

APPENDIX 'A'

GEOTECHNICAL REPORT



Quality Engineering | Valued Relationships

WSP Canada Group Winnipeg
20-R-05 Local Street Renewals

Prepared for:

WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B
Attention: Lissa VanDorp, P.Eng.

Project Number:

1000 043 10 400

Date:

March 2, 2020
Final Report



Quality Engineering | Valued Relationships

March 2, 2020

Our File No. 1000 043 10 400

Lissa VanDorp, P.Eng.
WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B

**RE: Road Investigation Report for
20-R-05 Local Street Renewals**

TREK Geotechnical Inc. is pleased to submit our report for the road investigations for the 20-R-05 Local Street Renewals project.

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 "Nelson John Ferreira".

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


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

Revision History

Revision No.	Author	Issue Date	Description
1	AFK	March 2, 2020	Final Report

Authorization Signatures

Prepared By:


Angela Fidler-Kliwer, C. Tech
Manager of Laboratory and Field Services



Reviewed By:

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



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- Appendix B Test Hole Logs, Summary Table & Lab Testing Results and Pavement Core Photos – Fluery Place
- Appendix C Test Hole Logs, Summary Table & Lab Testing Results and Pavement Core Photos – Rosewarne Ave
- Appendix D Summary Table and Photographs of Pavement Core Samples – Oakridge Bay
- Appendix E Summary Table and Photographs of Pavement Core Samples – Drake Blvd.

1.0 Introduction

This report summarizes the results of the road investigation completed for the 20-R-05 Local Street Renewal project. The test holes were completed along Rosewarne Ave, Fluery Place and Blackwater Bay. Additional pavement core samples were also taken along Oakridge Bay and Drake Blvd. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure at the test hole locations.

2.0 Road Investigation and Laboratory Program

The investigation included coring of pavement and drilling of test holes. The investigation locations are shown on Figure 01 through Figure 08 (attached) and Table 1 below summarizes the investigation program per street.

Table 1 – Road Investigation Program

Street	# of Locations	Investigation
Rosewarne Ave – Kingston Row to St. Mary’s Road	5	Pavement Cores and Test Holes
Fluery Place – Fontaine Cres. To Fontaine Cres.	4	Pavement Cores and Test Holes
Blackwater Bay – Charing Cross Cres. To Blackwater Bay.	3	Pavement Cores and Test Holes
Oakridge Bay – Metz St. to Metz St.	6	Pavement Cores Only
Drake Blvd. – Autumnwood Dr. to Cottonwood Rd.	8	Pavement Cores Only
Blackwater Bay – Charing Cross Cres. To Blackwater Bay	6	Pavement Cores Only

The road investigation was conducted between January 15, 2020 and January 28, 2020. The pavement structure (asphalt and/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 test holes were drilled to a depth of 3.0 m below road surface by Maple Leaf Drilling Ltd. using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. The sub-surface conditions were observed during drilling and visually classified by Nuno Mendonca of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples and bulk 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. Retrieving core samples were not possible at some locations along Rosewarne (3) due to the poor condition of the concrete where the concrete broke down and crumbled.

The laboratory testing program consisted of moisture content determination on all samples, as well as 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 (Appendices A through C). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, and photos of the concrete cores. A summary table and asphalt and concrete pavement core photographs are included in Appendices D and E.

Core and test hole locations noted on the summary tables and test hole logs are based on UTM coordinates obtained using a hand-held GPS and their location relative to the nearest address, and measured distance 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.

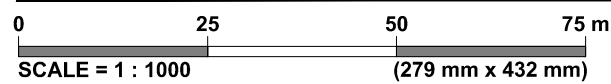
All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and 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 WSP Canada Group (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 B (11.00 x 17.00 inches)

Z:\Projects\1000 Soils Lab\Lab Projects\1000-043 WSP\1000-043-10 Local Streets and Alleys\3 Survey and Dwg\3.4 CAD\3.4.3 Working Folder\20.02.13 TH LOCATIONS -BLACKWATER_OAKRIDGE.dwg, 3/2/2020 12:56:34 PM



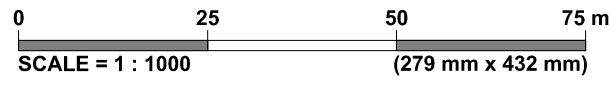
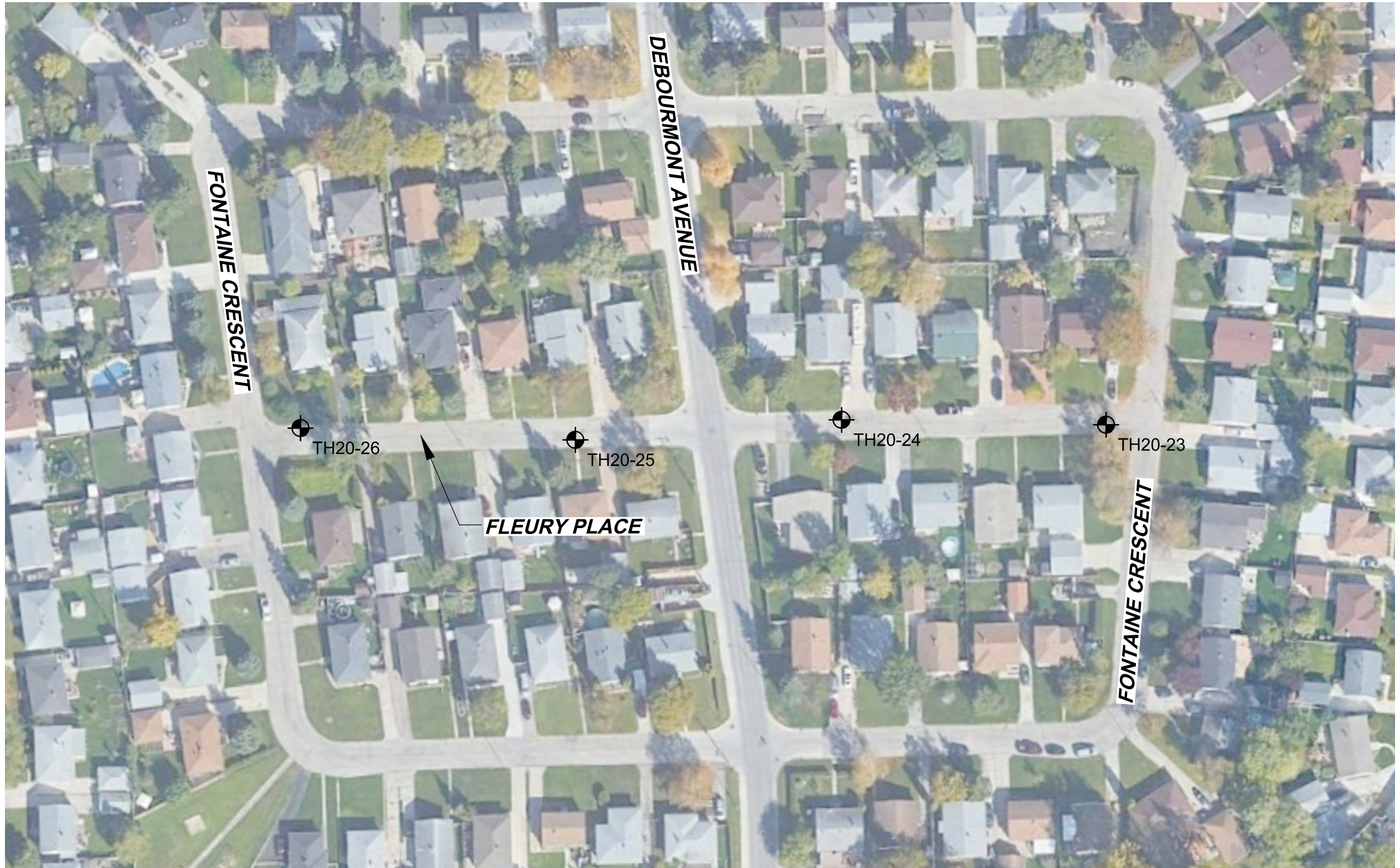
LEGEND:
 TEST HOLE (TREK, 2020)
 PAVEMENT CORE (TREK, 2020)

NOTES:
 1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
 2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 01
TEST HOLE & PAVEMENT CORE LOCATION PLAN

ANSI full bleed B (11.00 x 17.00 inches)

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LEGEND:  TEST HOLE (TREK, 2020)

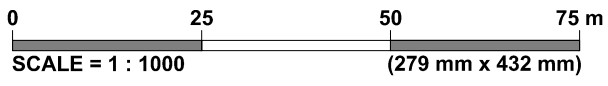
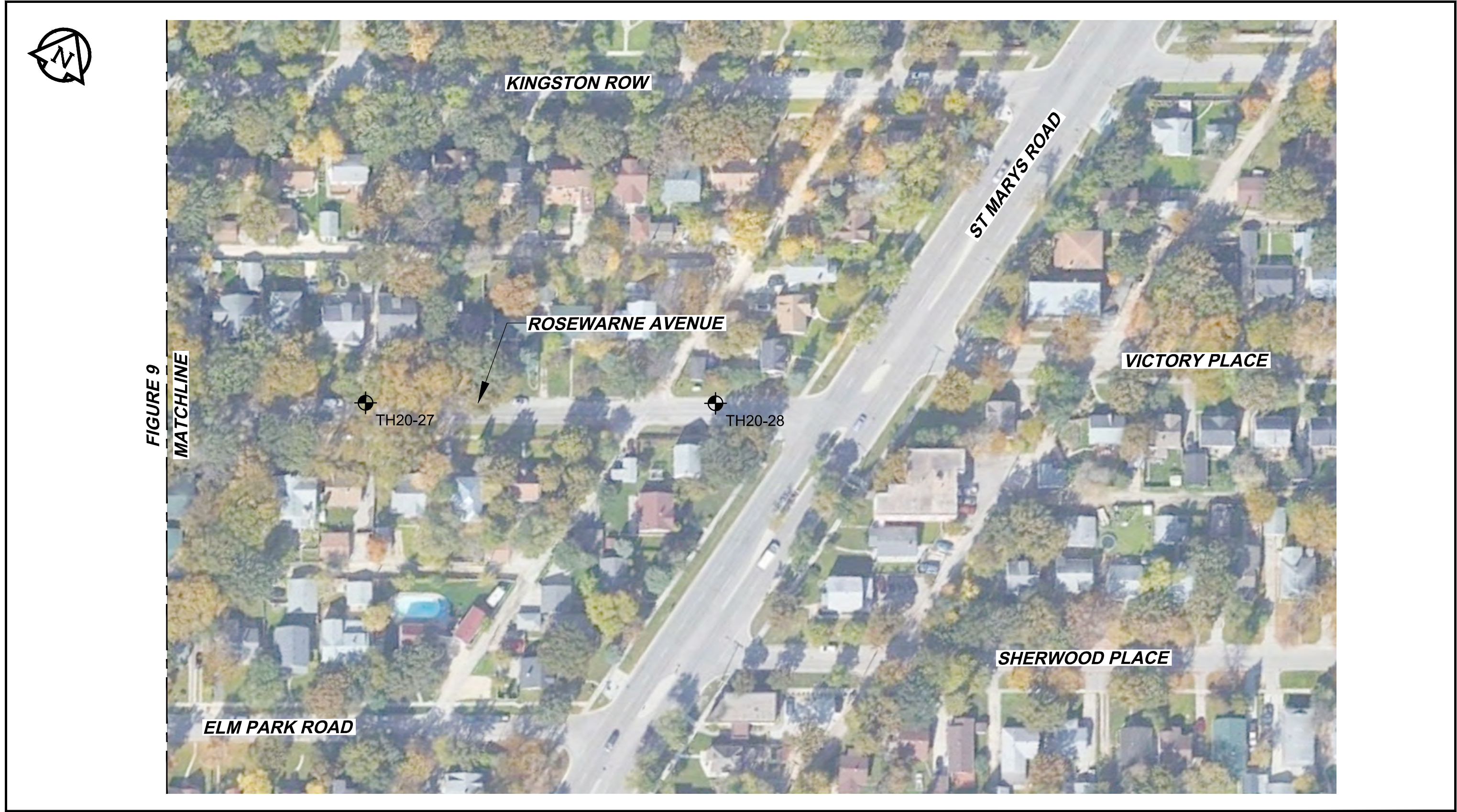
NOTES:

1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 02
TEST HOLE LOCATION PLAN

ANSI full bleed B (11.00 x 17.00 inches)

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LEGEND: TEST HOLE (TREK, 2020)

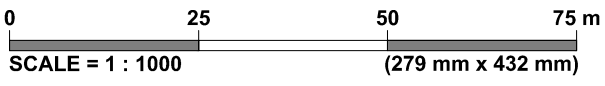
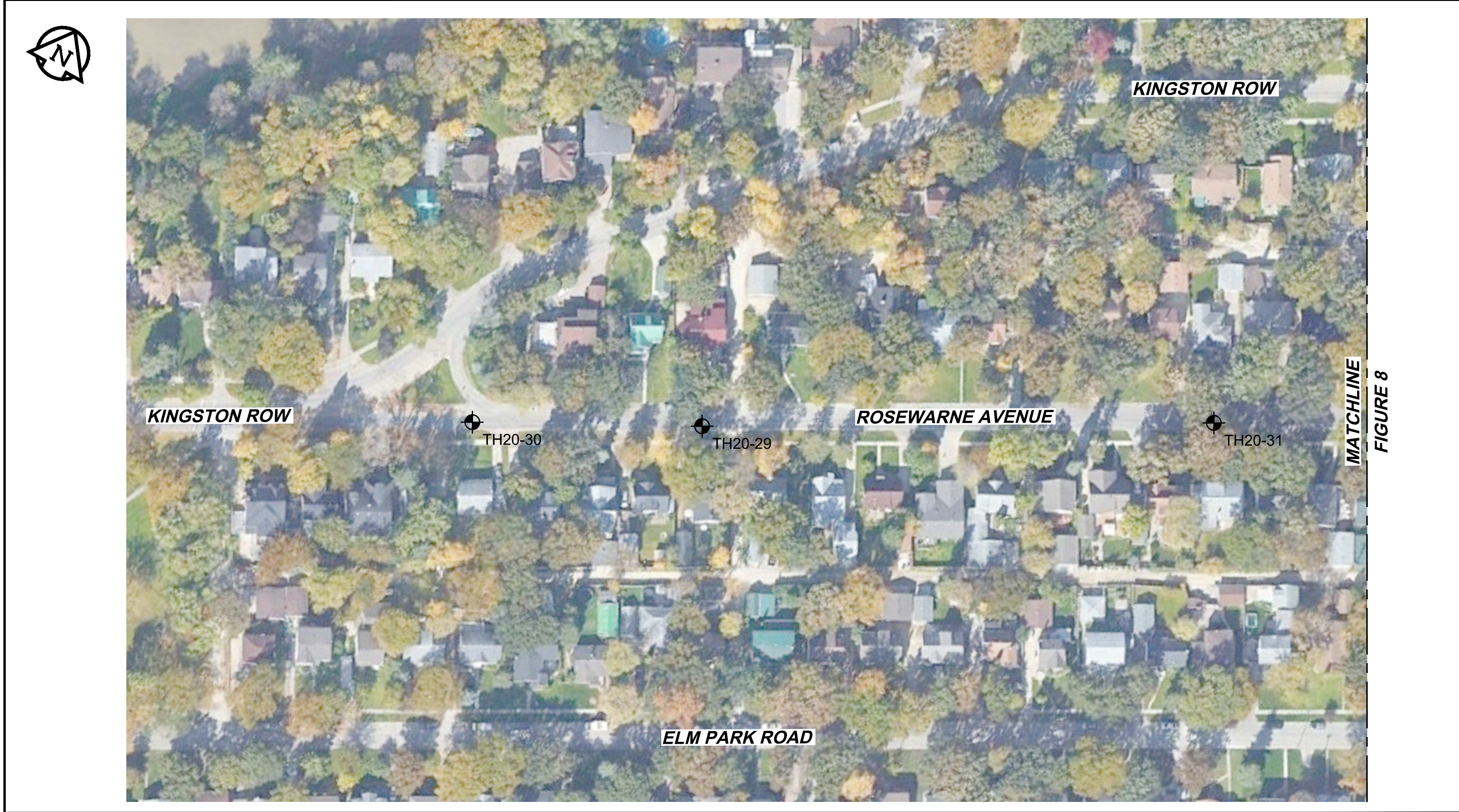
NOTES:

