AECOM

Lanark Street

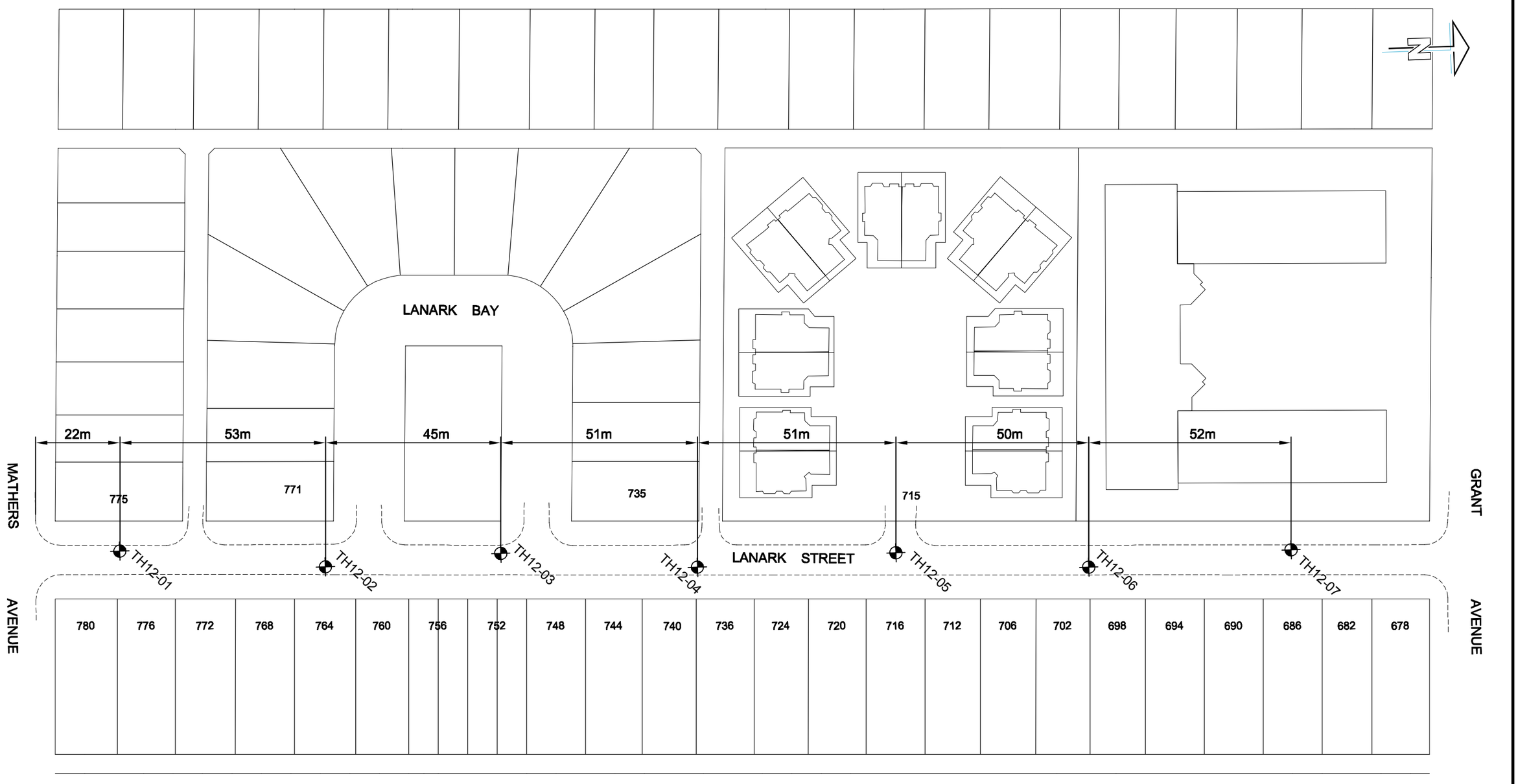
B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 12/02/10 1:03:12 PM

Saved By: cloustonc

AECOM FILE NAME: 60241484-01-B-F01-R0X.dwg

ISS/REV: 0A



0 10 20 30 m

SCALE 1:1000

City of Winnipeg
2012 Residential Package
Test Hole Locations
Lanark Street

Figure - 01

Winnipeg

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Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

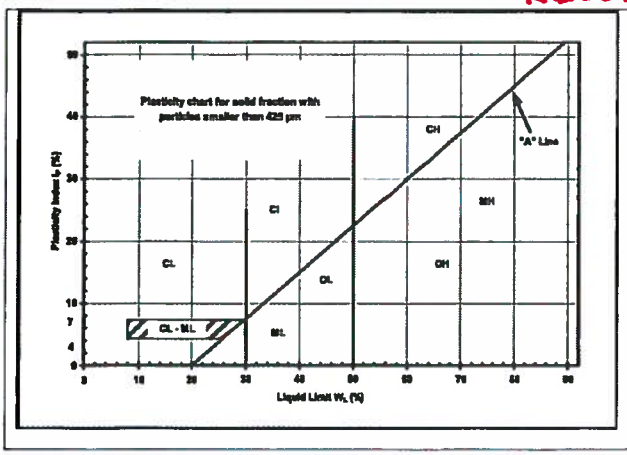
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-01
LOCATION: Lanark Street; In Front of House #775, Southbound Lane, 1.5 m East of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 50 mm)				
		CONCRETE (thickness = 200 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen to 1.2 m, moist when thawed - intermediate plasticity		G1		
				G2		
				G3		
1						1
		- below 1.2 m, compact to loose - suspected hydrocarbon odour		G4		
				G5		
		SILTY CLAY - brown - moist, firm - intermediate plasticity		G6		
2						2
				G7		
		END OF TEST HOLE AT 2.1 m in silty clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.				
3						

