry + tare	228.3	241.1	246.2	239.2	233.8	214.2
Mass water	79.1	79.3	75.0	69.4	105.4	114.3
Mass dry soil	221.6	232.6	237.9	230.6	225.3	207.5
Moisture %	35.7%	34.1%	31.5%	30.1%	46.8%	55.1%

Test Pit	TH17-27	TH17-27	TH17-27	TH17-27	TH17-27	TH17-27
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G211	G212	G213	G214	G215	G216
Tare ID	W34	W04	F126	AB47	Z88	Z96
Mass of tare	8.4	8.4	8.4	6.6	8.4	8.6
Mass wet + tare	210.8	389.2	282.0	281.0	293.0	303.6
Mass dry + tare	146.4	295.0	214.6	208.0	215.8	213.8
Mass water	64.4	94.2	67.4	73.0	77.2	89.8
Mass dry soil	138.0	286.6	206.2	201.4	207.4	205.2
Moisture %	46.7%	32.9%	32.7%	36.2%	37.2%	43.8%

Test Pit	TH17-27					
Depth (m)	2.7 - 2.9					
Sample #	G217					
Tare ID	D19					
Mass of tare	8.6					
Mass wet + tare	306.8					
Mass dry + tare	208.8					
Mass water	98.0					
Mass dry soil	200.2					
Moisture %	49.0%					



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Atterberg Limits
ASTM D4318-10e1

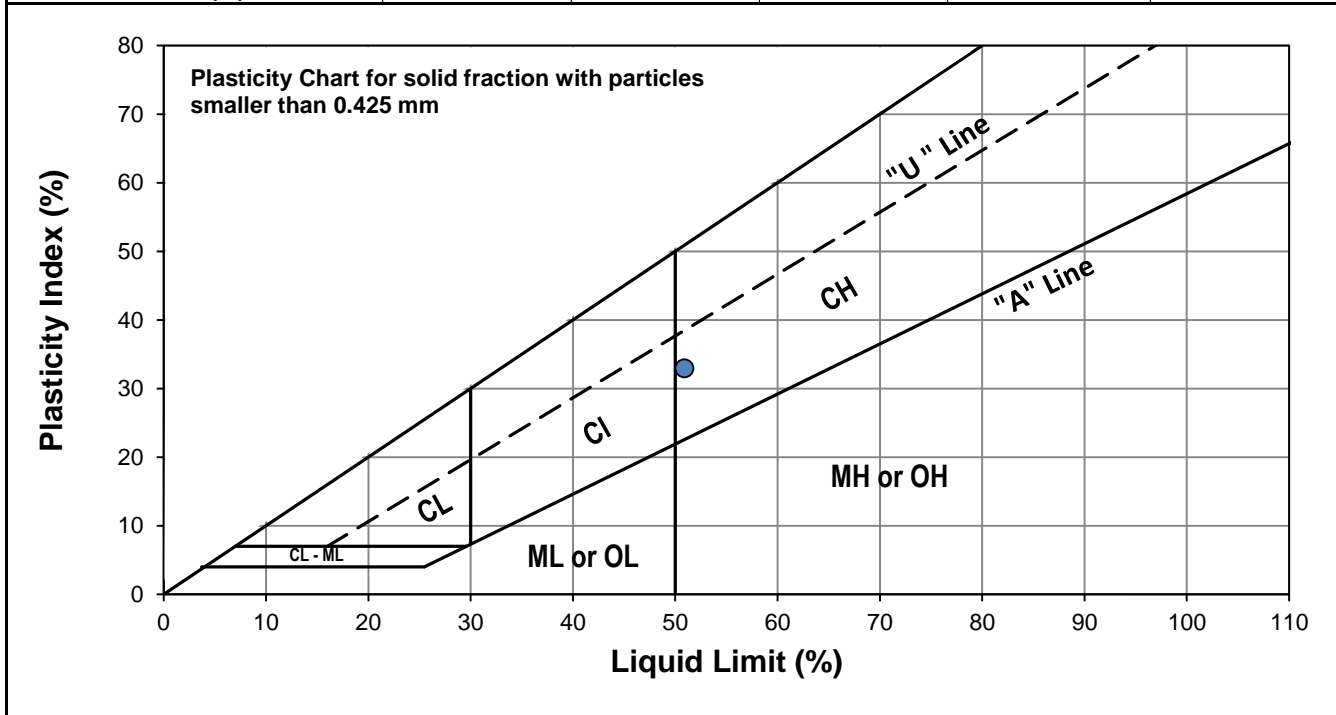
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Kilarney