1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 03
TEST HOLE LOCATION PLAN

ANSI full bleed B (11.00 x 17.00 inches)

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LEGEND: TEST HOLE (TREK, 2020)

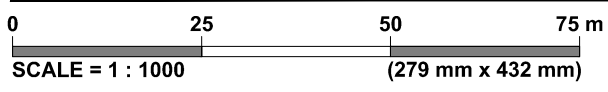
NOTES:

1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 04
TEST HOLE LOCATION PLAN

ANSI full bleed B (11.00 x 17.00 inches)

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LEGEND:  PAVEMENT CORE (TREK, 2020)

NOTES:

1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

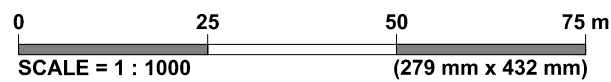
Figure 05
PAVEMENT CORE LOCATION PLAN

ANSI full bleed B (11.00 x 17.00 inches)

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FIGURE 12



LEGEND:  PAVEMENT CORE (TREK, 2020)

NOTES:

1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 06
PAVEMENT CORE LOCATION PLAN

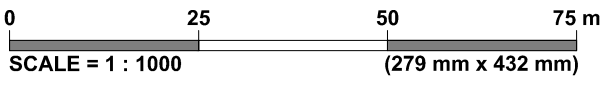
ANSI full bleed B (11.00 x 17.00 inches)

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FIGURE 11

FIGURE 13



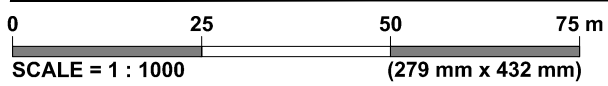
LEGEND: PAVEMENT CORE (TREK, 2020)

NOTES: 1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 07
PAVEMENT CORE LOCATION PLAN

ANSI full bleed B (11.00 x 17.00 inches)

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LEGEND: PAVEMENT CORE (TREK, 2020)

NOTES:

1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 08
PAVEMENT CORE LOCATION PLAN

Appendix A

Blackwater Bay

**Test Hole Logs, Summary Table, Lab Testing
Results and Pavement Core Photos**

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 #10 to #4 #40 to #10 #200 to #40 < #200			
		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				
	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		
			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			
			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		Material Sand Coarse Medium Fine Silt or Clay
						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 TH20-20

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Blackwater Bay) Location: UTM N-5519283, E-636343
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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						
					Particle Size (%)											
					0	20	40	60	80	100						
					PL MC LL 0 20 40 60 80 100						Test Type △ Torvane △ ⊕ Pocket Pen. ⊕ ⊗ Qu ⊗ ○ Field Vane ○					
					0	20	40	60	80	100	0	50	100	150	200	250
0.0 - 0.1		CONCRETE - 160 mm thick														
0.1 - 0.5		SAND (FILL) - silty, gravelly, some silt, trace clay, trace concrete debris, brown, frozen, moist compact when thawed poorly graded sand to gravel (<25 mm diam.), angular crushed limestone	▲	G141												
0.5 - 1.1		CLAY - silty, trace sand, trace organics - black, - frozen to 1.4 m depth, moist firm to stiff when thawed - high plasticity	▲	G142												
1.1 - 1.5		- no organics, grey below 1.1 m	▲	G143												
1.5 - 2.0			▲	G144												
2.0 - 2.5			▲	G145												
2.5 - 2.9			▲	G146												
2.9 - 3.0		- trace oxidation at 2.9 m	▲	G147												

END OF TEST HOLE AT 3.0 m IN CLAY
 1) No seepage or sloughing observed.
 2) Test hole open to 2.9 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located 76 m North and 1.8 m East of Blackwater Bay and Charing cross intersection (side of #78 at Backwater Bay).

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS 1000-043-10 0.0 A NM BLACKWATER BAY GPJ TREK GEOTECHNICAL GDT 2/28/20



Sub-Surface Log

Test Hole TH20-21

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Blackwater Bay) Location: UTM N-5519258, E-636353
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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	
0.0		CONCRETE - 160 mm thick									
0.0		SAND (FILL) - silty, gravelly, some silt, trace clay, trace concrete debris, brown, frozen, moist compact when thawed poorly graded sand to gravel (<25 mm diam.), angular crushed limestone	G148								
0.5		CLAY - silty - grey - frozen to 1.5 m depth, moist and firm to stiff when thawed - high plasticity	G149								
0.8			G150								
1.0			G151								
1.5			G152								
2.0		- trace silt inclusions (<10 mm diam.)	G153								
3.0			G156								

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed.
- 2) Test hole open to 3.0 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located 46 m North and 2 m West of Charing Crossing Crescent and Blackwater Bay intersection (side of #84 Blackwater Bay garage).

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS 1000-043-10 0.0 A NM BLACKWATER BAY GPJ TREK GEOTECHNICAL GDT 2/28/20



Sub-Surface Log

Test Hole TH20-22

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Blackwater Bay) Location: UTM N-5519240, E-636367
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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						
0.0 - 0.1		CONCRETE - 170 mm thick															
0.1 - 0.4		SAND (FILL) - silty, gravelly, some silt, trace clay, trace concrete debris, brown, frozen, moist compact when thawed poorly graded sand to gravel (<25 mm diam.), angular crushed limestone	<input checked="" type="checkbox"/>	G157													
0.4 - 1.4		CLAY - silty, trace sand - grey - frozen to 1.4 m depth, moist and soft to firm when thawed - high plasticity	<input checked="" type="checkbox"/>	G158													
0.4 - 1.1		- no sand, firm to stiff below 1.1 m	<input checked="" type="checkbox"/>	G159													
1.1 - 1.4		- dark brown below 1.4 m	<input checked="" type="checkbox"/>	G160													
1.4 - 1.8			<input checked="" type="checkbox"/>	G161													
1.8 - 2.1			<input checked="" type="checkbox"/>	G162													
2.1 - 3.0			<input checked="" type="checkbox"/>	G163													

END OF TEST HOLE AT 3.0 m IN CLAY
 1) No seepage or sloughing observed.
 2) Test hole open to 3.0 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located 16 m North and 2 m East of Charing Cross Crescent and Blackwater Bay intersection.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS 1000-043-10 0.0 A NM BLACKWATER BAY GPJ TREK GEOTECHNICAL GDT 2/28/20



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

Moisture Content Report ASTM D2216-10

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Blackwater Bay

Sample Date 16-Jan-20
Test Date 27-Jan-20
Technician HS

Test Hole	TH20-20	TH20-20	TH20-20	TH20-20	TH20-20	TH20-20
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 #	G141	G142	G143	G144	G145	G146
Tare ID	B1	Z66	E102	Z14	F86	H30
Mass of tare	385.6	8.6	9.4	8.7	8.7	8.5
Mass wet + tare	1837.3	475.3	157.1	180.5	189.3	357.6
Mass dry + tare	1665.4	344.0	115.2	134.3	139.1	245.0
Mass water	171.9	131.3	41.9	46.2	50.2	112.6
Mass dry soil	1279.8	335.4	105.8	125.6	130.4	236.5
Moisture %	13.4%	39.1%	39.6%	36.8%	38.5%	47.6%

Test Hole	TH20-20	TH20-21	TH20-21	TH20-21	TH20-21	TH20-21
Depth (m)	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G147	G148	G149	G150	G151	G152
Tare ID	F451	E5	W44	D47	AB61	AB03
Mass of tare	8.4	8.6	8.5	8.6	6.6	6.8
Mass wet + tare	282.8	152.5	112.0	447.2	194.8	224.3
Mass dry + tare	197.5	133.7	84.2	329.9	143.2	163.4
Mass water	85.3	18.8	27.8	117.3	51.6	60.9
Mass dry soil	189.1	125.1	75.7	321.3	136.6	156.6
Moisture %	45.1%	15.0%	36.7%	36.5%	37.8%	38.9%

Test Hole	TH20-21	TH20-21	TH20-22	TH20-22	TH20-22	TH20-22
Depth (m)	1.7 - 1.8	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G153	G156	G157	G158	G159	G160
Tare ID	F2	E35	W101	H21	F22	F76
Mass of tare	8.5	8.5	8.5	8.5	8.6	8.7
Mass wet + tare	234.1	241.0	227.1	177.9	253.5	208.6
Mass dry + tare	157.8	195.1	195.1	129.2	181.5	148.7
Mass water	76.3	45.9	32.0	48.7	72.0	59.9
Mass dry soil	149.3	186.6	186.6	120.7	172.9	140.0
Moisture %	51.1%	24.6%	17.1%	40.3%	41.6%	42.8%



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Moisture Content Report ASTM D2216-10

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Blackwater Bay

Sample Date 16-Jan-20
Test Date 27-Jan-20
Technician HS

Test Hole	TH20-22	TH20-22	TH20-22			
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.9 - 3.0			
Sample #	G161	G162	G163			
Tare ID	W30	AA10	N80			
Mass of tare	8.4	6.8	8.5			
Mass wet + tare	209.3	317.8	302.2			
Mass dry + tare	149.5	211.8	201.7			
Mass water	59.8	106.0	100.5			
Mass dry soil	141.1	205.0	193.2			
Moisture %	42.4%	51.7%	52.0%			



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Atterberg Limits
ASTM D4318-10e1

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Blackwater Bay

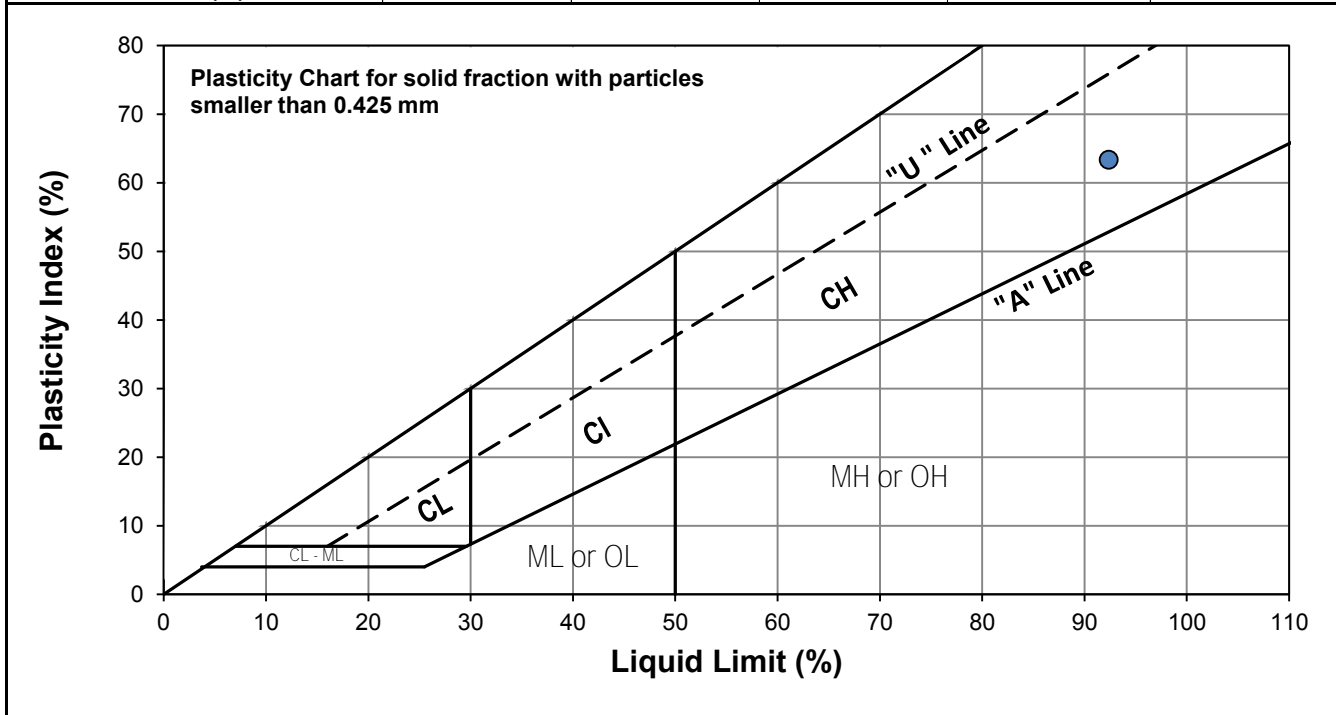


Test Hole TH20-20
Sample # G143
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 9-Feb-20
Technician HS

Liquid Limit	92
Plastic Limit	29
Plasticity Index	63

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	18	28	32
Mass Wet Soil + Tare (g)	25.449	24.449	25.590
Mass Dry Soil + Tare (g)	19.915	19.631	20.214
Mass Tare (g)	14.213	14.288	14.202
Mass Water (g)	5.534	4.818	5.376
Mass Dry Soil (g)	5.702	5.343	6.012
Moisture Content (%)	97.054	90.174	89.421



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.175	14.098			
Mass Wet Soil + Tare (g)	21.403	21.901			
Mass Dry Soil + Tare (g)	19.766	20.156			
Mass Water (g)	1.637	1.745			
Mass Dry Soil (g)	5.591	6.058			
Moisture Content (%)	29.279	28.805			



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Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Blackwater Bay

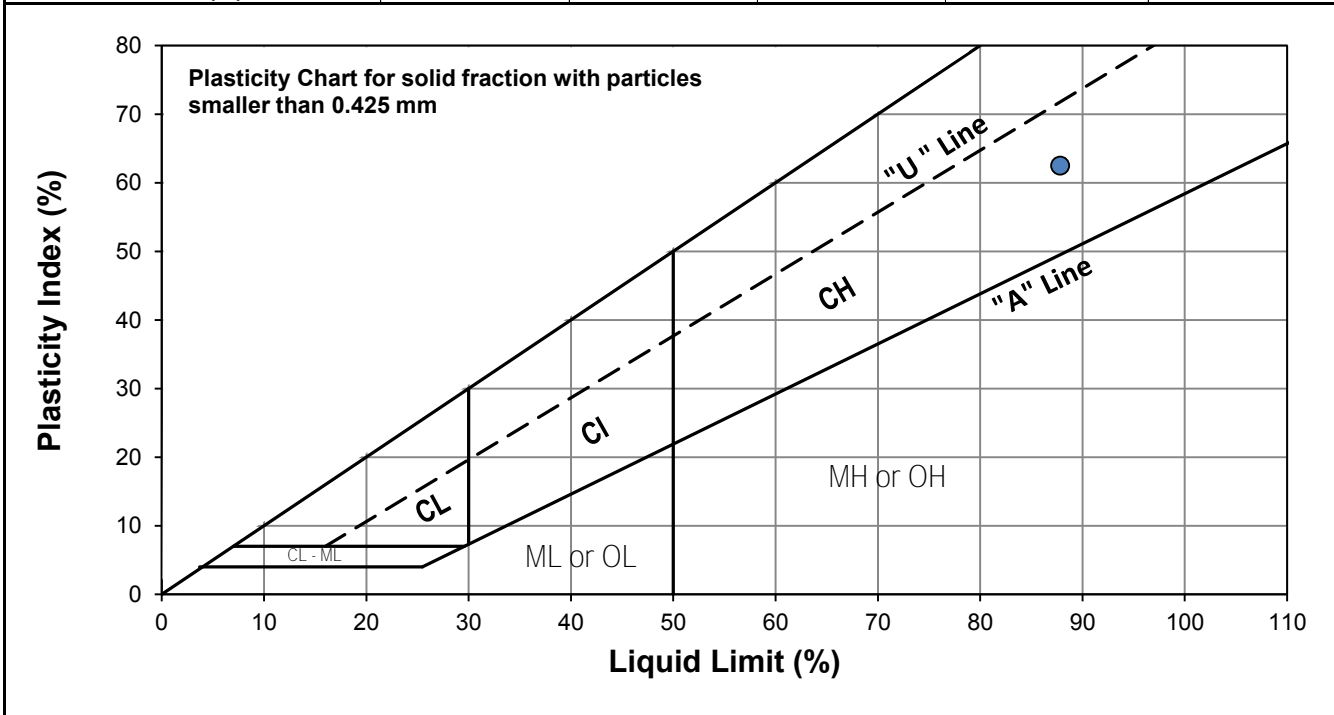


Test Hole TH20-21
Sample # G150
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 9-Feb-20
Technician HS

