

APPENDIX 'F'

GEOTECHNICAL REPORT



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

Embrace the Spirit • Vivez l'esprit

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.

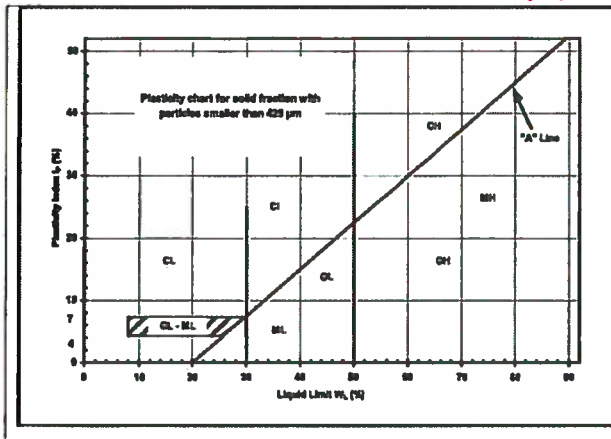
EXPLANATION OF FIELD & LABORATORY TEST DATA

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 $4 < W_p < 7$ $C_u = \frac{D_{60}}{D_{10}}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$	
			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 ORGANIC SOILS	Peat and other highly organic soils		Pt	Von Post Classification Limit	Strong colour or odour, and often fibrous texture				
	Asphalt		Till			AECOM			
	Concrete		Bedrock (Undifferentiated)						
	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. Reference to city of Winnipeg Specs for Geotechnical Investigation street reconstruction (Oct. 2008).

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	75	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	
Silt (non-plastic) or Clay (plastic)	< 0.075 mm		10-20	some
* for example: gravelly, sandy clayey, silty				
Definition of Oversize Material COBBLES: 75mm 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/m³).
- 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