Test Hole TH17-24
Sample # G188
Depth (m) 0.8 - 0.9
Sample Date 14-Dec-17
Test Date 06-Jan-18
Technician JB

Liquid Limit	51
Plastic Limit	18
Plasticity Index	33

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	21	27	35
Mass Wet Soil + Tare (g)	21.747	21.823	20.659
Mass Dry Soil + Tare (g)	19.167	19.317	18.488
Mass Tare (g)	14.149	14.361	14.159
Mass Water (g)	2.580	2.506	2.171
Mass Dry Soil (g)	5.018	4.956	4.329
Moisture Content (%)	51.415	50.565	50.150



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	16.263	17.721			
Mass Wet Soil + Tare (g)	15.951	17.169			
Mass Dry Soil + Tare (g)	14.239	14.065			
Mass Water (g)	0.312	0.552			
Mass Dry Soil (g)	1.712	3.104			
Moisture Content (%)	18.224	17.784			



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ASTM D4318-10e1

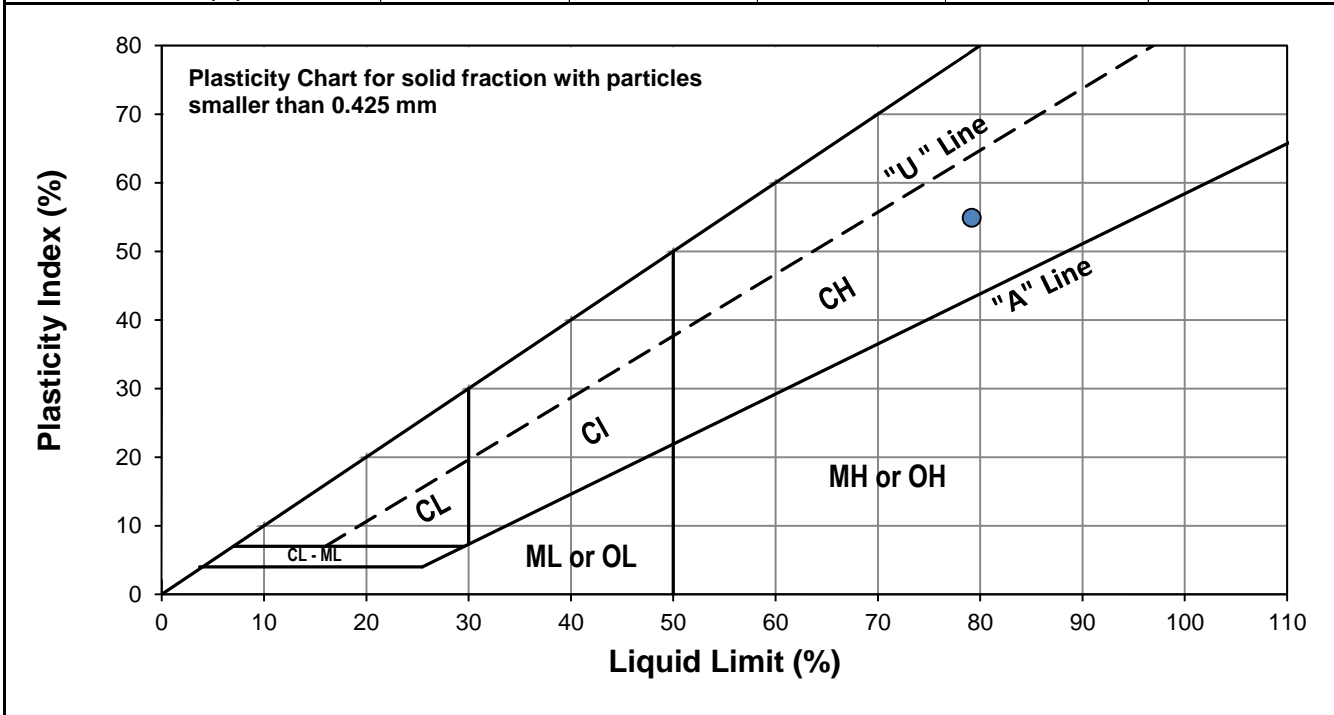
Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Kilarney

Test Hole TH17-27
Sample # G212
Depth (m) 0.6 - 0.8
Sample Date 14-Dec-17
Test Date 06-Jan-18
Technician JB