Liquid Limit	88
Plastic Limit	25
Plasticity Index	62

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	21	33
Mass Wet Soil + Tare (g)	24.031	25.520	24.016
Mass Dry Soil + Tare (g)	19.241	20.011	19.462
Mass Tare (g)	14.086	13.892	14.056
Mass Water (g)	4.790	5.509	4.554
Mass Dry Soil (g)	5.155	6.119	5.406
Moisture Content (%)	92.919	90.031	84.240



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.177	14.163			
Mass Wet Soil + Tare (g)	20.764	20.780			
Mass Dry Soil + Tare (g)	19.423	19.450			
Mass Water (g)	1.341	1.330			
Mass Dry Soil (g)	5.246	5.287			
Moisture Content (%)	25.562	25.156			



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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

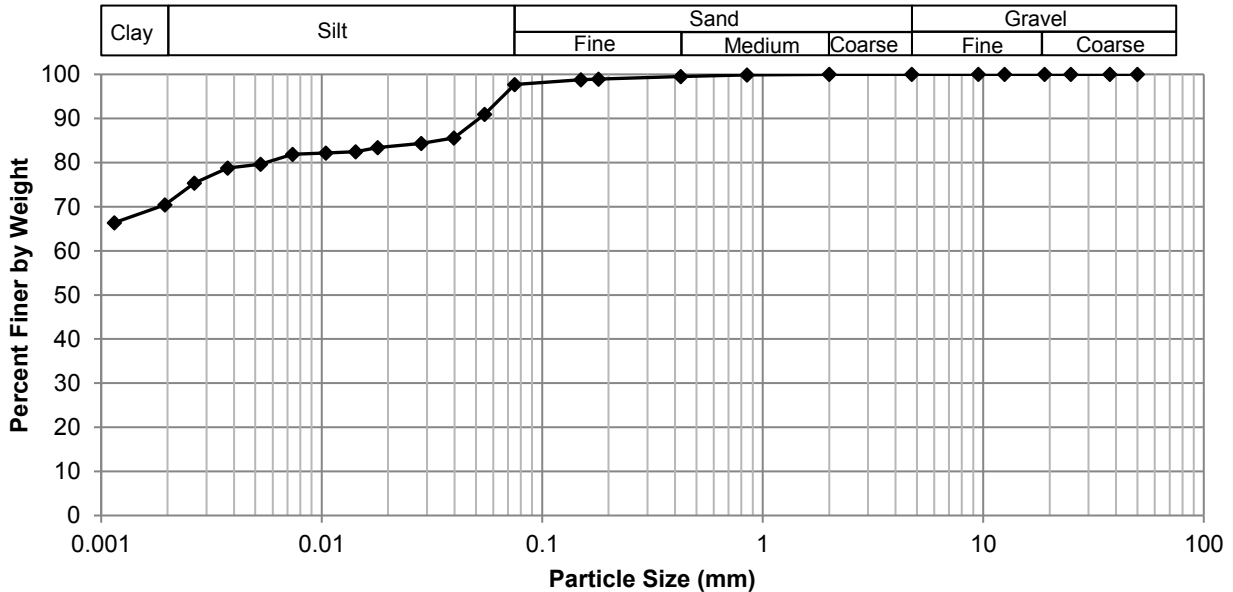
Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alleys- Blackwater Bay



Test Hole TH20-20
Sample # G142
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 5-Feb-20
Technician HS

Gravel	0.0%
Sand	2.3%
Silt	26.9%
Clay	70.8%

Particle Size Distribution Curve



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	97.67
37.5	100.00	2.00	100.00	0.0549	90.92
25.0	100.00	0.850	99.88	0.0398	85.61
19.0	100.00	0.425	99.53	0.0283	84.36
12.5	100.00	0.180	98.93	0.0180	83.42
9.50	100.00	0.150	98.79	0.0143	82.48
4.75	100.00	0.075	97.67	0.0104	82.17
				0.0074	81.85
				0.0053	79.67
				0.0037	78.73
				0.0026	75.34
				0.0019	70.40
				0.0011	66.39



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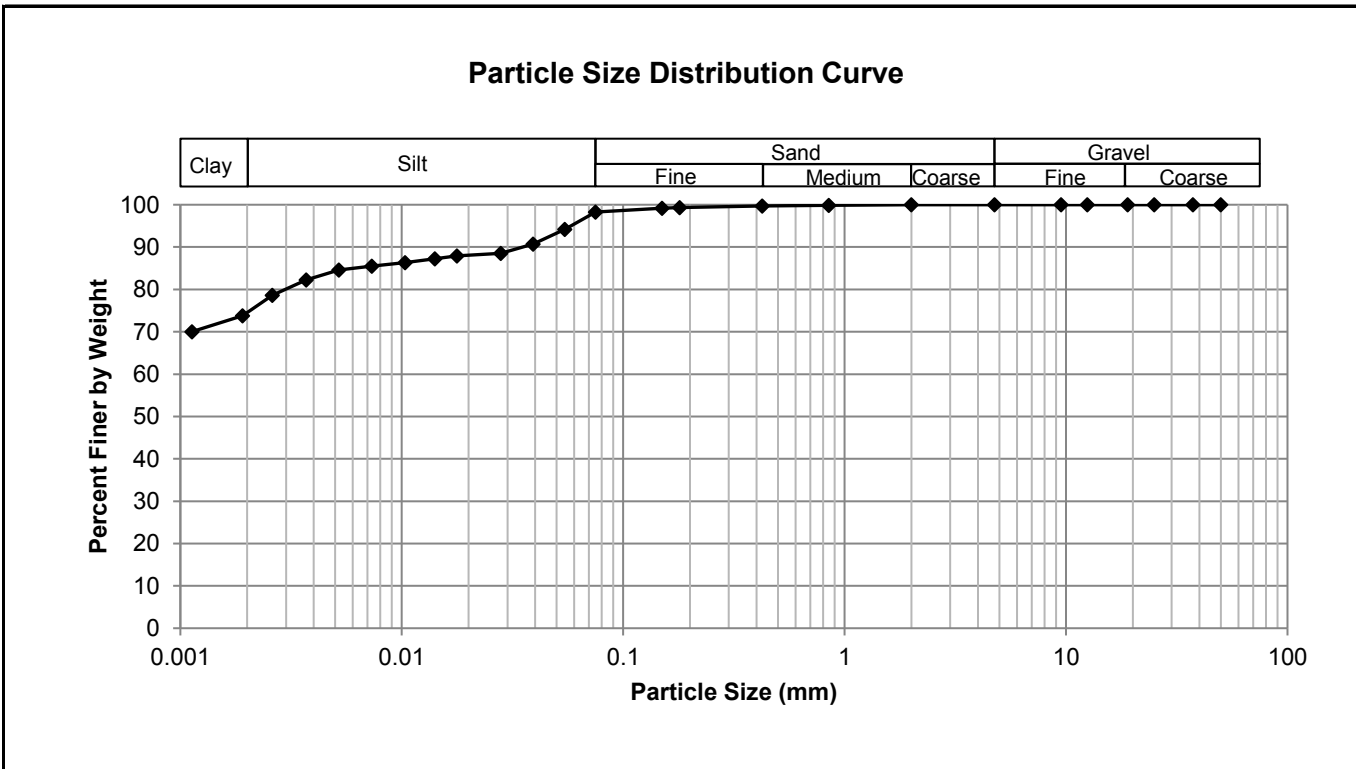
Grain Size Analysis (Hydrometer Method)
AASHTO T 88

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Blackwater Bay



Test Hole TH20-20
Sample # G143
Depth (m) 0.8 - 0.9
Sample Date 15-Jan-20
Test Date 10-Feb-20
Technician HS

Gravel	0.0%
Sand	1.7%
Silt	23.9%
Clay	74.4%



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	98.27
37.5	100.00	2.00	100.00	0.0545	94.15
25.0	100.00	0.850	99.90	0.0392	90.72
19.0	100.00	0.425	99.70	0.0280	88.53
12.5	100.00	0.180	99.30	0.0178	87.90
9.50	100.00	0.150	99.19	0.0141	87.28
4.75	100.00	0.075	98.27	0.0103	86.34
				0.0073	85.47
				0.0052	84.59
				0.0037	82.29
				0.0026	78.66
				0.0019	73.79
				0.0011	70.03



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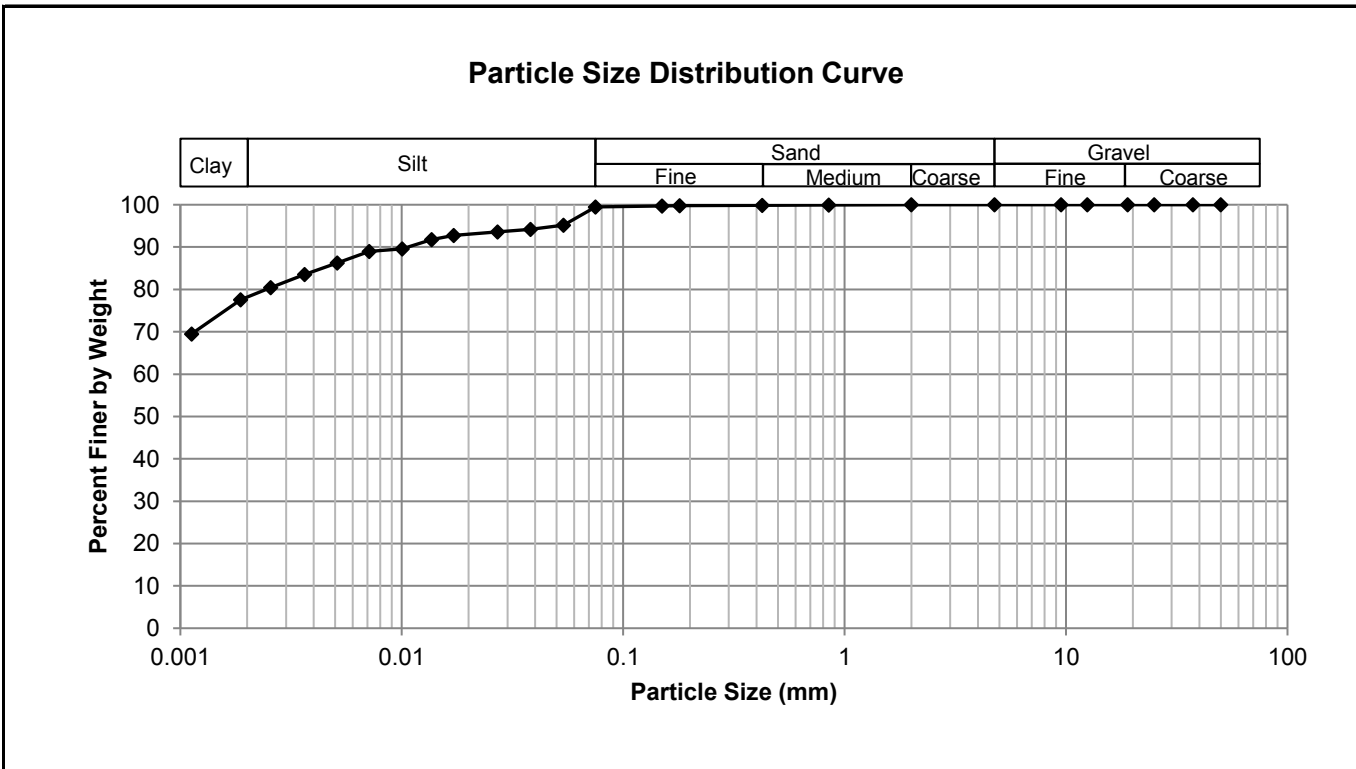
Grain Size Analysis (Hydrometer Method)
AASHTO T 88

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Blackwater Bay



Test Hole TH20-21
Sample # G150
Depth (m) 0.8 - 0.9
Sample Date 15-Jan-20
Test Date 3-Feb-20
Technician HS

Gravel	0.0%
Sand	0.5%
Silt	21.3%
Clay	78.1%



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	99.46
37.5	100.00	2.00	100.00	0.0537	95.16
25.0	100.00	0.850	99.93	0.0382	94.22
19.0	100.00	0.425	99.86	0.0271	93.59
12.5	100.00	0.180	99.76	0.0172	92.72
9.50	100.00	0.150	99.70	0.0136	91.78
4.75	100.00	0.075	99.46	0.0101	89.59
				0.0071	88.97
				0.0051	86.22
				0.0036	83.54
				0.0026	80.41
				0.0019	77.60
				0.0011	69.52



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Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Blackwater Bay

Test Hole TH20-20
Sample # G141
Depth (m) 0.2 - 0.3
Date Sampled 16-Jan-20
Date Tested 14-Feb-20
Technician HS