PENETRATION TESTS: ✳ Becker ✳ | ◇ Dynamic Cone ◇ | ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + | × QU × | □ Lab Vane □ | △ Pocket Pen. △ | ✣ Field Vane ✣ (kPa) 50 100 150 200

AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
	REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
	PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-02
LOCATION: Lanark Street; In Front of House #764, Northbound Lane, 2.0 m West of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
0		ASPHALT (thickness = 40 mm)		
		CONCRETE (thickness = 200 mm)		
		CLAY (FILL) - some silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G8
				G9
		GRANULAR (FILL) - possible concrete pipe (abandoned) - dry, loose upon recovery		G10
1				
		CLAY - trace silt - brown - moist firm - high plasticity		G11
				G12
				G13
2		- silt pocket at 1.9 m		G14
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.24 m, solid stem augers to 2.1 m.		
3				

PENETRATION TESTS
✳ Becker ✳
◇ Dynamic Cone ◇
◆ SPT (Standard Pen Test) ◆
(Blows/300mm)
0 20 40 60 80 100
■ Total Unit Wt ■
(kN/m³)
16 17 18 19 20 21
Plastic MC Liquid
20 40 60 80 100

UNDRAINED SHEAR STRENGTH
+ Torvane +
× QU ×
☐ Lab Vane ☐
△ Pocket Pen. △
✪ Field Vane ✪
(kPa)
50 100 150 200

COMMENTS

DEPTH

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-03
LOCATION: Lanark Street; Opposite House #752, Southbound Lane, 2.0 m East of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 60 mm)				
		CONCRETE (thickness = 180 mm)				
		CLAY (FILL) - some silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G15		
		CLAY - some silt, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity		G16	Gradation: Sand = 3.0%, Silt = 18.7%, Clay = 78.2%	
				G17		
1						1
		- below 1.2 m, firm		G18		
				G19		
		- at 1.75 m, silt pocket				
		- below 1.8 m, trace silt		G20		
2						2
				G21		
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diameter core to 0.24 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-04
LOCATION: Lanark Street; Along Property Line of House #740 and 736, Northbound Lane, 2.0 m West of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 55 mm)				
		CONCRETE (thickness = 190 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G22		
				G23		
		CLAY - some silt, trace sand - dark brown - frozen to 1.2 m, moist when thawed - high plasticity		G24	Gradation: Sand = 1.5%, Silt = 12.1%, Clay = 86.4%	
1						1
				G25		
		- below 1.4 m, firm				
		- below 1.5 m, silt inclusions		G26		
				G27		
2		CLAYEY SILT - trace sand - brown - moist, soft to firm - intermediate plasticity		G28		2
		END OF TEST HOLE AT 2.1 m in clayey silt.				
3		NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.245 m, solid stem augers to 2.1 m.				

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-05
LOCATION: Lanark Street; Opposite House #716, Southbound Lane, 2.0 m East of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 65 mm)				
		CONCRETE (thickness = 150 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen to 1.2 m, moist when thawed - intermediate plasticity		G29		
				G30		
				G31		
1						1
		- below 1.2 m, compacted to loose - suspected hydrocarbon odour		G32		
				G33		
		CLAY - trace silt - moist, firm - high plasticity		G34		
2						2
		SILT - some clay - light brown - moist, soft - low to intermediate plasticity		G35		
		END OF TEST HOLE AT 2.1 m in silt.				
3						

NOTES:
1. No sloughing observed.
2. No seepage observed.
3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface.
4. Drilled with 150 mm diamond core to 0.215 m, solid stem augers to 2.1 m.

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-06
LOCATION: Lanark Street; Along Property Line of House #702 and 698, Northbound Lane, 2.0 m West of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 60 mm)				
		CONCRETE (thickness = 270 mm)				
		CLAY (FILL) - some silt to silty, trace sand - dark brown - frozen, moist when thawed - high plasticity		G36		
				G37	Gradation: Sand = 5.8%, Silt = 22.0%, Clay = 72.1%	
1						1
		CLAY - some silt, trace sand - brown - frozen to 1.2 m, moist when thawed - high plasticity - below 1.2 m, firm		G38	Gradation: Sand = 2.6%, Silt = 14.3%, Clay = 83.1%	
				G39		
				G40		
2						2
				G41		
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.330 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-07
LOCATION: Lanark Street; Opposite House #686, Southbound Lane, 1.25 m East of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 45 mm)				
		CONCRETE (thickness = 205 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G42		
				G43		
1						1
		CLAY - trace to some silt - brown - frozen to 1.2 m, moist when thawed - high plasticity - below 1.2 m, firm		G44		
				G45		
		CLAYEY SILT - trace sand - light brown - moist, soft - intermediate plasticity		G46		
2				G47		2
		END OF TEST HOLE AT 2.1 m in clayey silt. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