Liquid Limit	79
Plastic Limit	24
Plasticity Index	55

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	24	35
Mass Wet Soil + Tare (g)	21.333	21.511	20.798
Mass Dry Soil + Tare (g)	18.158	18.288	17.827
Mass Tare (g)	14.244	14.224	13.995
Mass Water (g)	3.175	3.223	2.971
Mass Dry Soil (g)	3.914	4.064	3.832
Moisture Content (%)	81.119	79.306	77.531



Plastic Limit

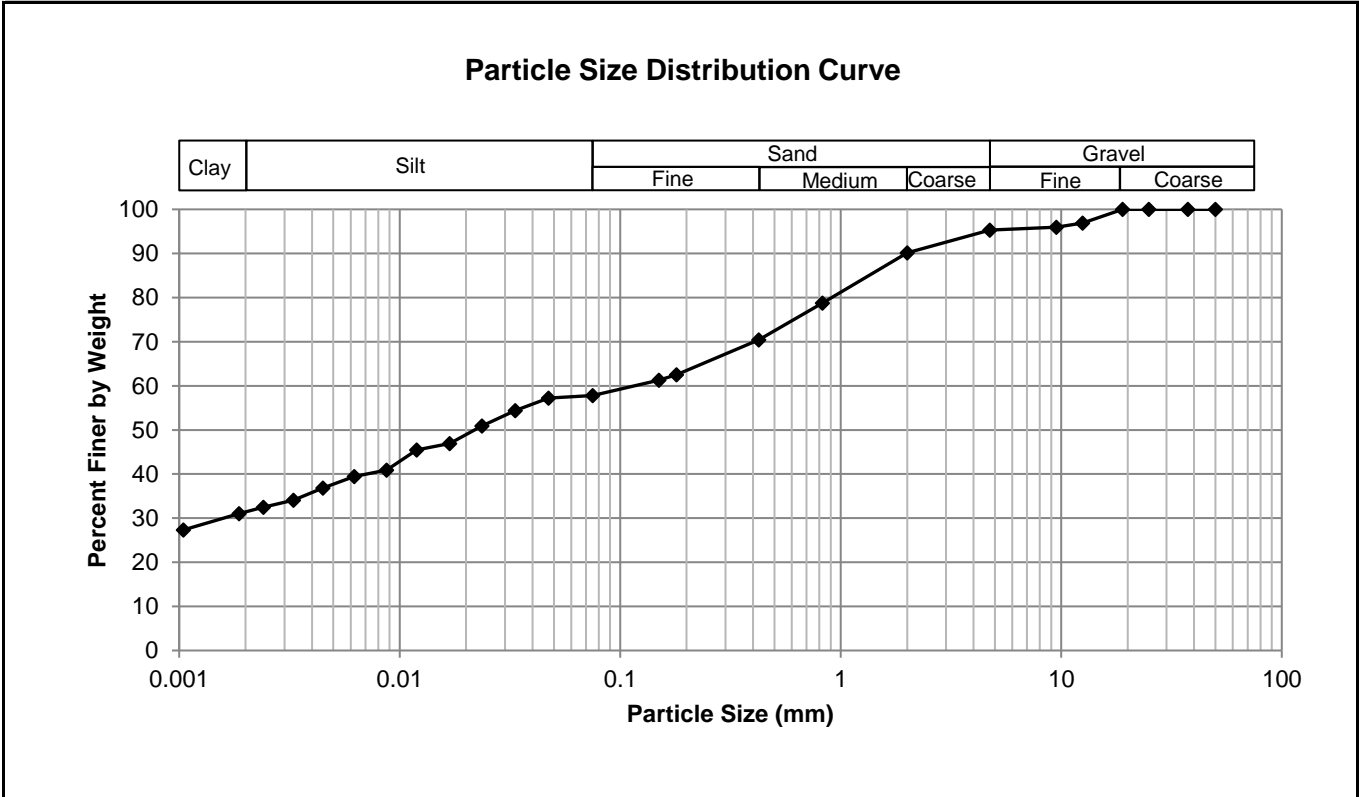
Trial #	1	2	3	4	5
Mass Tare (g)	16.458	16.565			
Mass Wet Soil + Tare (g)	15.992	16.084			
Mass Dry Soil + Tare (g)	14.038	14.140			
Mass Water (g)	0.466	0.481			
Mass Dry Soil (g)	1.954	1.944			
Moisture Content (%)	23.849	24.743			



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Kilarney

Test Hole TH17-24
Sample # G188
Depth (m) 0.8 - 0.9
Sample Date 14-Dec-17
Test Date 3-Jan-18
Technician LI/DS