Total Weight (g)	1246.0
Gravel %	19.1
Sand %	60.1
Fines %	20.8

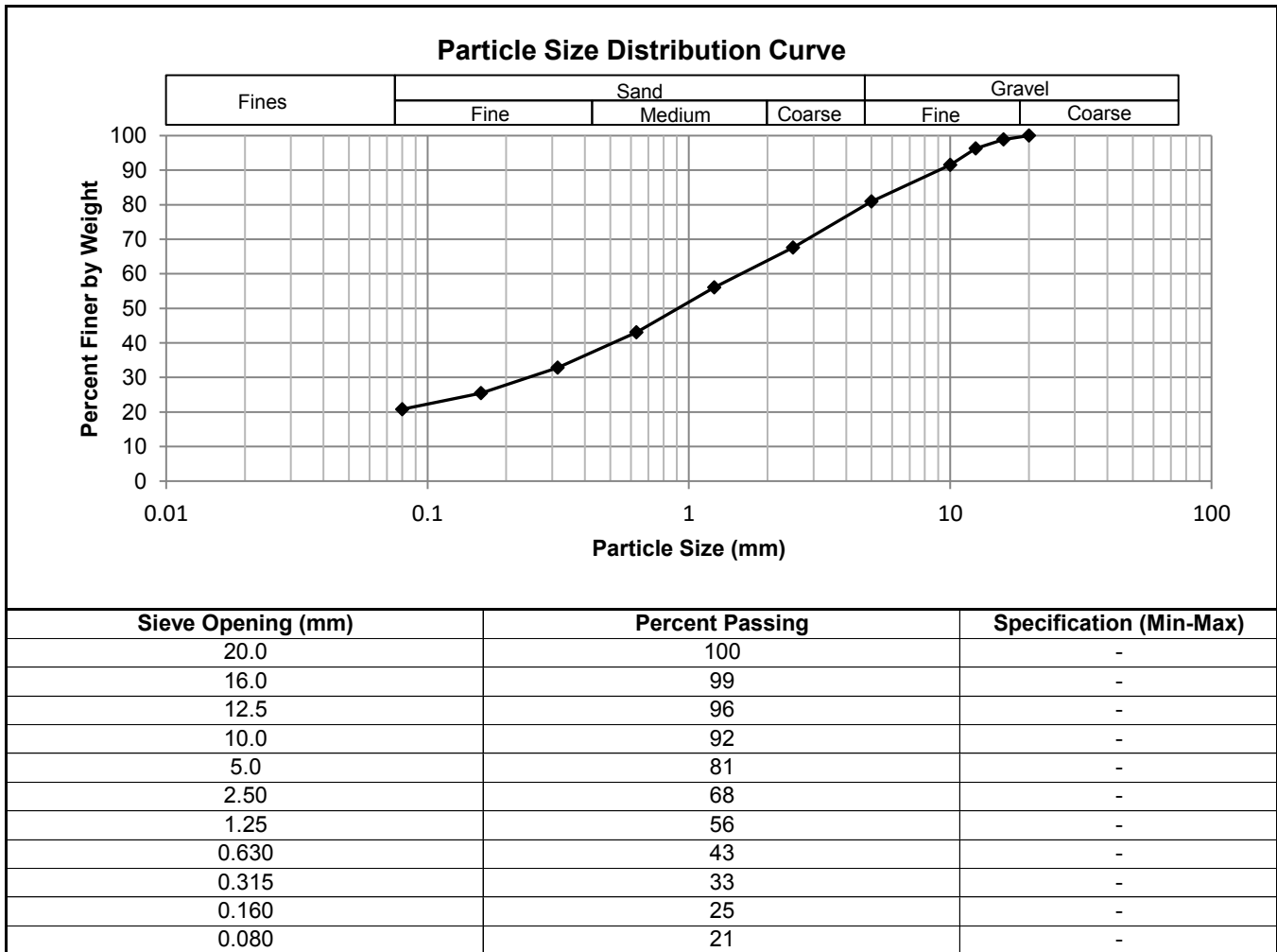




Photo 1: Pavement Core Sample at Test Hole TH20-01



Photo 2: Pavement Core Sample at Test Hole TH20-02



Photo 3: Pavement Core Sample at Test Hole TH20-03



**20-R-05 Local Street Renewal
Blackwater Bay**

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material	
		Type	Thickness (mm)	Type	Thickness (mm)
PC20-01	Located at House #7 Blackwater Bay, 1.2 m West of East curb of road UTM N-5519170 E-636229	Asphalt	N/A	Concrete	150
PC20-02	Located at House #15 Blackwater Bay, 1.2 m East of West curb of road UTM N-5519198 E-636211	Asphalt	N/A	Concrete	155
PC20-03	Located at House #54 Blackwater Bay, 1 m North of South curb of road UTM N-5519251 E-636261	Asphalt	N/A	Concrete	150
PC20-04	Located at House #71 Blackwater Bay, 1.6 m South of North curb of road UTM N-5519282 E-636305	Asphalt	N/A	Concrete	150
PC20-05	Located at House #84 Blackwater Bay, 0.4 m North of South curb of road UTM N-5519302 E-636349	Asphalt	N/A	Concrete	160
PC20-06	Located at House #108 Blackwater Bay, 2.5 m South of North curb of road UTM N-5519302 E-636349	Asphalt	N/A	Concrete	160



Photo 1: Pavement Core Sample at Test Hole PC20-01



Photo 2: Pavement Core Sample at Test Hole PC20-02



Photo 3: Pavement Core Sample at Test Hole PC20-03



Photo 4: Pavement Core Sample at Test Hole PC20-04



Photo 5: Pavement Core Sample at Test Hole PC20-05



Photo 6: Pavement Core Sample at Test Hole PC20-06

Appendix B

Fluery Place

**Test Hole Logs, Summary Table, Lab Testing
Results and Pavement Core Photos**

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 #10 to #4 #40 to #10 #200 to #40 < #200			
		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				
	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		
			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			
			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		Material Sand Coarse Medium Fine Silt or Clay
						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 TH20-23

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Fleury Place) Location: UTM N-5525805, E-638017
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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		
					Particle Size (%)							
					0	20	40	60	80	100		
					PL MC LL 0 20 40 60 80 100							
					0 50 100 150 200 250							
0.00 - 0.05		ASPHALT - 50 mm thick										
0.05 - 0.10		CONCRETE - 100 mm thick										
0.10 - 0.45		SAND (FILL) - silty, trace gravel, trace clay, brown, frozen, moist and compact when thawed, poorly graded sand to gravel (<25 mm diam.), angular crushed limestone	G164									
0.45 - 1.40		SILT AND CLAY - trace sand, trace organics - black - frozen to 1.4 m, moist and soft to firm when thawed - high plasticity	G165									
1.40 - 1.95		- trace silt inclusions (<10 mm diam.), light grey, firm to stiff below 1.4 m	G166									
1.95 - 2.00			G167									
2.00 - 2.95		CLAY - silty, trace silt inclusions (<10 mm diam.), trace oxidation - grey - moist, firm - high plasticity	G168									
2.95 - 3.00			G169									
3.00			G170									

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed.
- 2) Test hole open to 2.9 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located in front of house #24 and 2.0 m West of East curb.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM_FLEURY PLACE.GPJ_TREK.GEOTECHNICAL.GDT_2/28/20



Sub-Surface Log

Test Hole TH20-24

1 of 1

Client: WSP Canada **Project Number:** 1000-043-10
Project Name: 20-R-05 Local Streets and Alleys (Fleury Place) **Location:** UTM N-5525806, E-637953
Contractor: Maple Leaf Drilling Ltd. **Ground Elevation:** Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** January 16, 2020

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		
0.0 - 0.1		ASPHALT - 130 mm thick										
0.1 - 0.6		SAND (FILL) - silty, trace gravel, trace clay - brown, frozen - moist and compact when thawed - poorly graded sand to gravel (<25 mm diam.) - angular crushed limestone		G171								
0.6 - 0.8				G172								
0.8 - 1.0		SILT - sandy, trace gravel, trace clay, brown, frozen, moist and compact when thawed		G173								
1.0 - 1.4		CLAY - silty, trace sand - grey, - frozen to 1.4 m depth, moist and firm to stiff when thawed - high plasticity		G174								
1.4 - 2.9		- mottled grey and brown, trace oxidation below 1.4 m		G175								
2.9 - 3.0		- trace silt inclusions (<10 mm diam.) at 2.9 m		G176								
3.0				G177								

END OF TEST HOLE AT 3.0 m IN CLAY
 1) No seepage or sloughing observed.
 2) Test hole open to 3.0 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located in front of house #17 and 2.5 m East of West curb.

Logged By: Nuno Mendonca **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM_FLEURY PLACE.GPJ_TREK.GEOTECHNICAL.GDT_2/28/20



Sub-Surface Log

Test Hole TH20-25

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Fleury Place) Location: UTM N-5525801, E-637889
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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 - 140 mm thick														
		SAND (FILL) - silty, trace gravel, trace clay, brown, frozen, moist and compact when thawed, poorly graded sand to gravel (<25 mm diam.), angular crushed limestone		G178												
		SILT AND CLAY - trace sand - light brown - frozen to 1.2 m depth, moist and soft to firm when thawed - intermediate plasticity		G179												
				G180												
		SILT - clayey - light brown - moist, soft - intermediate plasticity - grey, firm below 1.2 m		G181												
				G182												
		CLAY - silty - grey - moist, firm - high plasticity		G183												
				G184												

END OF TEST HOLE AT 3.0 m IN CLAY
 1) No seepage or sloughing observed.
 2) Test hole open to 2.9 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located in front of house #10 and 2.5 m West of East curb.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM_FLEURY PLACE GPJ_TREK GEOTECHNICAL GDT_2/28/20



Sub-Surface Log

Test Hole TH20-26

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Fleury Place) Location: UTM N-5525804, E-637823
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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)	Test Type
					16	17	18	19		
0.0		ASPHALT - 50 mm thick								
0.0		CONCRETE - 100 mm thick								
0.0		SAND (FILL) - silty, trace clay to some clay, trace gravel, brown, frozen, moist and compact when thawed, poorly graded sand to gravel (<25 mm diam.), angular crushed limestone	G185							
0.0		SILT AND CLAY - trace organics - grey - frozen, moist and firm when thawed - intermediate plasticity	G186							
0.5			G187							
1.0		SILT - clayey - light brown - frozen to 1.4 m depth, moist and soft when thawed - intermediate plasticity	G188							
1.5		CLAY - silty - mottled brown and grey - moist, firm to stiff - high plasticity	G189							
2.0			G190							
3.0			G191							

END OF TEST HOLE AT 3.0 m IN CLAY
 1) No seepage or sloughing observed.
 2) Test hole open to 3.0 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located in front of house #1, 1.0 m West of East curb.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS 1000-043-10 0.0 A NM FLEURY PLACE GP1 TREK GEOTECHNICAL GDT 2/28/20



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Winnipeg, MB R3H 0L3
Tel: 204.975.9433 Fax: 204.975.9435

Moisture Content Report ASTM D2216-10

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Flury Place

Sample Date 16-Jan-20
Test Date 27-Jan-20
Technician HS

Test Hole	TH20-23	TH20-23	TH20-23	TH20-23	TH20-23	TH20-23
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 #	G164	G165	G166	G167	G168	G169
Tare ID	HA	AB58	Z85	AC17	E116	Z109
Mass of tare	364.2	6.7	8.4	6.8	8.6	8.6
Mass wet + tare	1939.8	452.2	244.8	227.9	246.1	191.8
Mass dry + tare	1764.0	325.5	177.4	165.1	174.8	143.0
Mass water	175.8	126.7	67.4	62.8	71.3	48.8
Mass dry soil	1399.8	318.8	169.0	158.3	166.2	134.4
Moisture %	12.6%	39.7%	39.9%	39.7%	42.9%	36.3%

Test Hole	TH20-23	TH20-24	TH20-24	TH20-24	TH20-24	TH20-24
Depth (m)	2.9 - 3.0	0.1 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G170	G171	G172	G173	G174	G175
Tare ID	E52	I20	AB54	NIK	W94	D13
Mass of tare	8.5	255.2	6.7	305.0	8.7	8.7
Mass wet + tare	162.2	1152.0	235.1	1442.0	194.4	111.7
Mass dry + tare	106.6	1093.9	219.7	1329.1	142.8	85.0
Mass water	55.6	58.1	15.4	112.9	51.6	26.7
Mass dry soil	98.1	838.7	213.0	1024.1	134.1	76.3
Moisture %	56.7%	6.9%	7.2%	11.0%	38.5%	35.0%

Test Hole	TH20-24	TH20-24	TH20-25	TH20-25	TH20-25	TH20-25
Depth (m)	1.7 - 1.8	2.9 - 3.0	0.0 - 0.2	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1
Sample #	G176	G177	G178	G179	G180	G181
Tare ID	AC06	AA05	AC28	F31	A1	N113
Mass of tare	6.6	6.6	6.7	8.6	8.3	8.7
Mass wet + tare	158.8	205.7	259.5	164.5	160.2	120.9
Mass dry + tare	108.7	136.6	230.1	128.9	117.8	101.4
Mass water	50.1	69.1	29.4	35.6	42.4	19.5
Mass dry soil	102.1	130.0	223.4	120.3	109.5	92.7
Moisture %	49.1%	53.2%	13.2%	29.6%	38.7%	21.0%



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**Moisture Content Report
 ASTM D2216-10**

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Flury Place

Sample Date 16-Jan-20
Test Date 27-Jan-20
Technician HS

Test Hole	TH20-25	TH20-25	TH20-25	TH20-26	TH20-26	TH20-26
Depth (m)	1.2 - 1.4	1.5 - 1.7	2.9 - 3.0	0.1 - 0.3	0.5 - 0.6	0.8 - 0.9
Sample #	G182	G183	G184	G185	G186	G187
Tare ID	N04	F48	A103	N06	P23	Z103
Mass of tare	8.7	8.7	8.7	8.6	8.5	8.5
Mass wet + tare	220.8	191.0	154.7	217.7	123.9	482.2
Mass dry + tare	163.6	133.2	104.3	187.9	93.8	374.5
Mass water	57.2	57.8	50.4	29.8	30.1	107.7
Mass dry soil	154.9	124.5	95.6	179.3	85.3	366.0
Moisture %	36.9%	46.4%	52.7%	16.6%	35.3%	29.4%

Test Hole	TH20-26	TH20-26	TH20-26	TH20-26		
Depth (m)	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.9 - 3.0		
Sample #	G188	G189	G190	G191		
Tare ID	W06	Z36	Z115	E19		
Mass of tare	8.5	8.9	8.5	8.6		
Mass wet + tare	264.6	200.2	186.7	189.2		
Mass dry + tare	207.4	144.3	128.6	125.5		
Mass water	57.2	55.9	58.1	63.7		
Mass dry soil	198.9	135.4	120.1	116.9		
Moisture %	28.8%	41.3%	48.4%	54.5%		



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Atterberg Limits
ASTM D4318-10e1

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Fluary Place

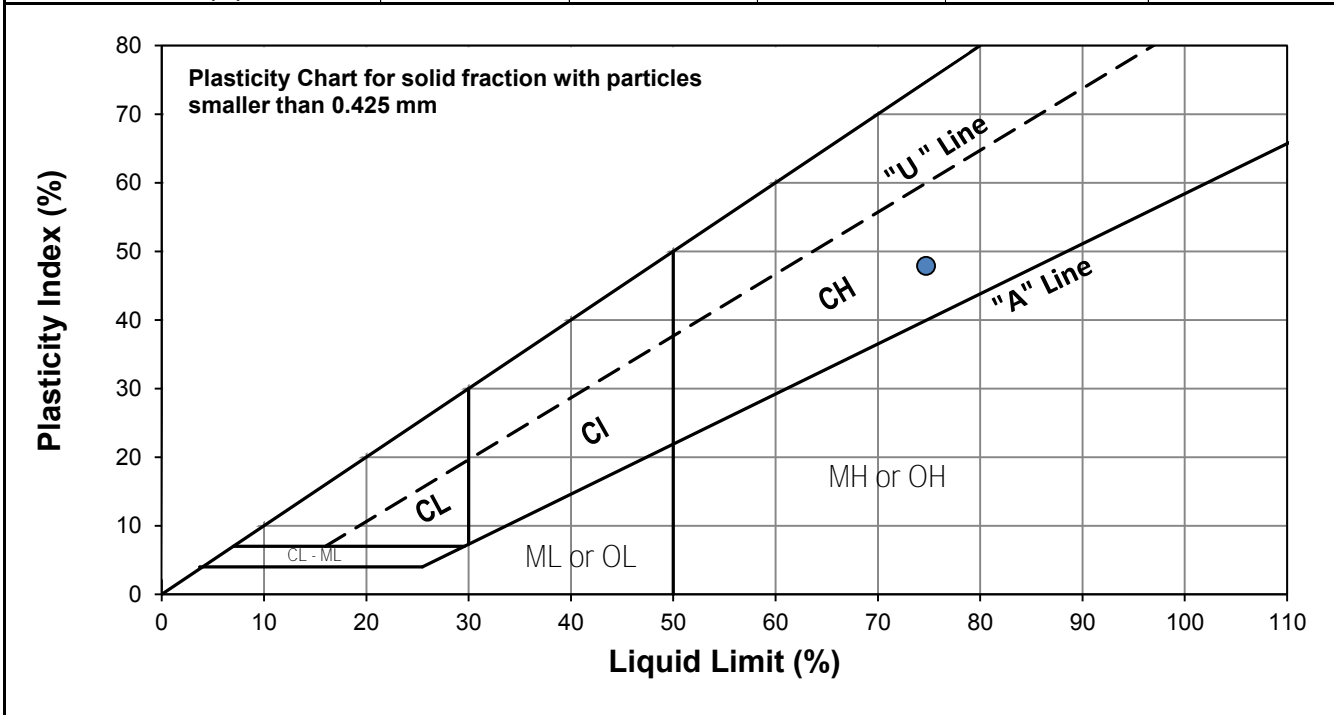


Test Hole TH20-23
Sample # G166
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 10-Feb-20
Technician HS