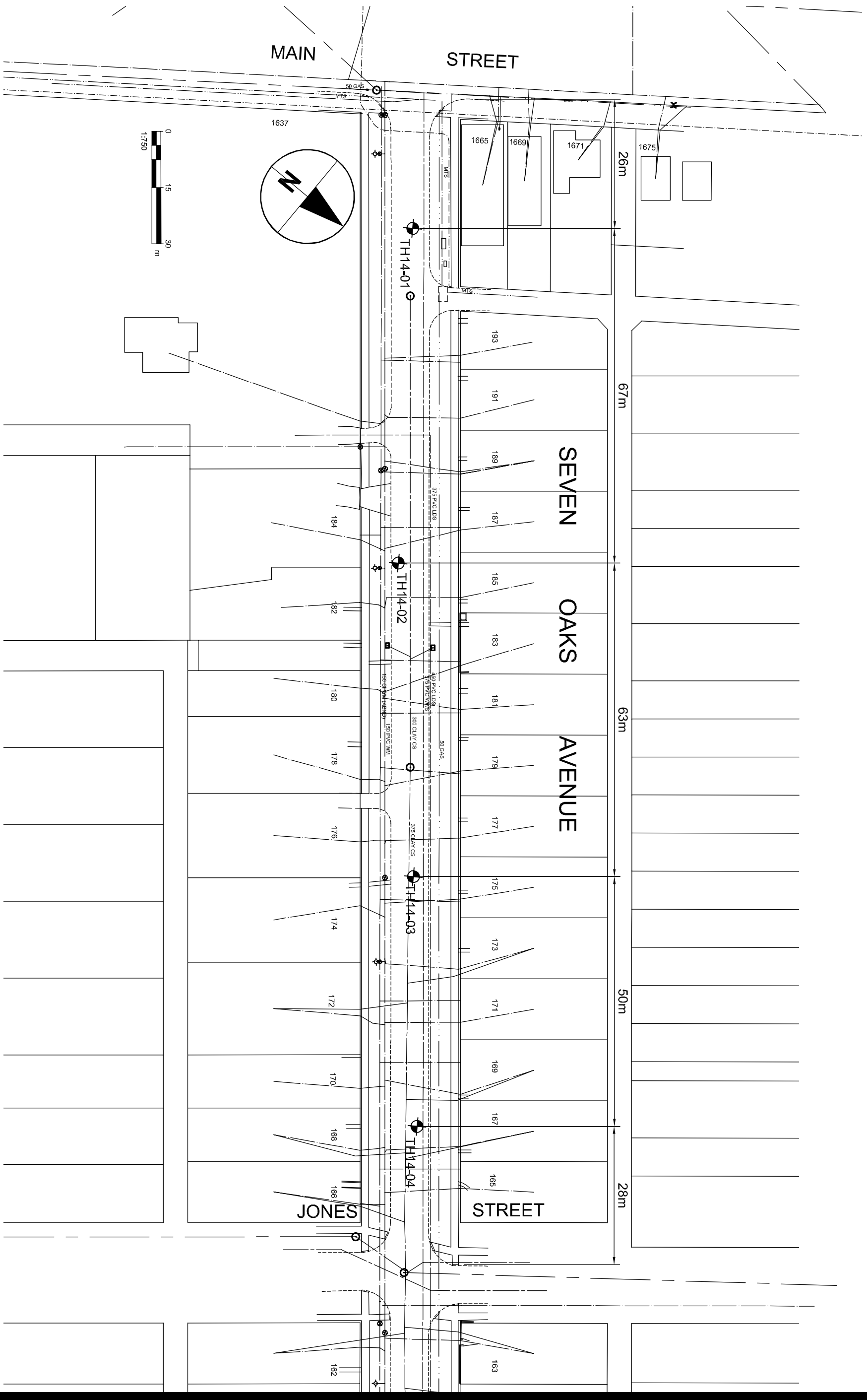


FIGURE 01: TEST HOLES LOCATION PLAN



Photograph 1. Seven Oaks Avenue – TH14-01



Photograph 2. Seven Oaks Avenue – TH14-02



Photograph 3. Seven Oaks Avenue – TH14-03



Photograph 4. Seven Oaks Avenue – TH14-04

PROJECT: Local street Package 14-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH14-01
LOCATION: Seven Oaks ;5 m South of North Curb		PROJECT NO.: 60312285
CONTRACTOR: Paddock Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS		UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)			
0		CONCRETE (thickness = 121 mm)							
		CLAY (Fill) - some gravel, trace sand - brown - frozen to 1.67 m , moist when thawed - high plasticity		G49	●				
		CLAY - trace sand - grayish brown - frozen to 1.67 m , moist when thawed - high plasticity		G50	●	—		Clay: 63.9% , Silt: 28.4% Sand: 7.7% , Gravel: 0.0%	
1		- brown below 1.0 m		G51	●				1
		- silty, light brown, intermediate plasticity below 1.25 m		G52	●				
		-soft to firm below 1.67m.		G53	●				
2		SILT - clayey, - light brown, - soft, moist to wet - low plasticity		G54	●				2
				G55	●				
				G56	●				
3		END OF TEST HOLE AT 2.44 m IN 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 0.28 m, solid stem augers to 2.4 m.							

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim	COMPLETION DEPTH: 2.44 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/3/14
PROJECT ENGINEER:	Page 1 of 1

PROJECT: Local street Package 14-R-03 CLIENT: City of Winnipeg TESTHOLE NO: TH14-02
 LOCATION: Seven Oaks ;8 m South of North Curb PROJECT NO.: 60312285
 CONTRACTOR: Paddock 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
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)				
0		CONCRETE (thickness = 140 mm)								
		CLAY (Fill) - trace sand - black to dark brown, - frozen to 1.5 m, moist when thawed - high plasticity								
		CLAY - trace sand, trace oxidation, - dark brown, - frozen to 1.5 m, moist when thawed - high plasticity								
1				G57	●					
				G58	●	—				
				G59	●					
				G60	●					
				G61	●					
				G62	●					
				G63	●					
				G64	●					
		- brown, firm, below 1.5 m								
		END OF TEST HOLE AT 2.44 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 2.4								
3										

Clay: 69.2%, Silt: 26.2%
Sand: 4.6%, Gravel: 0.0%

LOGGED BY: Saba Ibrahim COMPLETION DEPTH: 2.44 m
 REVIEWED BY: Faris Khalil COMPLETION DATE: 2/3/14
 PROJECT ENGINEER: Page 1 of 1



LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14

PROJECT: Local street Package 14-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH14-03
LOCATION: Seven Oaks ;4 m South of North Curb		PROJECT NO.: 60312285
CONTRACTOR: Paddock Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS		UNDRAINED SHEAR STRENGTH		COMMENTS	DEPTH
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)				
0		ASHPHALT (thickness = 140 mm)								
		CLAY (Fill) - some sand, trace gravel - black, - frozen to 1.67 m, moist when thawed - high plasticity		G65	●					
		SAND(FILL) - some gravel, - light brown, - frozen to 1.67 m, dry to moist when thawed		G66	●					
		CLAY -silty, some sand, - grayish brown, - frozen to 1.5 m, moist when thawed - intermediate plasticity		G67	●				Clay: 39.0%, Silt: 46.0% Sand: 14.1% , Gravel: 0.8%	
		- soft to firm below 1.5 m		G68	●					
		SILT - clayey, - light brown - soft, moist to wet - low plasticity		G69	●					
		CLAY - - dark brown, - stiff, moist , - high plasticity		G70	●					
		CLAY - - dark brown, - stiff, moist , - high plasticity		G71	●					
		END OF TEST HOLE AT 2.44 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 2.4		G72	●					