Gravel	4.7%
Sand	37.5%
Silt	26.4%
Clay	31.4%



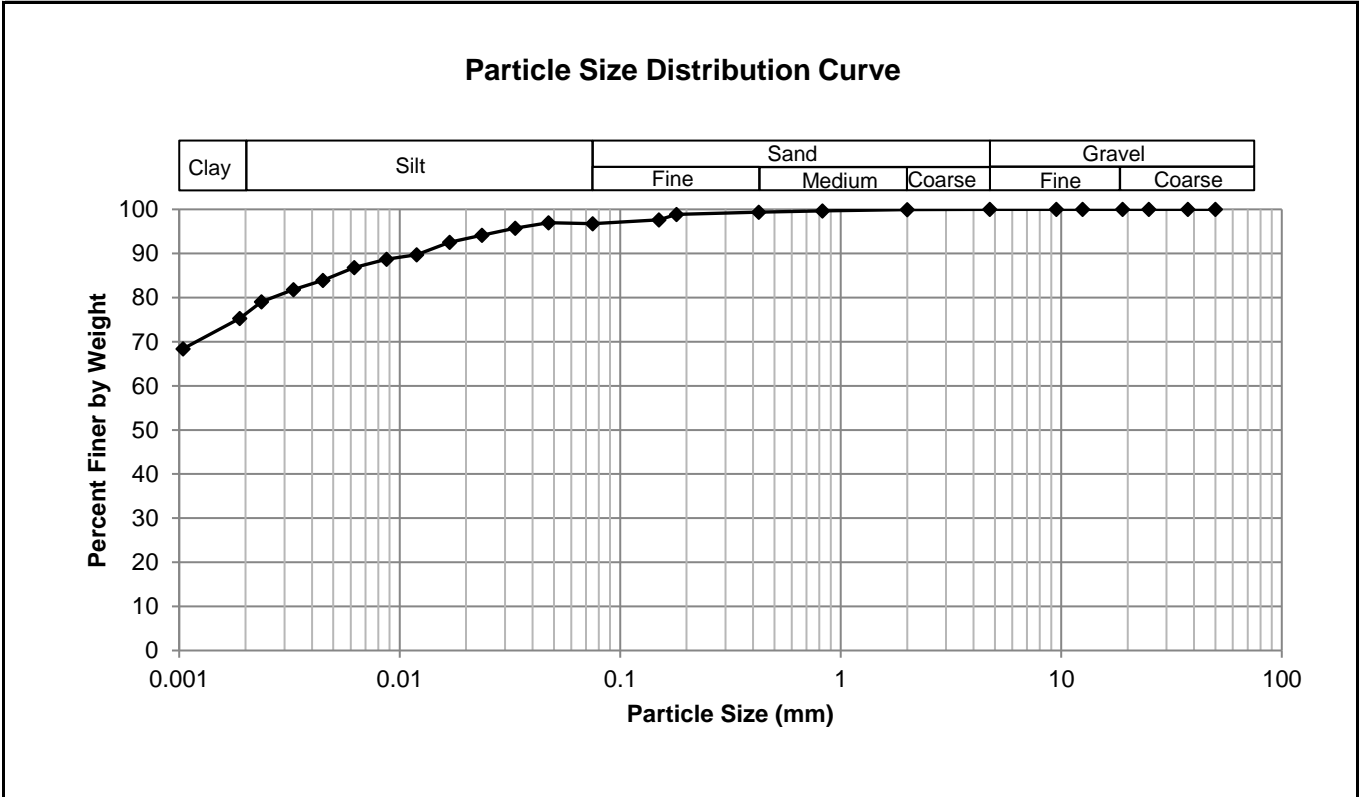
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	95.33	0.0750	57.81
37.5	100.00	2.00	90.18	0.0473	57.24
25.0	100.00	0.825	78.80	0.0334	54.37
19.0	100.00	0.425	70.40	0.0236	50.93
12.5	96.90	0.180	62.48	0.0169	46.92
9.50	95.93	0.150	61.31	0.0119	45.49
4.75	95.33	0.075	57.81	0.0087	40.91
				0.0062	39.42
				0.0045	36.85
				0.0033	34.11
				0.0024	32.49
				0.0019	31.05
				0.0010	27.33



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets 18-R-03 - Kilarney

Test Hole TH17-27
Sample # G212
Depth (m) 0.6 - 0.8
Sample Date 14-Dec-17
Test Date 3-Jan-18
Technician LI/DS