Liquid Limit	75
Plastic Limit	27
Plasticity Index	48

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	16	21	31
Mass Wet Soil + Tare (g)	22.303	27.365	21.279
Mass Dry Soil + Tare (g)	18.724	21.686	18.330
Mass Tare (g)	14.103	14.182	14.315
Mass Water (g)	3.579	5.679	2.949
Mass Dry Soil (g)	4.621	7.504	4.015
Moisture Content (%)	77.451	75.680	73.450



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.207	14.307			
Mass Wet Soil + Tare (g)	25.441	20.813			
Mass Dry Soil + Tare (g)	23.074	19.430			
Mass Water (g)	2.367	1.383			
Mass Dry Soil (g)	8.867	5.123			
Moisture Content (%)	26.694	26.996			



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Atterberg Limits
ASTM D4318-10e1

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Fluary Place

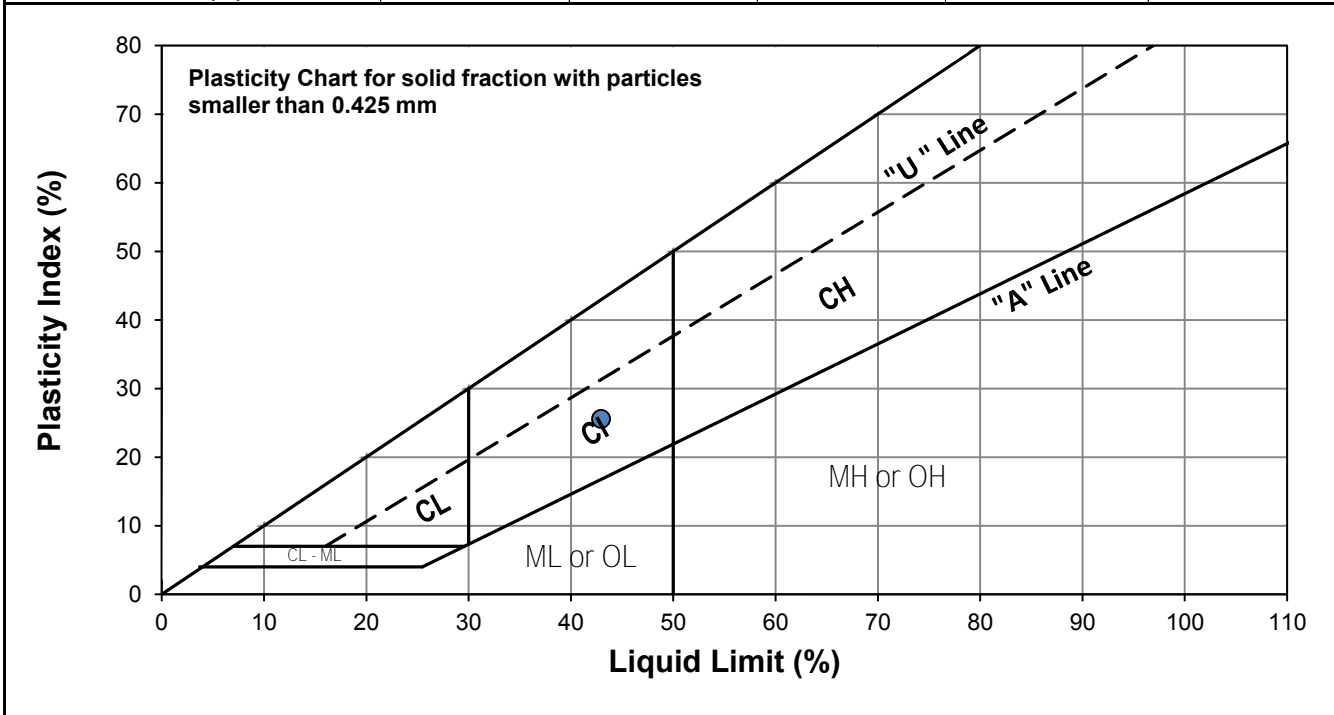


Test Hole TH20-26
Sample # G187
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 12-Feb-20
Technician HS

Liquid Limit	43
Plastic Limit	17
Plasticity Index	26

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	25	35
Mass Wet Soil + Tare (g)	25.823	29.119	23.165
Mass Dry Soil + Tare (g)	22.297	24.653	20.529
Mass Tare (g)	14.205	14.298	14.292
Mass Water (g)	3.526	4.466	2.636
Mass Dry Soil (g)	8.092	10.355	6.237
Moisture Content (%)	43.574	43.129	42.264



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.202	14.129			
Mass Wet Soil + Tare (g)	21.214	22.090			
Mass Dry Soil + Tare (g)	20.155	20.930			
Mass Water (g)	1.059	1.160			
Mass Dry Soil (g)	5.953	6.801			
Moisture Content (%)	17.789	17.056			



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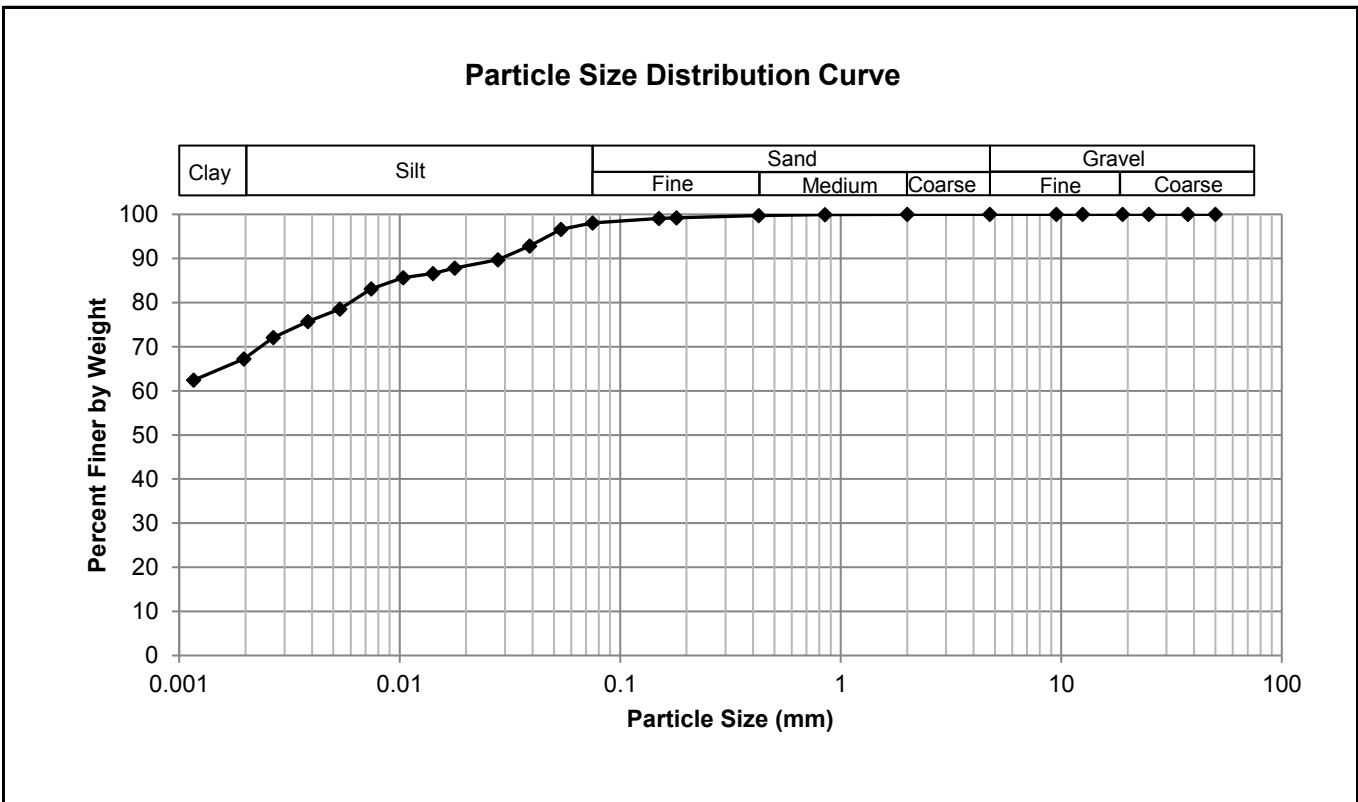
Grain Size Analysis (Hydrometer Method)
AASHTO T 88

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Fluery Place



Test Hole TH20-23
Sample # G166
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 6-Feb-20
Technician HS

Gravel	0.0%
Sand	1.9%
Silt	30.6%
Clay	67.5%



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	98.07
37.5	100.00	2.00	100.00	0.0539	96.59
25.0	100.00	0.850	99.95	0.0388	92.84
19.0	100.00	0.425	99.76	0.0279	89.71
12.5	100.00	0.180	99.22	0.0178	87.84
9.50	100.00	0.150	99.05	0.0141	86.59
4.75	100.00	0.075	98.07	0.0104	85.65
				0.0074	83.15
				0.0054	78.53
				0.0038	75.72
				0.0027	72.10
				0.0020	67.24
				0.0012	62.42



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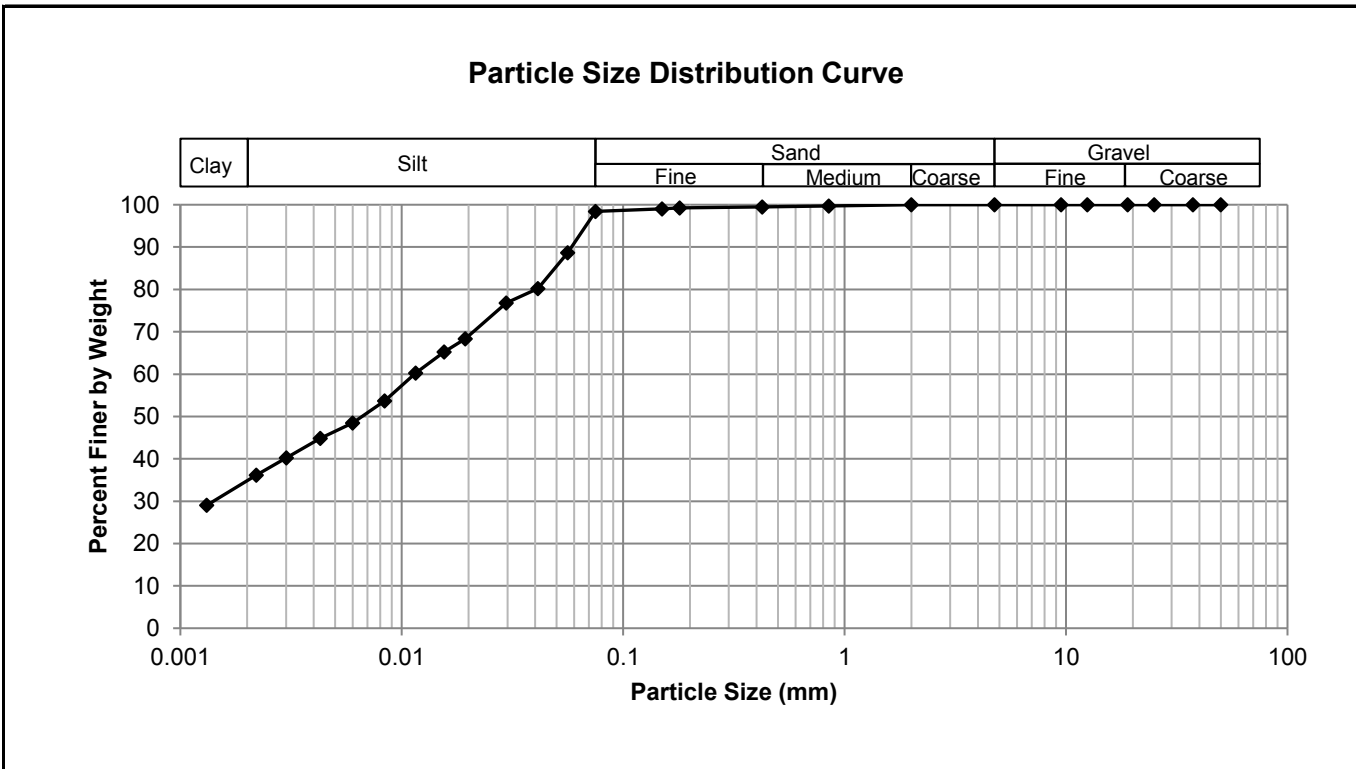
Grain Size Analysis (Hydrometer Method)
AASHTO T 88

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Fluery Place



Test Hole TH20-26
Sample # G187
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 6-Feb-20
Technician HS

Gravel	0.0%
Sand	1.6%
Silt	63.9%
Clay	34.5%



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	98.40
37.5	100.00	2.00	100.00	0.0561	88.68
25.0	100.00	0.850	99.68	0.0412	80.24
19.0	100.00	0.425	99.50	0.0296	76.80
12.5	100.00	0.180	99.23	0.0194	68.36
9.50	100.00	0.150	99.00	0.0155	65.23
4.75	100.00	0.075	98.40	0.0116	60.23
				0.0084	53.72
				0.0060	48.51
				0.0043	44.87
				0.0030	40.24
				0.0022	36.17
				0.0013	29.05



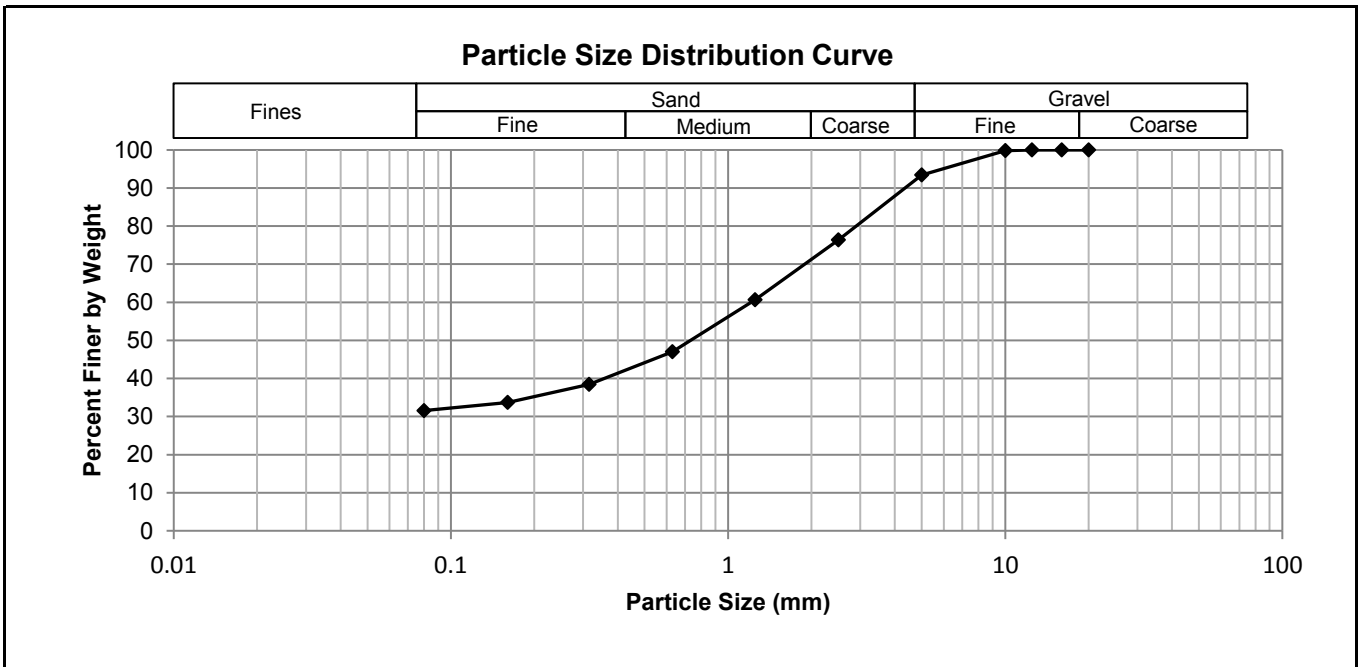
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Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Fleury Place