City of Winnipeg
Local Streets Package 12-R-02
Geotechnical Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-01	Lanark Street; In Front of House #775, Southbound Lane, 1.5 m East of Curb	Asphalt	50	None	n/a	Clay Fill	0.3	20.9							
						Clay Fill	0.6	17.6							
						Clay Fill	0.9	17.0							
		Concrete	200			Clay Fill	1.2	5.7							
						Clay Fill	1.5	6.7							
						Silty Clay	1.8	35.0							
						Silty Clay	2.1	38.1							
TH12-02	Lanark Street, In Front of House #764, Northbound Lane, 2.0 m West of Curb	Asphalt	40	None	n/a	Clay Fill	0.3	26.9							
						Clay Fill	0.6	29.6							
						Granular Fill	0.9	10.5							
		Concrete	200			Clay	1.2	32.0							
						Clay	1.5	37.3							
						Clay	1.8	37.9							
						Clay	2.1	42.9							
TH12-03	Lanark Street, Opposite House #752, Southbound Lane, 2.0 m East of Curb	Asphalt	60	None	n/a	Clay Fill	0.3	22.2							
						Clay	0.6	27.1	0.0	3.0	18.7	78.2	69.6	22.9	46.7
						Clay	0.9	29.2							
		Concrete	180			Clay	1.2	32.1							
						Clay	1.5	37.1							
						Clay	1.8	41.7							
						Clay	2.1	43.4							
TH12-04	Lanark Street; Along Property Line of House #740 and 736, Northbound Lane, 2.0 m West of Curb	Asphalt	55	None	n/a	Clay Fill	0.3	37.1							
						Clay Fill	0.6	33.3							
						Clay	0.9	30.4	0.0	1.5	12.1	86.4	81.9	24.3	57.6
		Concrete	190			Clay	1.2	31.9							
						Clay	1.5	36.2							
						Clay	1.8	42.0							
						Clayey Silt	2.1	42.5							
TH12-05	Lanark Street; Opposite House #716, Southbound Lane, 2.0 m East of Curb	Asphalt	65	None	n/a	Clay Fill	0.3	15.7							
						Clay Fill	0.6	15.1							
						Clay Fill	0.9	16.4							
		Concrete	150			Clay Fill	1.2	16.6							
						Clay Fill	1.5	19.5							
						Clay	1.8	42.9							
						Silt	2.1	46.4							

City of Winnipeg
Local Streets Package 12-R-02
Geotechnical Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-06	Lanark Street; Along Property Line of House #702 and 698, Northbound Lane, 2.0 m West of Curb	Asphalt	60	None	n/a	Clay Fill	0.6	27.8							
						Clay Fill	0.9	31.3	0.0	5.8	22.0	72.1	65.6	23.4	42.2
		Concrete	270			Clay	1.2	28.7	0.0	2.6	14.3	83.1	74.2	23.1	51.2
						Clay	1.5	30.7							
						Clay	1.8	41.8							
						Clay	2.1	40.0							
TH12-07	Lanark Street; Opposite House #686, Southbound Lane, 1.25 m East of Curb	Asphalt	45	None	n/a	Clay Fill	0.6	38.3							
						Clay Fill	0.9	34.5							
		Concrete	205			Clay	1.2	33.3							
						Clay	1.5	37.4							
						Clayey Silt	1.8	41.3							
						Clayey Silt	2.1	41.0							

Photograph 1. Lanark Street – TH12-01

Photograph 2. Lanark Street – TH12-02

Photograph 3. Lanark Street – TH12-03

Photograph 4. Lanark Street – TH12-04

Photograph 5. Lanark Street – TH12-05

Photograph 6. Lanark Street – TH12-06

Photograph 7. Lanark Street – TH12-07

Mulvey Avenue

B SIZE 11" x 17" (279.4mm x 431.8mm)

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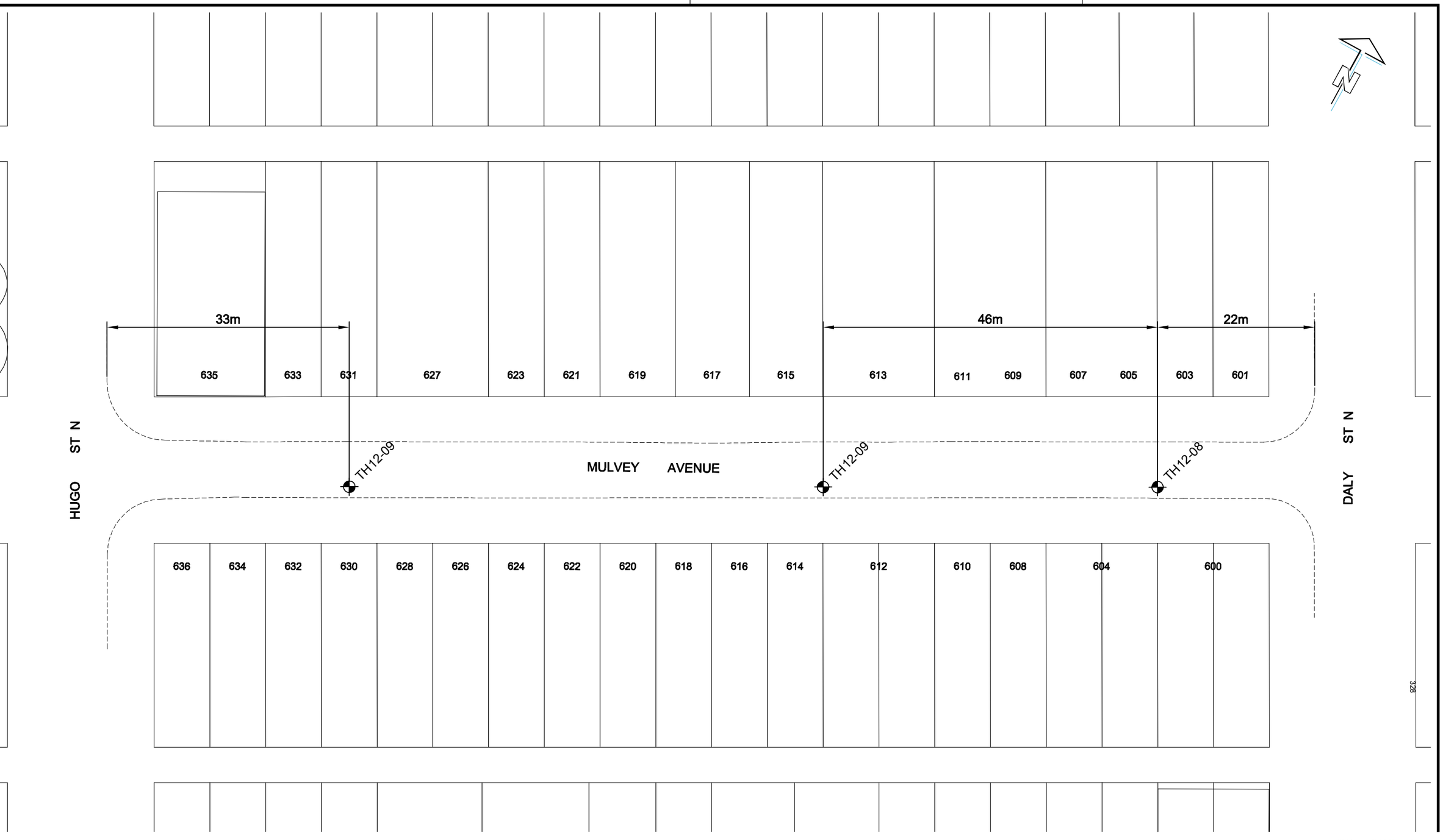