Gravel	0.0%
Sand	3.3%
Silt	20.5%
Clay	76.2%



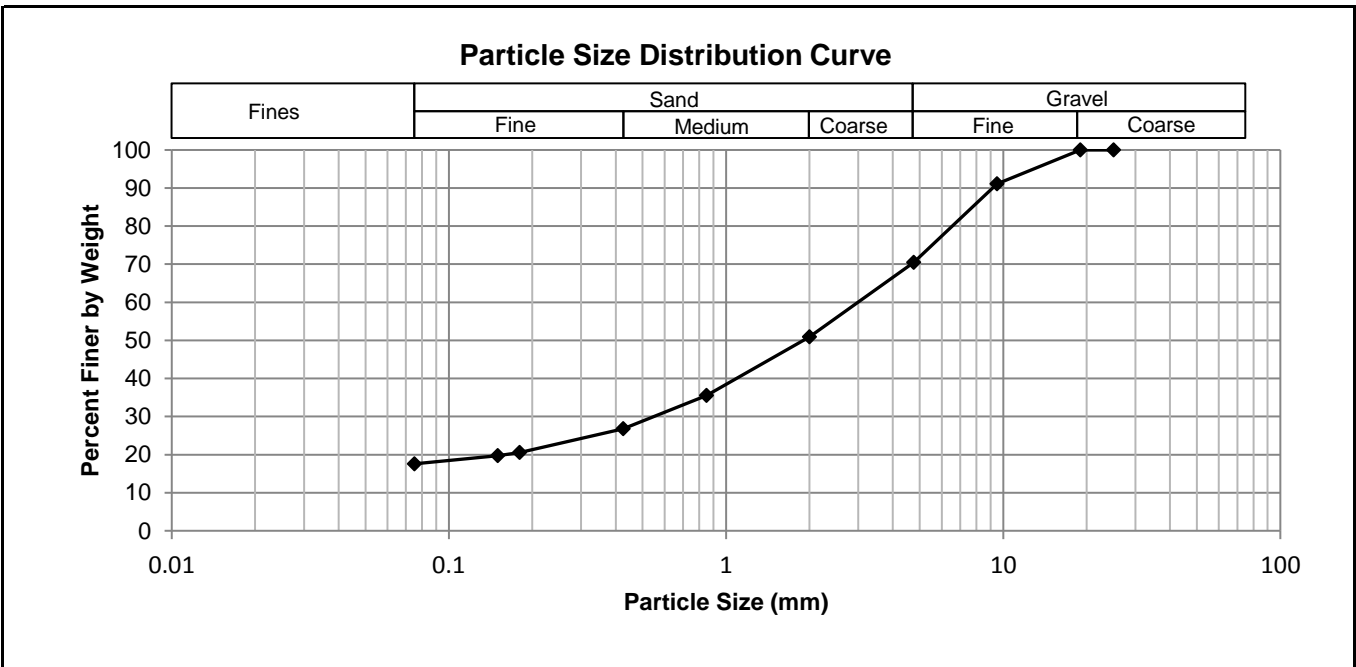
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	96.74
37.5	100.00	2.00	99.94	0.0473	96.99
25.0	100.00	0.825	99.67	0.0334	95.72
19.0	100.00	0.425	99.35	0.0236	94.13
12.5	100.00	0.180	98.89	0.0169	92.55
9.50	100.00	0.150	97.59	0.0119	89.69
4.75	100.00	0.075	96.74	0.0087	88.74
				0.0062	86.83
				0.0045	83.92
				0.0033	81.84
				0.0024	79.08
				0.0019	75.27
				0.0010	68.40



Project No. 0035-058-00
Client Morrison Hershfield
Project Local Streets - 18-R-03 - Kilarney

Test Hole TH17-25
Sample # G195
Depth (m) 0.3 - 0.5
Date Sampled 14-Dec-17
Date Tested 6-Jan-18
Technician DS/SX

Total Weight (g)	399.5
Gravel %	29.6
Sand %	52.8
Fines %	17.6



Sieve Number	Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
6"	150		
5"	125		
4"	100		
3"	75.0		
2"	50.0		
1 1/2"	37.5		
1"	25.0	100	
3/4"	19.0	100	
5/8"	16.0		
1/2"	12.5		
3/8"	9.50	91	
no. 4	4.75	70	
no. 10	2.00	51	
no. 20	0.850	36	
no. 40	0.425	27	
no. 80	0.180	21	
no. 100	0.150	20	
no. 200	0.075	18	



Photo 1: Pavement Core Sample at Test Hole TH17-24



Photo 2: Pavement Core Sample at Test Hole TH17-25



Photo 3: Pavement Core Sample at Test Hole TH17-26



Photo 4: Pavement Core Sample at Test Hole TH17-27