Test Hole TH20-24
Sample # G171
Depth (m) 0.1 - 0.3
Date Sampled 16-Jan-20
Date Tested 14-Feb-20
Technician HS

Total Weight (g)	837.0
Gravel %	6.5
Sand %	61.9
Fines %	31.6



Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
12.5	100	-
10.0	100	-
5.0	93	-
2.50	76	-
1.25	61	-
0.630	47	-
0.315	38	-
0.160	34	-
0.080	32	-



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Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Fleury Place

Test Hole TH20-24
Sample # G173
Depth (m) 0.8 - 0.9
Date Sampled 16-Jan-20
Date Tested 14-Feb-20
Technician HS

Total Weight (g)	1024.2
Gravel %	9.3
Sand %	33.0
Fines %	57.7

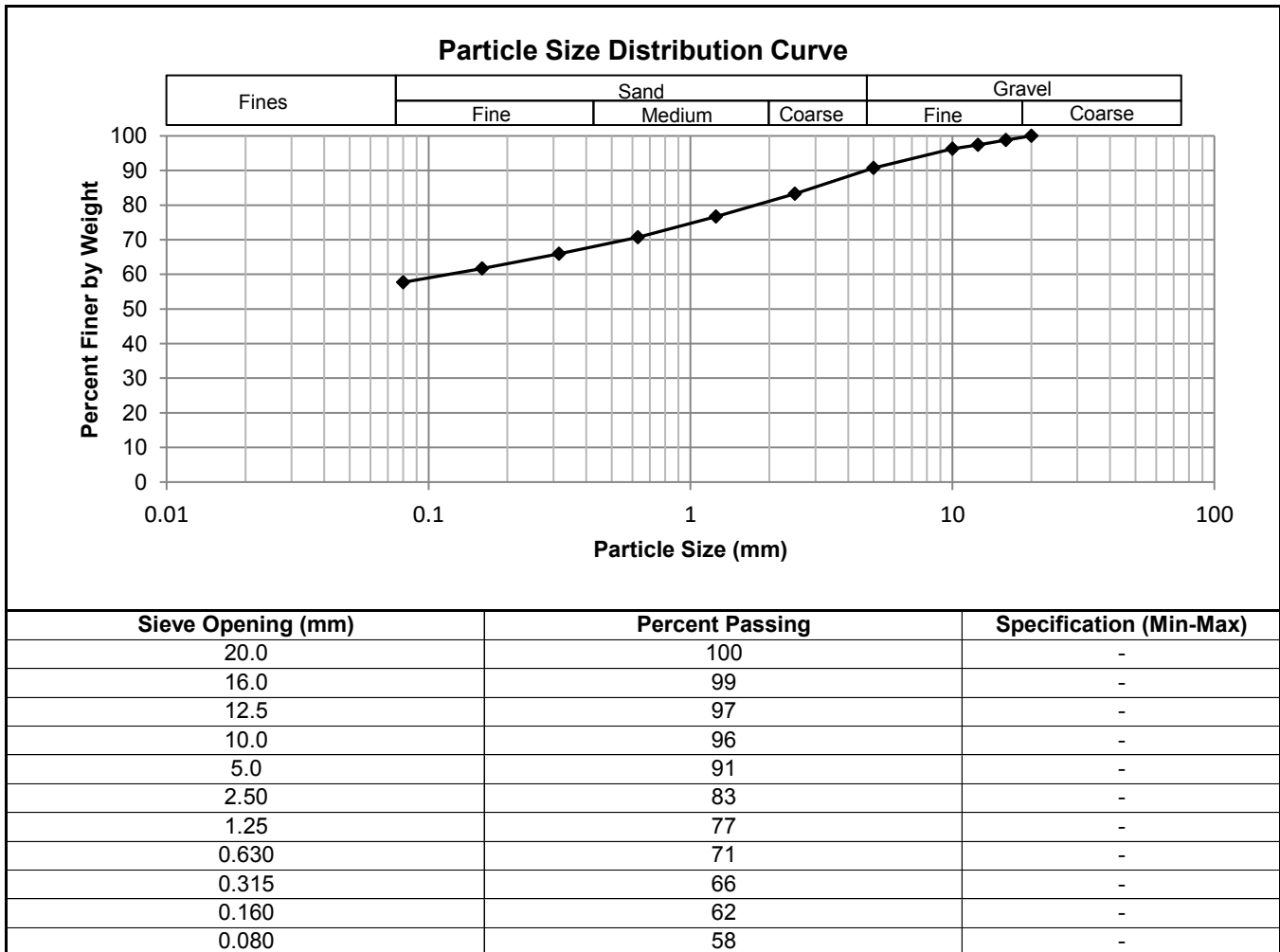




Photo 1: Pavement Core Sample at Test Hole TH20-23



Photo 2: Pavement Core Sample at Test Hole TH20-24



Photo 3: Pavement Core Sample at Test Hole TH20-25



Photo 4: Pavement Core Sample at Test Hole TH20-26

Appendix C

Rosewarne Ave

**Test Hole Logs, Summary Table, Lab Testing
Results and Pavement Core Photos**

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 #10 to #4 #40 to #10 #200 to #40 < #200			
		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				
	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		
			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			
			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
						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		Material Sand Coarse Medium Fine Silt or Clay					
	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							
Highly Organic Soils				Von Post Classification Limit	Strong colour or odour, and often fibrous texture	Material Boulders Cobbles Gravel Coarse Fine			

* 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 TH20-27

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Rosewarne Avenue) Location: UTM N-5524587, E-635572
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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						
					Particle Size (%)											
					0	20	40	60	80	100						
					PL MC LL 0 20 40 60 80 100						Test Type △ Torvane △ ⊕ Pocket Pen. ⊕ ⊠ Qu ⊠ ○ Field Vane ○					
					0	20	40	60	80	100	0	50	100	150	200	250
0.0 - 0.1		ASPHALT - 225 mm thick														
0.1 - 0.2		CONCRETE - 100 mm thick														
0.2 - 0.5		SILT AND CLAY - silty, trace sand, trace organics - black - frozen, moist and firm to stiff when thawed - high plasticity	G	G192												
0.5 - 0.9			G	G193												
0.9 - 1.5			G	G194												
1.5 - 2.0		SILT - clayey, trace sand - brown - frozen to 1.5 m depth, moist and firm when thawed - intermediate plasticity - light brown, soft below 1.6 m	G	G195												
2.0 - 2.4			G	G196												
2.4 - 2.7		CLAY - silty, trace silt inclusions (<10 mm diam.) - grey - moist, stiff - high plasticity	G	G197												
2.7 - 3.0			G	G198												
3.0 - 3.0			G	G199												

END OF TEST HOLE AT 3.0 m IN CLAY
 1) No seepage or sloughing observed.
 2) Test hole open to 3.0 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located in front of house #17 Rosewarne Ave, 1.8 m South of North curb.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM ROSEWARNE PLACE GPJ_TREK GEOTECHNICAL_GDT_2/28/20



Sub-Surface Log

Test Hole TH20-28

1 of 1

Client: WSP Canada **Project Number:** 1000-043-10
Project Name: 20-R-05 Local Streets and Alleys (Rosewarne Avenue) **Location:** UTM N-5524634, E-635657
Contractor: Maple Leaf Drilling Ltd. **Ground Elevation:** Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** January 16, 2020

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
0.0 - 0.1		ASPHALT - 100 mm thick														
0.1 - 0.5		CONCRETE - 500 mm thick														
0.5 - 1.4		SILT AND CLAY - trace sand, trace organics - dark grey - frozen to 1.4 m depth, moist and firm to stiff when thawed - high plasticity	G202													
1.4 - 1.5		- grey below 1.4 m	G203													
1.5 - 2.0		SILT - trace to some clay - light brown - moist to wet, soft - low to intermediate plasticity	G204													
2.0 - 2.5			G205													
2.5 - 3.0		CLAY - silty, trace silt inclusions (<10 mm diam) - brown - moist, firm to stiff - high plasticity	G206													

END OF TEST HOLE AT 3.0 m IN CLAY
 1) No seepage or sloughing observed. Test hole caved at 1.0 m depth.
 2) Test hole open to 1.0 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located 15 m East and 2 m South of backlane intersection and, 2.0 m North of South curb.

Logged By: Nuno Mendonca **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM ROSEWARNE PLACE GPJ_TREK GEOTECHNICAL_GDT_2/28/20



Sub-Surface Log

Test Hole TH20-29

1 of 1

Client: WSP Canada **Project Number:** 1000-043-10
Project Name: 20-R-05 Local Streets and Alleys (Rosewarne Avenue) **Location:** UTM N-5524468, E-635366
Contractor: Maple Leaf Drilling Ltd. **Ground Elevation:** Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** January 16, 2020

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
0.0 - 0.1		ASPHALT - 100 mm thick														
0.1 - 0.2		CONCRETE - 180 mm thick														
0.2 - 0.5		SILT AND CLAY - trace sand, trace organics - dark grey - frozen to 1.5 m depth, moist and soft to firm when thawed - high plasticity		G208												
0.5 - 1.0		- trace silt inclusions (<10 mm diam.) and stiff below 1.1 m		G209												
1.0 - 1.4		- mottled brown and grey, very stiff below 1.4 m		G210												
1.4 - 1.7		- firm to stiff below 1.7 m		G211												
1.7 - 2.0				G212												
2.0 - 2.5																
2.5 - 3.0				G213												

END OF TEST HOLE AT 3.0 m IN SILT AND CLAY
 1) No seepage or sloughing observed. Test hole caved at 1.0 m depth.
 2) Test hole open to 1.0 m immediately after drilling.
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
 4) Test hole located in front of house #52 Rosewarne Ave, and 1.0 m North of South curb.

Logged By: Nuno Mendonca **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM ROSEWARNE PLACE GPJ TREK GEOTECHNICAL_GDT_2/28/20



Sub-Surface Log

Test Hole TH20-30

1 of 1

Client: WSP Canada **Project Number:** 1000-043-10
Project Name: 20-R-05 Local Streets and Alleys (Rosewarne Avenue) **Location:** UTM N-5524439, E-635310
Contractor: Maple Leaf Drilling Ltd. **Ground Elevation:** Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount **Date Drilled:** January 16, 2020

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		ASPHALT - 100 mm thick															
0.1 - 0.2		CONCRETE - 200 mm thick															
0.2 - 0.4		SAND AND GRAVEL (FILL) - some silt, trace clay - grey, frozen, moist and compact when thawed - well graded sand to gravel (<20 mm diam.), sub-rounded to angular crushed "pit run"	G214														
0.4 - 0.8		SILT AND CLAY - trace sand - dark grey - frozen to 1.4 m depth, moist and soft to firm when thawed - high plasticity	G215														
0.8 - 1.1			G216														
1.1 - 1.5		- very stiff below 1.2 m	G217														
1.5 - 2.0		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, firm to very stiff - high plasticity	G218														
2.0 - 2.5			G219														
2.5 - 3.0			G220														

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed. Test hole caved at 1.1 m depth.
- 2) Test hole open to 1.1 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located in front of house #60 Rosewarne Ave, 2.0 m North of South curb.

Logged By: Nuno Mendonca **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM_ROSEWARNE PLACE GPJ_TREK GEOTECHNICAL_GDT_2/28/20



Sub-Surface Log

Test Hole TH20-31

1 of 1

Client: WSP Canada Project Number: 1000-043-10
 Project Name: 20-R-05 Local Streets and Alleys (Rosewarne Avenue) Location: UTM N-5524537, E-635489
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: January 16, 2020

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		
					Particle Size (%)							
					0	20	40	60	80	100		
					PL ----- MC ----- LL 0 20 40 60 80 100							
					0 50 100 150 200 250							
0.0 - 0.1		ASPHALT - 200 mm thick										
0.1 - 0.2		CONCRETE - 100 mm thick										
0.2 - 0.6		SILT AND CLAY - trace sand, trace organics - black - frozen, moist and soft to firm when thawed - intermediate to high plasticity	G222									
0.6 - 1.0		SILT - clayey, trace sand - brown - frozen to 1.2 m depth, moist and soft when thawed - intermediate plasticity	G223									
1.0 - 1.6		CLAY - silty - brown - moist, firm to stiff - high plasticity	G224									
1.6 - 2.0		- trace oxidation below 1.6 m	G225									
2.0 - 2.2			G226									
2.2 - 2.4			G227									
2.4 - 3.0			G228									

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed. Test hole caved at 1.2 m depth.
- 2) Test hole open to 1.2 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located in front of house #32 Rosewarne Ave, 1.8 m North of South curb.

Logged By: Nuno Mendonca Reviewed By: Angela Fidler-Kliewer Project Engineer: Brent Hay

SUB-SURFACE LOG LOGS 2020-01-17 LOCAL STREETS AND ALLEYS_1000-043-10_0_A_NM ROSEWARNE PLACE GPJ_TREK GEOTECHNICAL_GDT_2/28/20



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Moisture Content Report ASTM D2216-10

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Rosewarne Ave

Sample Date 16-Jan-20
Test Date 27-Jan-20
Technician HS

Test Hole	TH20-27	TH20-27	TH20-27	TH20-27	TH20-27	TH20-27
Depth (m)	0.4 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1
Sample #	G192	G193	G194	G195	G196	G197
Tare ID	E1	P22	D37	F112	W32	AB62
Mass of tare	8.5	8.7	8.7	8.3	8.5	6.7
Mass wet + tare	417.3	213.2	169.3	159.0	254.0	187.0
Mass dry + tare	303.9	158.7	125.8	126.3	195.4	135.3
Mass water	113.4	54.5	43.5	32.7	58.6	51.7
Mass dry soil	295.4	150.0	117.1	118.0	186.9	128.6
Moisture %	38.4%	36.3%	37.1%	27.7%	31.4%	40.2%

Test Hole	TH20-27	TH20-27	TH20-28	TH20-28	TH20-28	TH20-28
Depth (m)	2.3 - 2.4	2.9 - 3.0	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G198	G199	G202	G203	G204	G205
Tare ID	AA01	P24	N15	AC37	F17	W26
Mass of tare	6.8	8.4	8.8	6.8	8.7	8.4
Mass wet + tare	137.4	205.3	185.8	199.3	176.5	178.8
Mass dry + tare	98.7	146.5	134.9	145.3	136.7	143.8
Mass water	38.7	58.8	50.9	54.0	39.8	35.0
Mass dry soil	91.9	138.1	126.1	138.5	128.0	135.4
Moisture %	42.1%	42.6%	40.4%	39.0%	31.1%	25.8%

Test Hole	TH20-28	TH20-29	TH20-29	TH20-29	TH20-29	TH20-29
Depth (m)	2.3 - 2.4	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G206	G208	G209	G210	G211	G212
Tare ID	F116	E74	Z97	N03	AB81	H6
Mass of tare	8.7	8.5	8.6	8.4	6.6	8.4
Mass wet + tare	195.0	167.4	146.6	153.7	160.5	220.3
Mass dry + tare	141.6	122.5	107.4	117.7	121.2	157.4
Mass water	53.4	44.9	39.2	36.0	39.3	62.9
Mass dry soil	132.9	114.0	98.8	109.3	114.6	149.0
Moisture %	40.2%	39.4%	39.7%	32.9%	34.3%	42.2%