City of Winnipeg
2012 Residential Package
Test Hole Locations
Mulvey Avenue

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Figure - 02

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

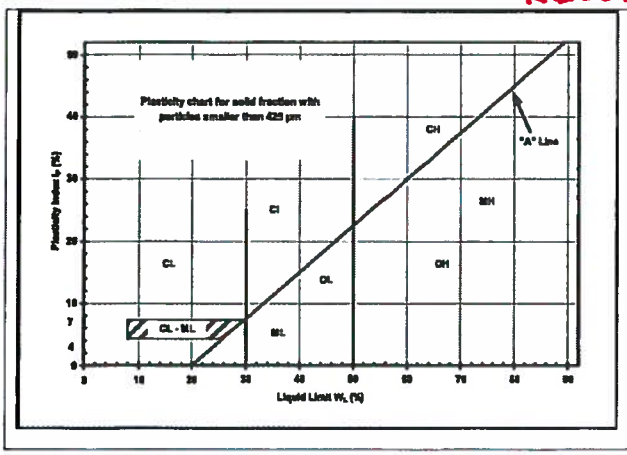
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-08
LOCATION: Mulvey Avenue; Along Property Line of House #602 and 604, Eastbound Lane, 1.5 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 95 mm)				
		CONCRETE (thickness = 155 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G48		
		SILTY CLAY - trace sand - brown - frozen, moist when thawed - intermediate plasticity		G49		
				G50	Gradation: Sand = 9.5%, Silt = 38.1%, Clay = 52.4%	
1						1
		SILT - some sand - light brown - frozen to 1.2 m, moist when thawed - low to intermediate plasticity - below 1.2 m, soft		G51		
				G52		
		- below 1.8 m, some clay, soft to firm		G53		
2		CLAY - trace silt - brown - moist, firm - high plasticity		G54		2
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-09
LOCATION: Mulvey Avenue; Along Property Line of House #612 and 614, Eastbound Lane, 1.5 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✪ Field Vane ✪ (kPa) 50 100 150 200	COMMENTS	DEPTH
0		ASPHALT (thickness = 55 mm)						
		CONCRETE (thickness = 175 mm)						
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G55				
				G56				
		SILT - trace clay, trace sand - light brown - frozen to 1.1 m, moist when thawed - low to intermediate plasticity		G57				
1		- below 1.1 m, soft		G58				1
				G59				
		- below 1.75 m, some clay		G60				
2		CLAY - some silt - brown - moist, firm - high plasticity		G61				2
		END OF TEST HOLE AT 2.3 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.23 m, solid stem augers to 2.3 m.						
3								

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.30 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-10
LOCATION: Mulvey Avenue; In Front of House #630, Eastbound Lane, 1.5 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 125 mm)				
		CONCRETE (thickness = 125 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G62		
		SILTY CLAY - trace sand - dark brown - frozen, moist when thawed - high plasticity		G63	Gradation: Sand = 7.3%, Silt = 37.1%, Clay = 55.6%	
		- at 0.9 m, brown, some silt		G64		
1						1
		SILT - trace clay - light brown - frozen to 1.2 m, moist when thawed - low plasticity - below 1.2 m, soft		G65		
				G66		
		- below 1.8 m, some clay		G67		
2		CLAY - some silt - brown - moist, firm - high plasticity		G68		2
		END OF TEST HOLE AT 2.1 m in clay.				
3		NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, sand and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.				

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/24/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

City of Winnipeg
Local Streets Package 12-R-02
Geotechnical Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-08	Mulvey Avenue; Along Property Line of House #602 and 604, Eastbound Lane, 1.5 m North of Curb	Asphalt	95	None	n/a	Clay Fill	0.3	29.6							
						Silty Clay	0.6	31.9							
						Silty Clay	0.9	36.6	0.0	9.5	38.1	52.4	45.4	19.6	25.7
		Concrete	155			Silt	1.2	23.3							
						Silt	1.5	14.6							
						Silt	1.8	20.1							
						Clay	2.1	28.2							
TH12-09	Mulvey Avenue; Along Property Line of House #612 and 614, Eastbound Lane, 1.5 m North of Curb	Asphalt	55	None	n/a	Clay Fill	0.3	33.4							
						Clay Fill	0.6	27.9							
						Silt	0.9	14.1							
		Concrete	175			Silt	1.2	15.9							
						Silt	1.5	16.1							
						Silt	1.8	27.5							
						Clay	2.1	29.6							
TH12-10	Mulvey Avenue; In Front of House #630, Eastbound Lane, 1.5 m North of Curb	Asphalt	125	None	n/a	Clay Fill	0.3	28.8							
						Clay	0.6	36.5	0.0	7.3	37.1	55.6	76.8	27.3	49.4
						Clay	0.9	31.9							
		Concrete	125			Silt	1.2	20.7							
						Silt	1.5	21.4							
						Silt	1.8	26.9							
						Clay	2.1	30.6							