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim	COMPLETION DEPTH: 2.44 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/3/14
PROJECT ENGINEER:	Page 1 of 1

PROJECT: Local street Package 14-R-03 CLIENT: City of Winnipeg TESTHOLE NO: TH14-04
 LOCATION: Seven Oaks ;3 m South of North Curb PROJECT NO.: 60312285
 CONTRACTOR: Paddock 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
					* 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	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200				
0		CONCRETE (thickness = 115 mm)								
		CLAY - trace sand, trace oxidation - dark brown to brown - frozen to 1.4 m, moist when thawed - high plasticity	<input checked="" type="checkbox"/>	G73	●					
			<input checked="" type="checkbox"/>	G74	●					
			<input checked="" type="checkbox"/>	G75	●					
			<input checked="" type="checkbox"/>	G76	●					
		SILT - clayey, trace sand, trace oxidation - brown to light brown - soft, moist - low plasticity	<input checked="" type="checkbox"/>	G77	●					
		CLAY - silty, trace sand - brown - soft to stiff, moist - intermediate plasticity	<input checked="" type="checkbox"/>	G78	●					
			<input checked="" type="checkbox"/>	G79	●					
			<input checked="" type="checkbox"/>	G80	●					
		END OF TEST HOLE AT 2.44 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 0.305 m, solid stem augers to 2.4 m.								

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim COMPLETION DEPTH: 2.44 m
 REVIEWED BY: Faris Khalil COMPLETION DATE: 2/3/14
 PROJECT ENGINEER: Page 1 of 1