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Moisture Content Report ASTM D2216-10

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Rosewarne Ave

Sample Date 16-Jan-20
Test Date 27-Jan-20
Technician HS

Test Hole	TH20-29	TH20-30	TH20-30	TH20-30	TH20-30	TH20-30
Depth (m)	2.9 - 3.0	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G213	G214	G215	G216	G217	G218
Tare ID	H77	G19	E40	Z140	N112	F46
Mass of tare	8.3	8.5	8.4	8.5	8.3	8.6
Mass wet + tare	144.5	478.4	140.4	456.6	240.1	143.7
Mass dry + tare	102.0	414.9	108.4	358.1	181.4	105.2
Mass water	42.5	63.5	32.0	98.5	58.7	38.5
Mass dry soil	93.7	406.4	100.0	349.6	173.1	96.6
Moisture %	45.4%	15.6%	32.0%	28.2%	33.9%	39.9%

Test Hole	TH20-30	TH20-30	TH20-31	TH20-31	TH20-31	TH20-31
Depth (m)	1.8 - 2.0	2.9 - 3.0	0.4 - 0.5	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G219	G220	G222	G223	G224	G225
Tare ID	W58	F119	W42	F68	F105	E134
Mass of tare	8.6	8.2	8.7	8.6	8.4	8.2
Mass wet + tare	158.2	161.7	145.9	348.7	128.3	175.3
Mass dry + tare	111.9	109.7	111.4	320.9	107.4	131.2
Mass water	46.3	52.0	34.5	27.8	20.9	44.1
Mass dry soil	103.3	101.5	102.7	312.3	99.0	123.0
Moisture %	44.8%	51.2%	33.6%	8.9%	21.1%	35.9%

Test Hole	TH20-31	TH20-31	TH20-31			
Depth (m)	1.7 - 1.8	2.0 - 2.1	2.9 - 3.0			
Sample #	G226	G227	G228			
Tare ID	D26	Z15	H11			
Mass of tare	8.6	8.4	8.4			
Mass wet + tare	212.5	222.8	179.8			
Mass dry + tare	151.2	153.5	123.7			
Mass water	61.3	69.3	56.1			
Mass dry soil	142.6	145.1	115.3			
Moisture %	43.0%	47.8%	48.7%			



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Atterberg Limits
ASTM D4318-10e1

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Rosewarne Ave

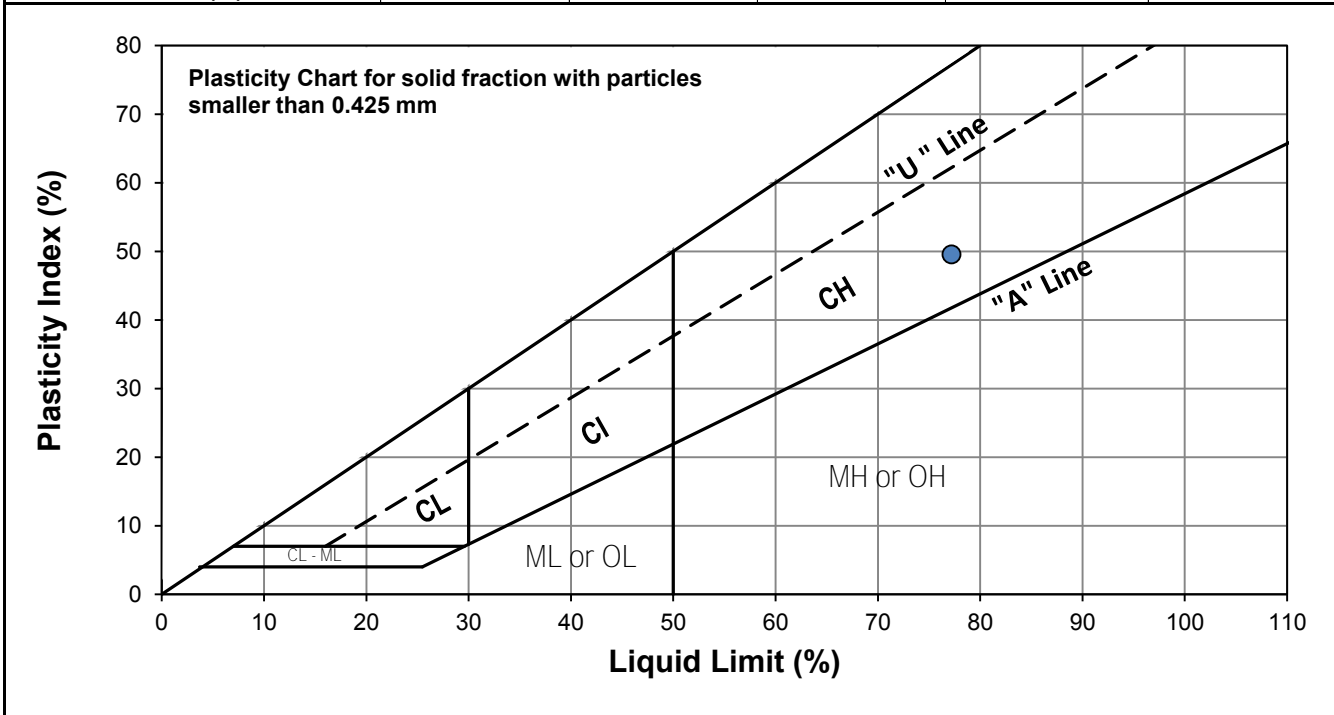


Test Hole TH20-27
Sample # G193
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 6-Feb-20
Technician HS

Liquid Limit	77
Plastic Limit	28
Plasticity Index	50

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	15	23	28
Mass Wet Soil + Tare (g)	22.234	25.062	26.549
Mass Dry Soil + Tare (g)	18.680	20.318	21.183
Mass Tare (g)	14.364	14.225	14.138
Mass Water (g)	3.554	4.744	5.366
Mass Dry Soil (g)	4.316	6.093	7.045
Moisture Content (%)	82.345	77.860	76.167



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.147	14.051			
Mass Wet Soil + Tare (g)	20.890	21.234			
Mass Dry Soil + Tare (g)	19.433	19.675			
Mass Water (g)	1.457	1.559			
Mass Dry Soil (g)	5.286	5.624			
Moisture Content (%)	27.563	27.720			



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Project No. 1000-043-10
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Project 2020 Local Street and Alley - Rosewarne Ave

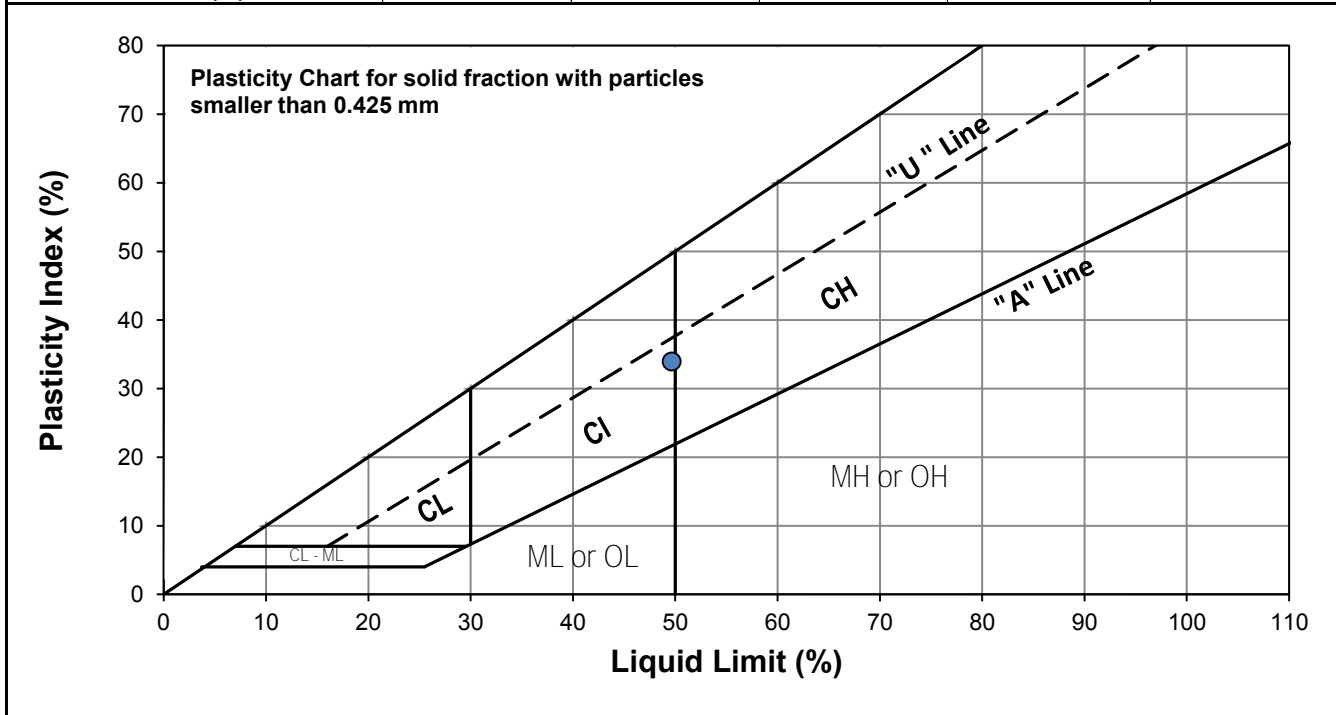


Test Hole TH20-30
Sample # G216
Depth (m) 0.9 - 1.1
Sample Date 16-Jan-20
Test Date 13-Feb-20
Technician HS

Liquid Limit	50
Plastic Limit	16
Plasticity Index	34

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	15	25	34
Mass Wet Soil + Tare (g)	26.667	24.539	25.196
Mass Dry Soil + Tare (g)	22.280	21.064	21.539
Mass Tare (g)	13.908	14.001	13.978
Mass Water (g)	4.387	3.475	3.657
Mass Dry Soil (g)	8.372	7.063	7.561
Moisture Content (%)	52.401	49.200	48.367



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.130	14.342			
Mass Wet Soil + Tare (g)	21.271	21.395			
Mass Dry Soil + Tare (g)	20.300	20.435			
Mass Water (g)	0.971	0.960			
Mass Dry Soil (g)	6.170	6.093			
Moisture Content (%)	15.737	15.756			



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Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Rosewarne Ave

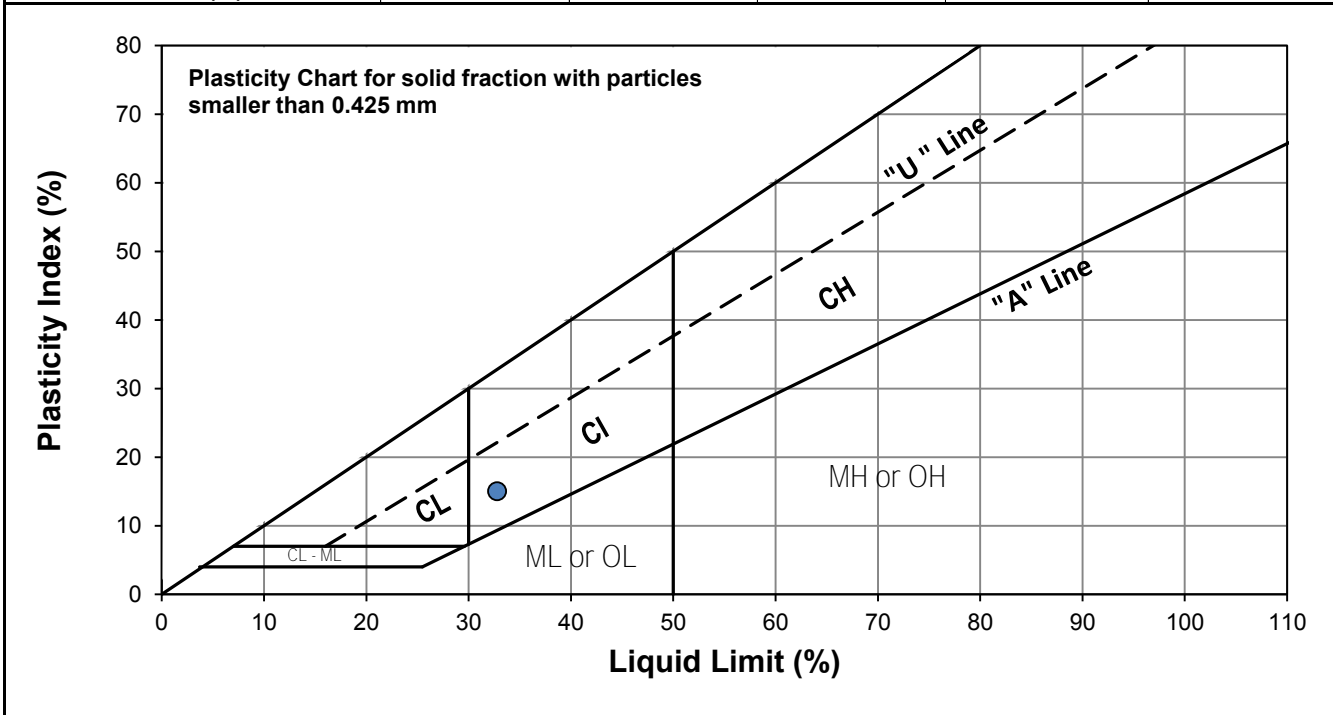


Test Hole TH20-31
Sample # G223
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 6-Feb-20
Technician HS

Liquid Limit	33
Plastic Limit	18
Plasticity Index	15

Liquid Limit

Trial #	1	2	3
Number of Blows (N)	17	23	35
Mass Wet Soil + Tare (g)	25.874	25.351	24.848
Mass Dry Soil + Tare (g)	22.812	22.572	22.281
Mass Tare (g)	13.750	14.155	14.227
Mass Water (g)	3.062	2.779	2.567
Mass Dry Soil (g)	9.062	8.417	8.054
Moisture Content (%)	33.789	33.017	31.872



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.050	14.031			
Mass Wet Soil + Tare (g)	21.688	20.539			
Mass Dry Soil + Tare (g)	20.544	19.550			
Mass Water (g)	1.144	0.989			
Mass Dry Soil (g)	6.494	5.519			
Moisture Content (%)	17.616	17.920			