Photograph 1. Mulvey Avenue – TH12-08

Photograph 2. Mulvey Avenue – TH12-09

Photograph 3. Mulvey Avenue – TH12-10

AECOM

Kane Avenue

B SIZE 11" x 17" (279.4mm x 431.8mm)

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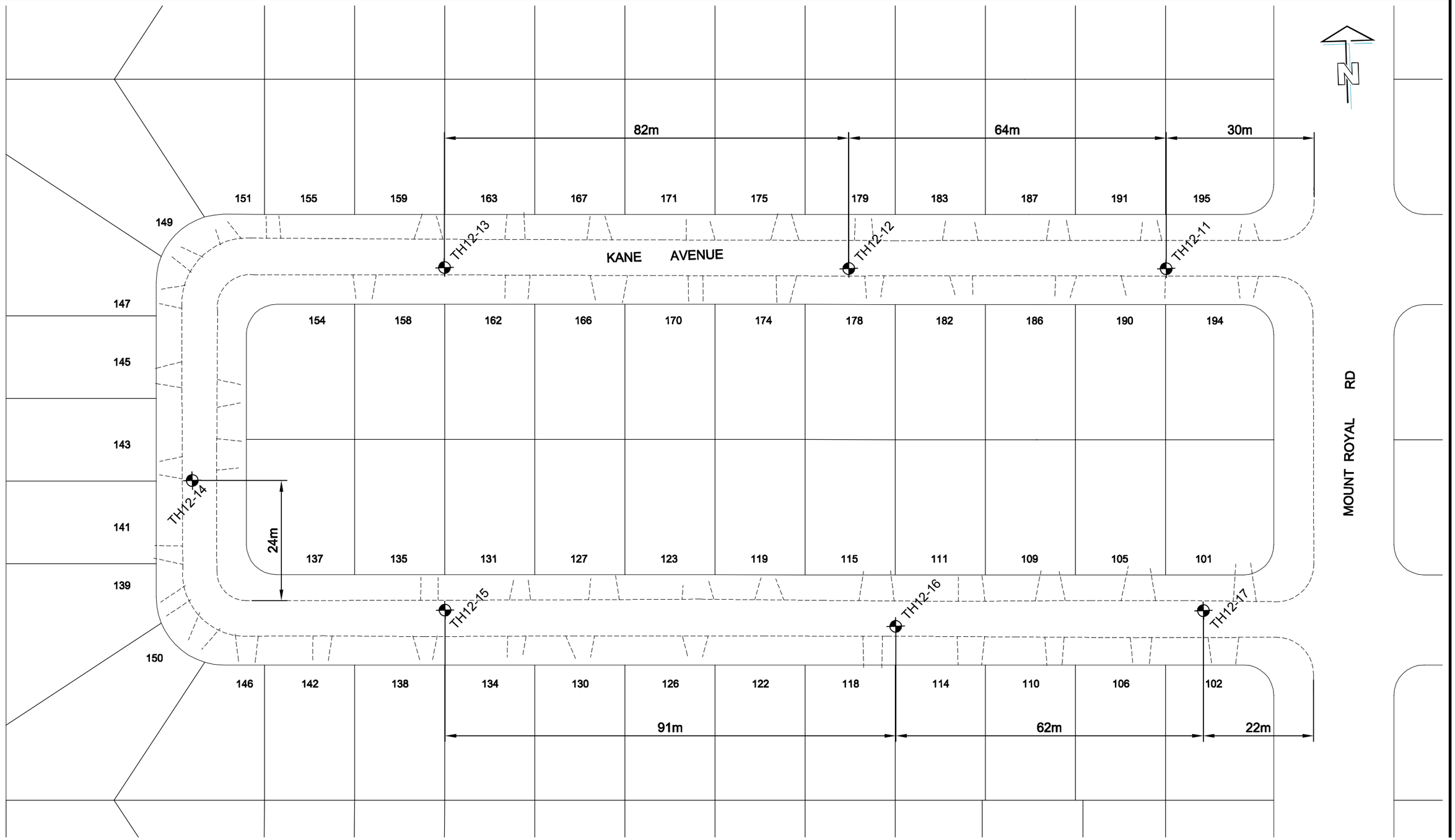

City of Winnipeg
2012 Residential Package
Test Hole Locations
Kane Avenue

AECOM

Figure - 03

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

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GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