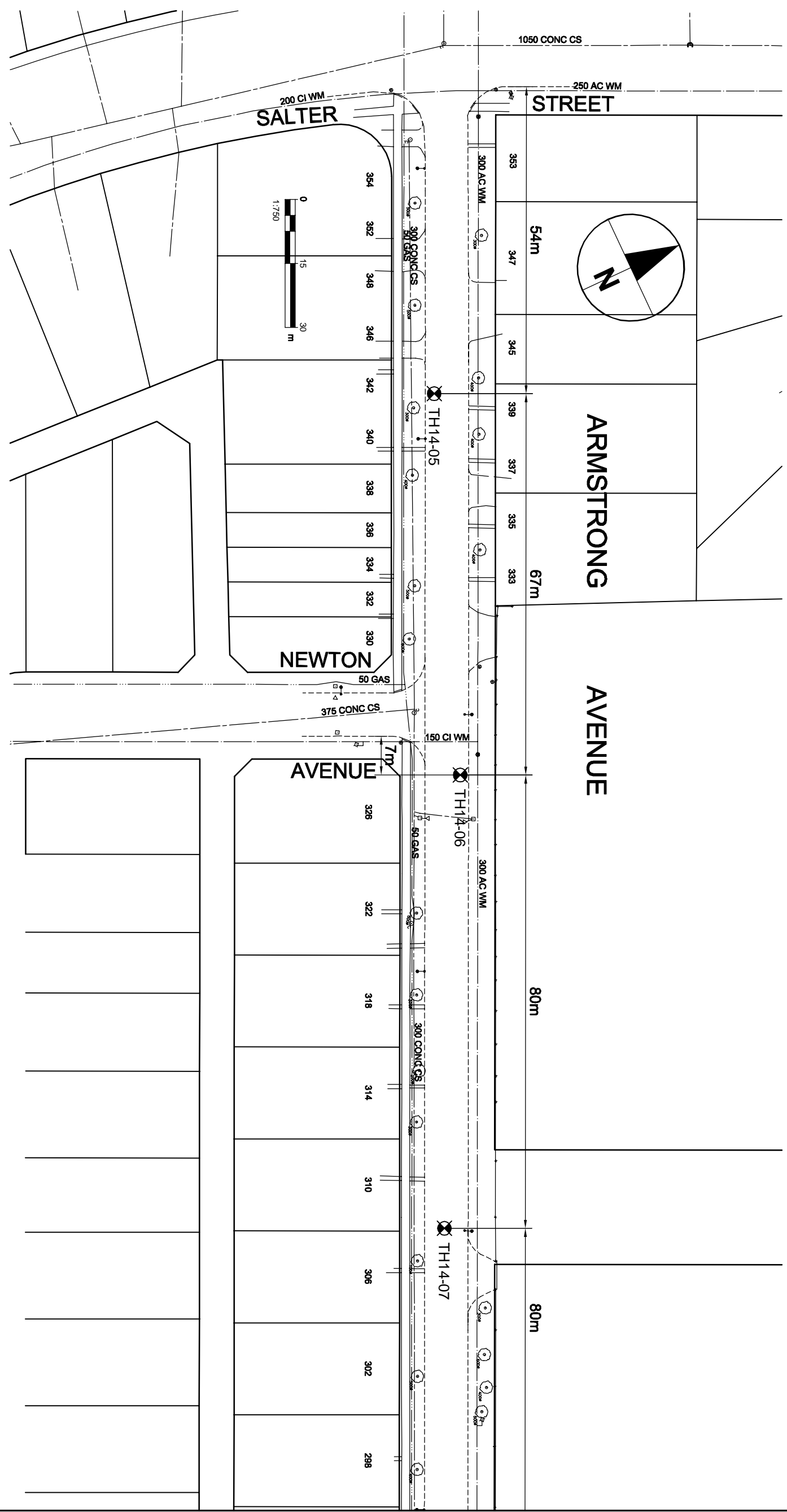
City of Winnipeg

Seven Oaks Avenue - Package 14-R-03

Geotechnical Investigation

Table 01- Summary of Laboratory Soil Testing

Test Hole No.	Testhole 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	
TH14-01	Seven Oaks Avenue ;5 m South of North Curb	Asphalt	n/a	None	n/a	Clay (Fill)	0.30-0.46	33.8								
						Clay	0.61-0.76	31.9	0.0	7.7	28.4	63.9	69.2	21.6	47.5	
						Clay	0.91-1.07	29.4								
						Silty Clay	1.22-1.37	29.0								
		Concrete	121			Silty Clay	1.52-1.68	25.8								
						Clayey Silt	1.83-1.98	23.3								
						Clayey Silt	2.13-2.29	21.8								
						Clayey Silt	2.36-2.44	33.0								
TH14-02	Seven Oaks Avenue ;8 m South of North Curb	Asphalt	n/a	None	n/a	Clay (Fill)	0.38-0.53	29.0								
						Clay	0.69-0.84	26.9	0.0	4.6	26.2	69.2	75.0	24.6	50.4	
		Concrete	140			Clay	0.99-1.14	24.7								
						Clay	1.30-1.45	21.9								
						Clay	1.60- 0.75	26.3								
						Clay	1.91-2.06	28.0								
						Clay	2.21-2.36	30.8								
						Clay	2.36-2.51	29.1								
TH14-03	Seven Oaks Avenue ;4 m South of North Curb	Asphalt	140	None	n/a	Clay (Fill)	0.23-0.38	36.5								
						Sand (Fill)	0.53-0.69	29.7								
		Concrete	n/a			Silty Clay	0.84-0.99	32.0	0.8	14.1	46.0	39.0	41.1	17.3	23.8	
						Silty Clay	1.14-1.30	22.9								
						Silty Clay	1.45-1.60	26.3								
						Clayey Silt	1.75-1.91	20.8								
						Clay	2.06-2.21	39.0								
						Clay	2.36-2.44	39.8								
TH14-04	Seven Oaks Avenue ;3 m South of North Curb	Asphalt	n/a	None	n/a	Clay	0.23-0.38	27.2								
						Clay	0.53-0.69	28.6								
						Clay	0.84-0.99	24.7								
						Clay	1.14-1.30	25.3								
		Concrete	115			Clayey Silt	1.45-1.60	22.5								
						Silty Clay	1.75-1.91	22.4								
						Silty Clay	2.06-2.21	22.7								
						Silty Clay	2.36-2.44	31.7								