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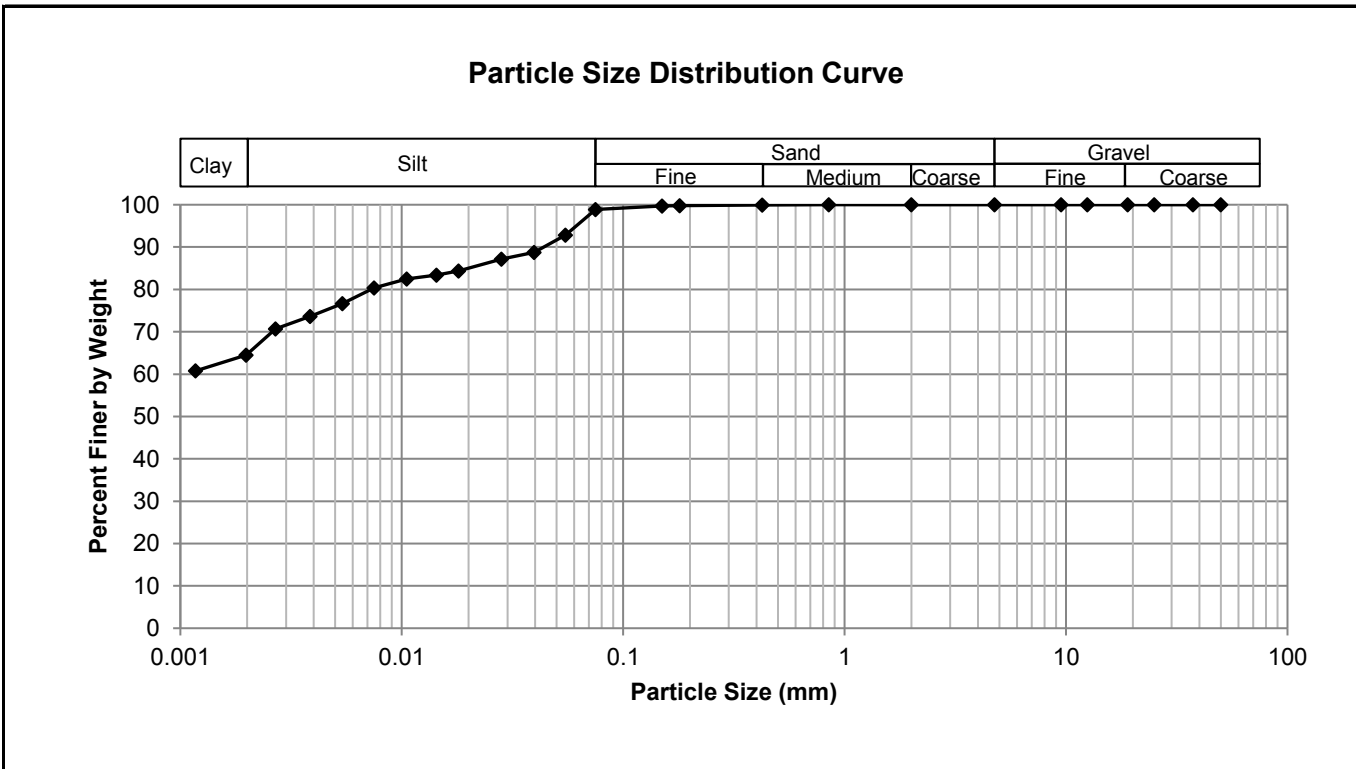
Grain Size Analysis (Hydrometer Method)
AASHTO T 88

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Rosewarne Ave



Test Hole TH20-27
Sample # G193
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 4-Feb-20
Technician HS

Gravel	0.0%
Sand	1.1%
Silt	34.2%
Clay	64.7%



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	98.86
37.5	100.00	2.00	100.00	0.0549	92.80
25.0	100.00	0.850	99.98	0.0396	88.74
19.0	100.00	0.425	99.93	0.0282	87.17
12.5	100.00	0.180	99.76	0.0181	84.36
9.50	100.00	0.150	99.68	0.0144	83.42
4.75	100.00	0.075	98.86	0.0105	82.48
				0.0075	80.35
				0.0054	76.65
				0.0039	73.64
				0.0027	70.67
				0.0020	64.53
				0.0012	60.76



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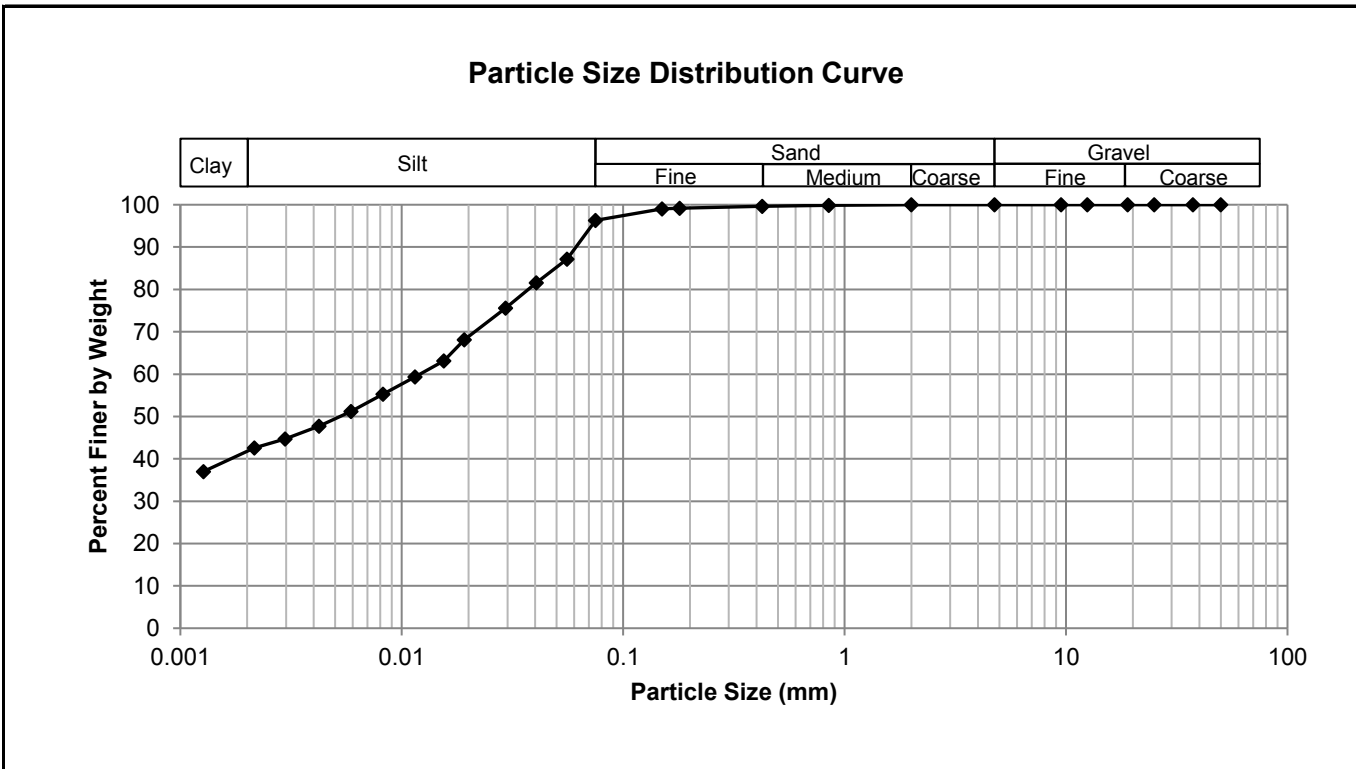
Grain Size Analysis (Hydrometer Method)
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Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Rosewarne Ave



Test Hole TH20-30
Sample # G216
Depth (m) 0.9 - 1.1
Sample Date 16-Jan-20
Test Date 6-Feb-20
Technician HS

Gravel	0.0%
Sand	3.7%
Silt	54.8%
Clay	41.6%



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	100.00	0.0750	96.31
37.5	100.00	2.00	100.00	0.0559	87.18
25.0	100.00	0.850	99.84	0.0405	81.55
19.0	100.00	0.425	99.64	0.0294	75.61
12.5	100.00	0.180	99.17	0.0192	68.11
9.50	100.00	0.150	99.03	0.0155	63.11
4.75	100.00	0.075	96.31	0.0115	59.35
				0.0082	55.29
				0.0059	51.22
				0.0042	47.71
				0.0030	44.67
				0.0022	42.56
				0.0013	37.02



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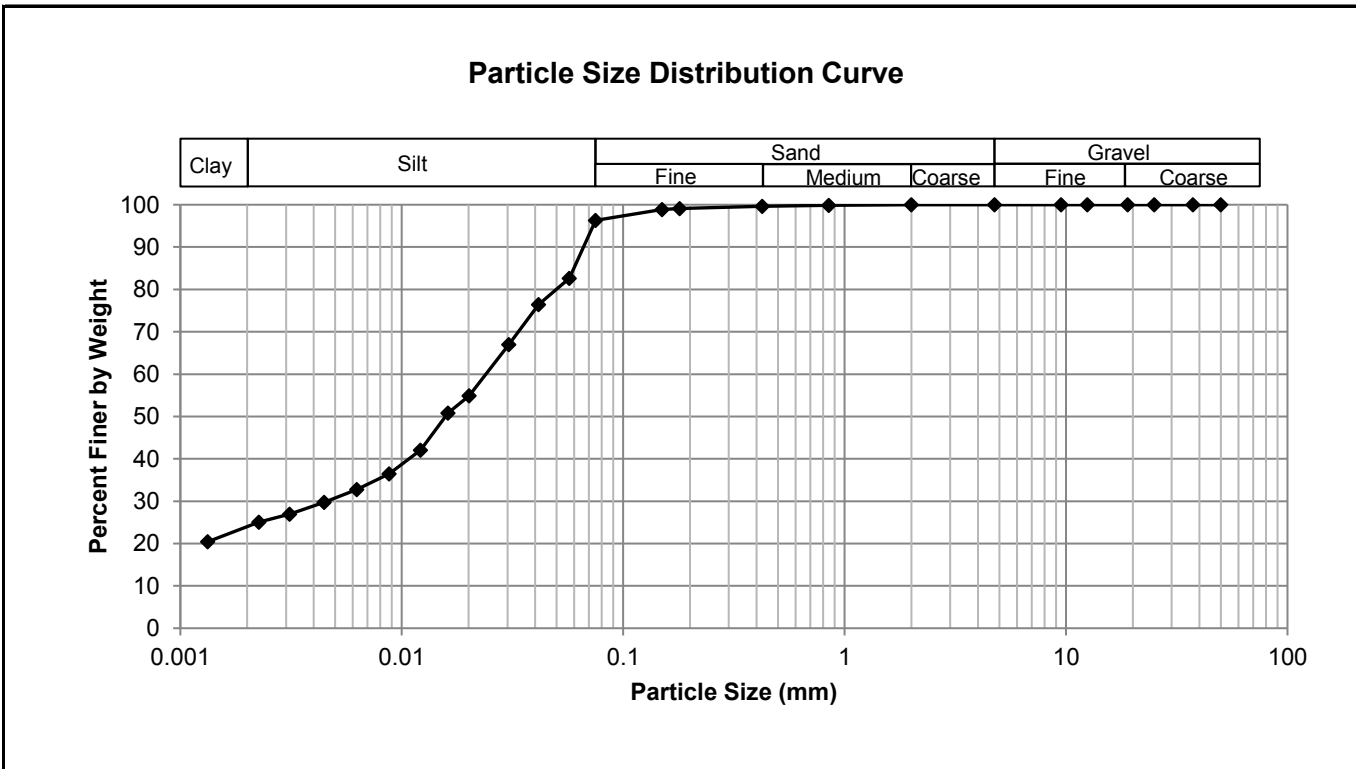
Grain Size Analysis (Hydrometer Method)
AASHTO T 88

Project No. 1000-043-10
Client WSP
Project 2020 Local Street and Alley - Rosewarne Ave



Test Hole TH20-31
Sample # G223
Depth (m) 0.8 - 0.9
Sample Date 16-Jan-20
Test Date 4-Feb-20
Technician HS

Gravel	0.0%
Sand	3.7%
Silt	72.6%
Clay	23.8%



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	96.34
37.5	100.00	2.00	100.00	0.0571	82.65
25.0	100.00	0.850	99.89	0.0415	76.40
19.0	100.00	0.425	99.67	0.0305	67.02
12.5	100.00	0.180	99.10	0.0202	54.89
9.50	100.00	0.150	98.90	0.0162	50.82
4.75	100.00	0.075	96.34	0.0122	42.07
				0.0088	36.44
				0.0063	32.76
				0.0045	29.76
				0.0031	26.95
				0.0023	25.07
				0.0013	20.43



Photo 1: Pavement Core Sample at Test Hole TH20-27



Photo 2: Pavement Core Sample at Test Hole TH20-28



Photo 3: Pavement Core Sample at Test Hole TH20-29



Photo 4: Pavement Core Sample at Test Hole TH20-30



Photo 5: Pavement Core Sample at Test Hole TH20-31

Appendix D

Oakridge Bay

Summary Table and Photographs of Pavement Core Samples



**20-R-05 Local Street Renewal
Oakridge Bay**

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material	
		Type	Thickness (mm)	Type	Thickness (mm)
PC20-07	Located at House #83 Oakridge Bay, 2 m North of South curb of road UTM N-5520789 E-634953	Asphalt	N/A	Concrete	150
PC20-08	Located at House #70 Oakridge Bay, 1 m South of North curb of road UTM N-5520749 E-634877	Asphalt	N/A	Concrete	130
PC20-09	Located at House #51 Oakridge Bay, 1 m East of West curb of road UTM N-5520783 E-634855	Asphalt	N/A	Concrete	130
PC20-10	Located at House #39 Oakridge Bay, 1.7 m West of East curb of road UTM N-5520787 E-634824	Asphalt	N/A	Concrete	135
PC20-11	Located at House #23 Oakridge Bay, 1.4 m South of North curb of road UTM N-5520824 E-634846	Asphalt	N/A	Concrete	140
PC20-12	Located at 33 m West & 1.5 m South of Metz Street & Oakridge Bay North intersection UTM N-5520853 E-634914	Asphalt	N/A	Concrete	150



Photo 1: Pavement Core Sample at Test Hole PC20-07



Photo 2: Pavement Core Sample at Test Hole PC20-08



Photo 3: Pavement Core Sample at Test Hole PC20-09



Photo 4: Pavement Core Sample at Test Hole PC20-10



Photo 5: Pavement Core Sample at Test Hole PC20-11



Photo 6: Pavement Core Sample at Test Hole PC20-12

Appendix E

Drake Blvd.

Summary Table and Photographs of Pavement Core Samples



**20-R-05 Local Street Renewal
Drake Boulevard**

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material	
		Type	Thickness (mm)	Type	Thickness (mm)
PC20-13	Located at House #780 Drake Boulevard, 2 m West of East curb of road UTM N-5525535 E-637501	Asphalt	100	Concrete	150
PC20-14	Located at 27 m South & 2 m West of Buttonwood Bay (N Leg) & Drake Boulevard intersection, 3 m East of West curb UTM N-5525449 E-637527	Asphalt	70	Concrete	180
PC20-15	Located at 16 m North & 2.8 m East of Blackberry Bay (S Leg) & Drake Boulevard intersection, 2 m West of East curb UTM N-5525345 E-637574	Asphalt	70	Concrete	200
PC20-16	Located at 18 m South & 2 m West of Bentwood Bay (S Leg) & Drake Boulevard intersection, 2 m East of West curb UTM N-5525243 E-637601	Asphalt	120	Concrete	180
PC20-17	Located at 27 m South & 2 m East of Burning Bush Bay (S Leg) & Drake Boulevard intersection, 2 m West of East curb UTM N-5525172 E-637643	Asphalt	120	Concrete	N/A
PC20-18	Located at 21 m North & 2 m West of Boulder Bay (N Leg) & Drake Boulevard intersection, 3 m East of West curb UTM N-5525073 E-637687	Asphalt	125	Concrete	180
PC20-19	Located at 13.5 m South & 2 m East of Birch Bay (N Leg) & Drake Boulevard intersection, 2.4 m West of East curb UTM N-5524971 E-637729	Asphalt	120	Concrete	N/A
PC20-20	Located at House #351 Drake Boulevard, 1.3 m East of West curb of road UTM N-5524905 E-637750	Asphalt	75	Concrete	175



Photo 1: Pavement Core Sample at Test Hole PC20-13



Photo 2: Pavement Core Sample at Test Hole PC20-14



Photo 3: Pavement Core Sample at Test Hole PC20-15



Photo 4: Pavement Core Sample at Test Hole PC20-16



Photo 5: Pavement Core Sample at Test Hole PC20-17



Photo 6: Pavement Core Sample at Test Hole PC20-18



Photo 7: Pavement Core Sample at Test Hole PC20-19



Photo 8: Pavement Core Sample at Test Hole PC20-20