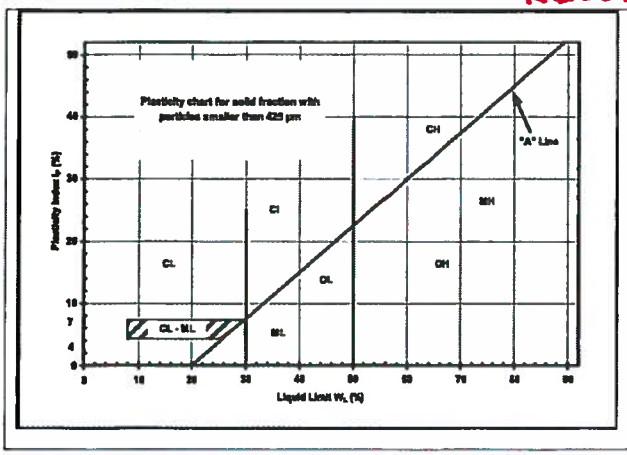
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-11
LOCATION: Kane Avenue; West Edge of House #194, Eastbound Lane, 1.5 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 55 mm)				
		CONCRETE (thickness = 170 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G69		
				G70		
		CLAY - some silt, trace sand - dark brown - frozen to 1.2 m, moist when thawed - high plasticity		G71	Gradation: Sand = 8.7%, Silt = 15.4%, Clay = 75.9%	
1						1
		- below 1.2 m, firm		G72		
				G73		
		- below 1.8 m, brown		G74		
2						2
				G75		
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.225 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-12
LOCATION: Kane Avenue; In Front of House #178, Eastbound Lane, 1.5 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▩ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 30 mm) CONCRETE (thickness = 155 mm)					
		CLAY - trace to some silt, trace sand - brown - frozen to 1.1 m, moist when thawed - high plasticity		G76			
				G77			
				G78			
1		- below 1.1 m, firm		G79			1
				G80			
				G81			
2				G82			2
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.185 m, solid stem augers to 2.1 m.					
3							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✪ Field Vane ✪ (kPa) 50 100 150 200

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-13
LOCATION: Kane Avenue; East Edge of House #158, Eastbound Lane, 1.5 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100
■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21
Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✪ Field Vane ✪ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 45 mm)				
		CONCRETE (thickness = 180 mm)				
		CLAY - some silt, trace sand - brown - frozen to 1.5 m, moist when thawed - high plasticity		G83		
				G84	Gradation: Sand = 5.1%, Silt = 15.1%, Clay = 79.8%	
				G85		
1						1
				G86		
		- below 1.5 m, firm to stiff		G87		
		- at 1.8 m, silt pockets, trace gypsum		G88		
2						2
				G89		
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.225 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-14
LOCATION: Kane Avenue; South Edge of House #143, Southbound Lane, 2.0 m East of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100
■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21
Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✪ Field Vane ✪ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 60 mm)				
		CONCRETE (thickness = 190 mm)				
		SILTY CLAY - dark brown - frozen, moist when thawed - intermediate plasticity		G90		
				G91		
				G92	Gradation: Silt = 40.7%, Clay = 59.3%	
1						1
		CLAYEY SILT - trace sand - brown - frozen to 1.4 m, moist when thawed - intermediate plasticity		G93		
		- below 1.4 m, firm		G94		
				G95		
2		SILT - trace clay - light brown - moist, soft - low plasticity		G96		2
		END OF TEST HOLE AT 2.1 m in silt.				
3		NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.25 m, solid stem augers to 2.1 m.				

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-15
LOCATION: Kane Avenue; Along Property Line of House #135 and 131, Westbound Lane, 2.0 m South of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 | ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 | Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ✣ Field Vane ✣ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 37 mm)				
		CONCRETE (thickness = 188 mm)				
		CLAY FILL - trace silt, trace sand, trace organics - dark brown - frozen, moist when thawed - high plasticity		G97		
				G98		
1		CLAY - trace silt - dark brown - frozen to 1.2 m, moist when thawed - high plasticity		G99		1
		- below 1.2 m, firm		G100		
		- below 1.5 m, brown		G101		
2				G102		2
				G103		
3		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.225 m, solid stem augers to 2.1 m.				

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-16
LOCATION: Kane Avenue; Along Property Line of House #118 and 114, Eastbound Lane, 2.0 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 35 mm)				
		CONCRETE (thickness = 165 mm)				
		CLAY - some silt, trace sand - dark brown - frozen to 1.1 m, moist when thawed - high plasticity		G104		
				G105	Gradation: Sand = 2.6%, Silt = 14.7%, Clay = 82.7%	
				G106		
1		- below 1.1 m, firm				1
		- below 1.2 m, brown		G107		
		- below 1.5 m, silt inclusions (< 10 mm)		G108		
				G109		
2				G110		2
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.20 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-17
LOCATION: Kane Avenue; In Front of House #101, Westbound Lane, 2.0 m South of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✪ Field Vane ✪ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		CONCRETE (thickness = 190 mm)				
		GRANULAR BASE - well graded (<19 mm diameter)				
		CLAY - trace silt - brown - frozen, moist when thawed - high plasticity		G111		
				G112		
				G113		
1						1
		SILT - trace clay - light brown - moist, soft - low plasticity		G114		
		CLAY - some silt, some silt inclusions (<10 mm) - brown - moist, firm - high plasticity		G115		
				G116		
2						2
				G117		
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.19 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

City of Winnipeg
Local Streets Package 12-R-02
Geotechnical Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-11	Kane Avenue; West Edge of House #194, Eastbound Lane, 1.5 m North of Curb	Asphalt	55	None	n/a	Clay Fill	0.3	27.5							
						Clay Fill	0.6	38.9							
						Clay	0.9	35.1	0.0	8.7	15.4	75.9	83.3	26.6	56.7
		Concrete	170			Clay	1.2	32.8							
						Clay	1.5	35.2							
						Clay	1.8	34.8							
						Clay	2.1	38.4							
TH12-12	Kane Avenue; In Front of House #178, Eastbound Lane, 1.5 m North of Curb	Asphalt	30	None	n/a	Clay	0.3	35.6							
						Clay	0.6	35.7							
						Clay	0.9	36.0							
		Concrete	155			Clay	1.2	37.9							
						Clay	1.5	36.9							
						Clay	1.8	37.6							
						Clay	2.1	35.5							
TH12-13	Kane Avenue; East Edge of House #158, Eastbound Lane, 1.5 m North of Curb	Asphalt	45	None	n/a	Clay	0.3	37.0							
						Clay	0.6	33.2	0.0	5.1	15.1	79.8	74.4	25.9	48.5
						Clay	0.9	30.6							
		Concrete	180			Clay	1.2	31.0							
						Clay	1.5	28.8							
						Clay	1.8	28.4							
						Clay	2.1	27.4							
TH12-14	Kane Avenue; South Edge of House #143, Southbound Lane, 2.0 m East of Curb	Asphalt	60	None	n/a	Silty Clay	0.3	29.2							
						Silty Clay	0.6	31.7							
						Silty Clay	0.9	22.3	0.0	0.0	40.7	59.3	44.6	18.3	26.3
		Concrete	190			Clayey Silt	1.2	26.5							
						Clayey Silt	1.5	25.9							
						Clayey Silt	1.8	28.8							
						Silt	2.1	26.9							
TH12-15	Kane Avenue; Along Property Line of House #135 and 131, Westbound Lane, 2.0 m South of Curb	Asphalt	37	None	n/a	Clay Fill	0.3	54.5							
						Clay Fill	0.6	50.0							
						Clay	0.9	35.3							
		Concrete	188			Clay	1.2	32.8							
						Clay	1.5	35.8							
						Clay	1.8	36.6							
						Clay	2.1	39.1							

City of Winnipeg
Local Streets Package 12-R-02
Geotechnical Investigation

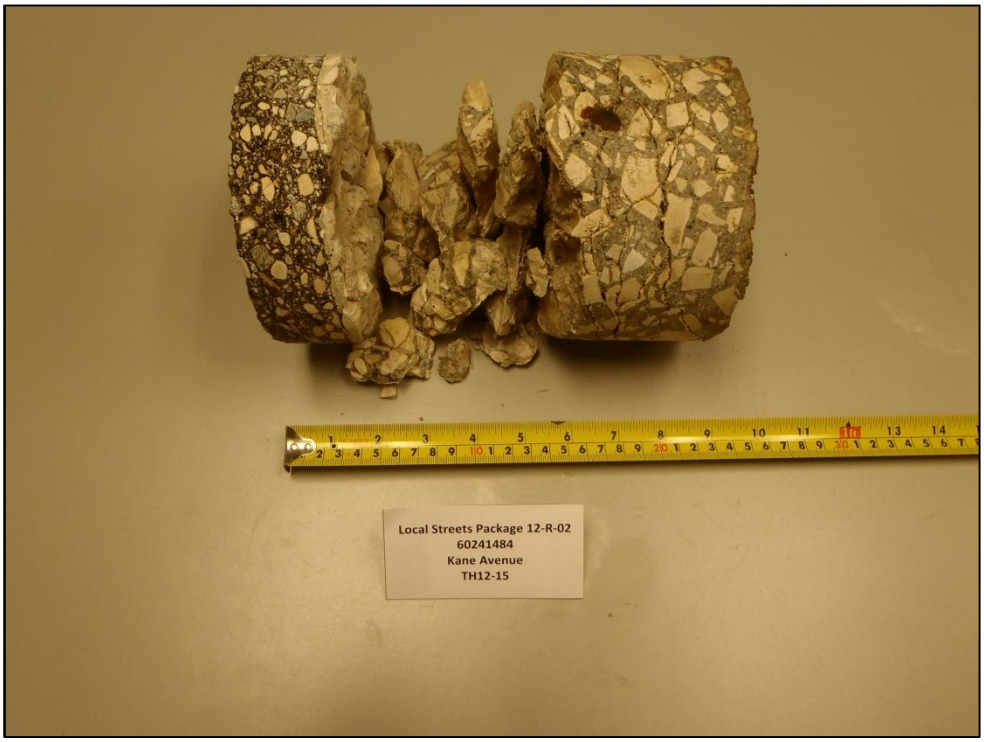
Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-16	Kane Avenue; Along Property Line of House #118 and 114, Eastbound Lane, 2.0 m North of Curb	Asphalt	35	None	n/a	Clay	0.3	28.4							
						Clay	0.6	33.5	0.0	2.6	14.7	82.7	82.3	24.4	57.9
						Clay	0.9	33.1							
		Concrete	165			Clay	1.2	37.4							
						Clay	1.5	36.2							
						Clay	1.8	39.2							
						Clay	2.1	37.8							
TH12-17	Kane Avenue; In Front of House #101, Westbound Lane, 2.0 m South of Curb	Concrete	190	Granular Base (<19mm diameter)	62	Clay	0.3	26.6							
						Clay	0.6	24.1							
						Clay	0.9	25.9							
						Silt	1.2	19.3							
						Clay	1.5	32.8							
						Clay	1.8	36.5							
						Clay	2.1	35.0							

Photograph 1. Kane Avenue – TH12-11

Photograph 2. Kane Avenue – TH12-12

Photograph 3. Kane Avenue – TH12-13

Photograph 4. Kane Avenue – TH12-14



Photograph 5. Kane Avenue – TH12-15

Photograph 6. Kane Avenue – TH12-16

Photograph 7. Kane Avenue – TH12-17

Wavell Avenue

City of Winnipeg
2012 Residential Package
Test Hole Locations
Wavell Avenue

AECOM

Figure - 04

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

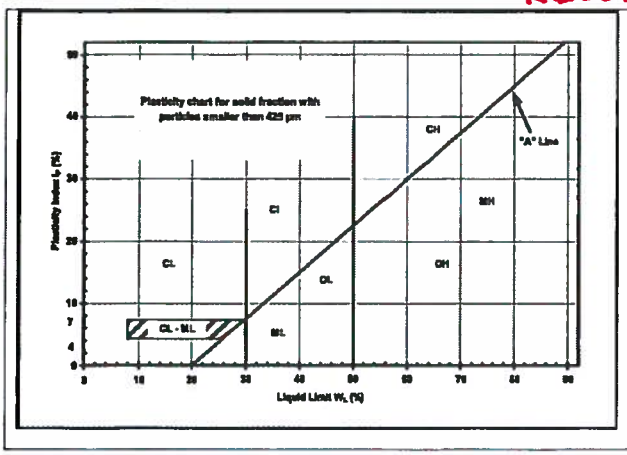
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		
	Concrete		Bedrock (Undifferentiated)		AECOM
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

NOT USED TO CLASSIFY SUBGRADE. REFER TO CITY OF WINNIPEG SPECS FOR GEOTECHNICAL INVESTIGATION STREET RECONSTRUCTION (OCT. 2008)



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-18
LOCATION: Wavell Avenue; In Front of House #231, Westbound Lane, 1.5 m South of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ▩ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 25 mm) CONCRETE (thickness = 175 mm)					
		SILTY CLAY - trace sand - brown - frozen to 1.1 m, moist when thawed - high plasticity		G118			
				G119		Gradation: Sand = 4.9%, Silt = 42.7%, Clay = 52.4%	
				G120			
1		- below 1.1 m, firm		G121			1
				G122			
				G123			
2				G124			2
		END OF TEST HOLE AT 2.1 m in silty clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.20 m, solid stem augers to 2.1 m.					
3							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ◓ Field Vane ◓ (kPa) 50 100 150 200

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

AECOM

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-19
LOCATION: Wavell Avenue; In Front of House #214, Eastbound Lane, 1.5 m North of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100
■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21
Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ✪ Field Vane ✪ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 35 mm)				
		CONCRETE (thickness = 160 mm)				
		CLAY - silty, trace sand - brown - frozen to 1.1 m, moist when thawed - high plasticity		G125		
				G126		
				G127		
1		- below 1.1 m, firm		G128		1
				G129		
				G130		
2				G131		2
		END OF TEST HOLE AT 2.1 m in clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diameter core to 0.195 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

PROJECT: Local Streets Package 12-R-02	CLIENT: City of Winnipeg	TESTHOLE NO: TH12-20
LOCATION: Wavell Avenue; In Front of House #203, Westbound Lane, 1.5 m South of Curb		PROJECT NO.: 60241484
CONTRACTOR: Maple Leaf Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE: GRAB | SHELBY TUBE | SPLIT SPOON | BULK | NO RECOVERY | CORE

PENETRATION TESTS: Becker; Dynamic Cone; SPT (Standard Pen Test) (Blows/300mm) 0 20 40 60 80 100; Total Unit Wt (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: Torvane; QU; Lab Vane; Pocket Pen.; Field Vane (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		ASPHALT (thickness = 25 mm)				
		CONCRETE (thickness = 160 mm)				
		CLAY (FILL) - trace silt, trace sand - dark brown - frozen, moist when thawed - high plasticity		G132		
		SILTY CLAY - trace sand, trace rootlets - brown - frozen to 1.2 m, moist when thawed - high plasticity		G133		
				G134	Gradation: Sand = 1.2%, Silt = 44.8%, Clay = 54.0%	
1						1
		- below 1.2 m, firm		G135		
				G136		
				G137		
2						2
				G138		
		END OF TEST HOLE AT 2.1 m in silty clay. NOTES: 1. No sloughing observed. 2. No seepage observed. 3. Test hole backfilled with auger cuttings, bentonite and asphalt cold patch to surface. 4. Drilled with 150 mm diamond core to 0.185 m, solid stem augers to 2.1 m.				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/12
PROJECT ENGINEER: Blair Cockrell	Page 1 of 1

LOG OF TEST HOLE LANARK, MULVEY, KANE & WAVELL LOGS.GPJ UMA WINN.GDT 2/13/12

City of Winnipeg
Local Streets Package 12-R-02
Geotechnical Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index
TH12-18	Wavell Avenue; In Front of House #231, Westbound Lane, 1.5 m South of Curb	Asphalt	25	None	n/a	Silty Clay	0.3	36.7							
						Silty Clay	0.6	33.6	0.0	4.9	42.7	52.4	65.8	22.1	43.6
						Silty Clay	0.9	28.6							
		Concrete	175			Silty Clay	1.2	30.0							
						Silty Clay	1.5	30.1							
						Silty Clay	1.8	27.9							
						Silty Clay	2.1	27.4							
TH12-19	Wavell Avenue; In Front of House #214, Eastbound Lane, 1.5 m North of Curb	Asphalt	35	None	n/a	Clay	0.3	32.1							
						Clay	0.6	32.6							
						Clay	0.9	27.2							
		Concrete	160			Clay	1.2	27.5							
						Clay	1.5	27.5							
						Clay	1.8	26.4							
						Clay	2.1	27.7							
TH12-20	Wavell Avenue; In Front of House #203, Westbound Lane, 1.5 m South of Curb	Asphalt	25	None	n/a	Clay Fill	0.3	37.9							
						Silty Clay	0.6	30.3							
						Silty Clay	0.9	26.6	0	1.2	44.8	54.0	68.1	23.8	44.4
		Concrete	160			Silty Clay	1.2	24.4							
						Silty Clay	1.5	25.0							
						Silty Clay	1.8	27.6							
						Silty Clay	2.1	26.4							

Photograph 1. Wavell Avenue – TH12-18

Photograph 2. Wavell Avenue – TH12-19

Photograph 3. Wavell Avenue – TH12-20