MATCHLINE SEE FIGURE 02B

FIGURE 02A: TEST HOLES LOCATION PLAN



MATCHLINE FROM FIGURE 02A

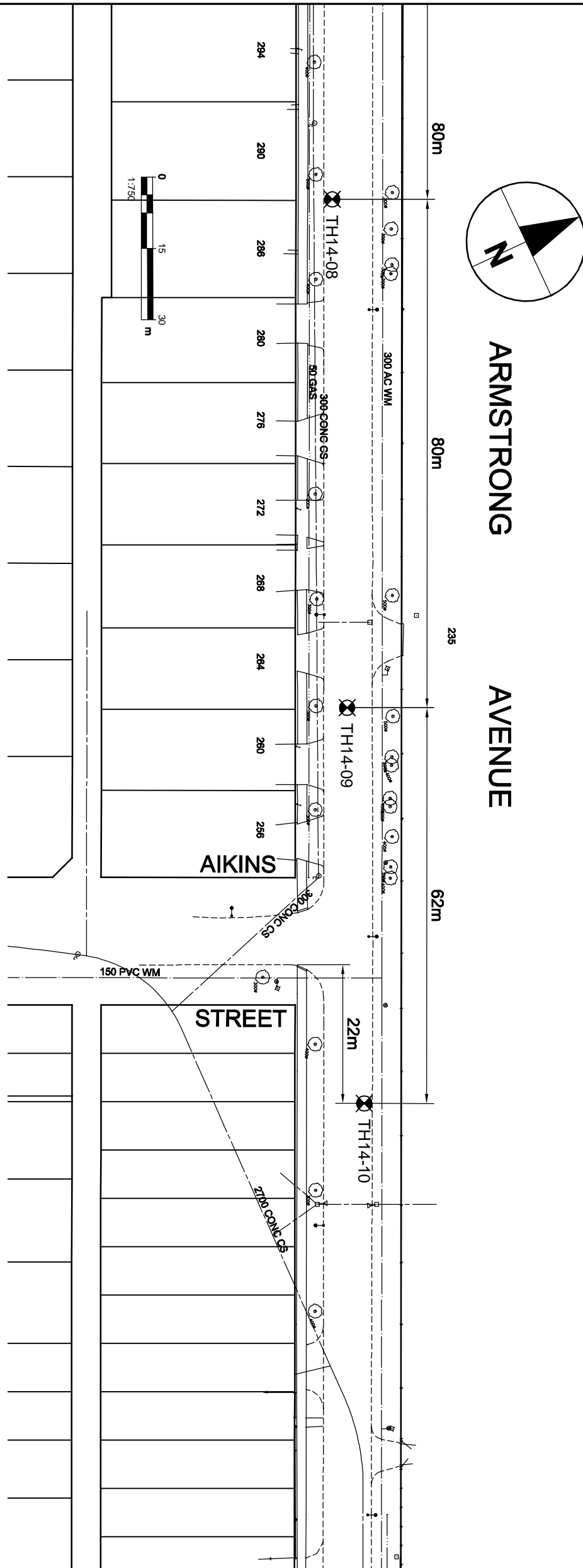


FIGURE 02B: TEST HOLES LOCATION PLAN



Photograph 1. Armstrong Avenue – TH14-05



Photograph 2. Armstrong Avenue – TH14-06



Photograph 3. Armstrong Avenue – TH14-07



Photograph 4. Armstrong Avenue – TH14-08



Photograph 5. Armstrong Avenue – TH14-09



Photograph 6. Armstrong Avenue – TH14-10

PROJECT: Local street Package 14-R-03 CLIENT: City of Winnipeg TESTHOLE NO: TH14-05
 LOCATION: Armstrong Avenue ;8 m South of North Curb PROJECT NO.: 60312285
 CONTRACTOR: Paddock 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
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)			
0		ASPHALT (thickness = 45 mm) CONCRETE (thickness = 140 mm)							
		CLAY (FILL) - some sand, trace gravel - black to light grey - frozen to 1.5 m, moist when thawed - high plasticity	<input checked="" type="checkbox"/>	G40	●				
		CLAY - trace sand - grey to dark brown, - frozen to 1.5 m, moist when thawed - high plasticity	<input checked="" type="checkbox"/>	G41	●	—		Clay: 70.8%, Silt: 24.7% Sand: 4.5% , Gravel: 0.0%	
1		- brown below 1.25 m	<input checked="" type="checkbox"/>	G42	●				1
		- silty, trace oxidation, light brown, firm below 1.5 m	<input checked="" type="checkbox"/>	G43	●				
			<input checked="" type="checkbox"/>	G45	●				
2			<input checked="" type="checkbox"/>	G46	●				2
			<input checked="" type="checkbox"/>	G47	●				
			<input checked="" type="checkbox"/>	G48	●				
3		END OF TEST HOLE AT 2.44 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 0.380 m, solid stem augers to 2.4 m.							

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim COMPLETION DEPTH: 2.44 m
 REVIEWED BY: Faris Khalil COMPLETION DATE: 2/3/14
 PROJECT ENGINEER: Page 1 of 1

PROJECT: Local street Package 14-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH14-06
LOCATION: Armstrong Avenue ;2 m South of North Curb		PROJECT NO.: 60312285
CONTRACTOR: Paddock Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS	UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 25 mm) CONCRETE (thickness = 76 mm) CLAY - trace sand, trace gravel, trace oxidation - grey, - frozen to 1.5 m, moist when thawed - high plasticity			* 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	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200		
				G32	●			
				G33	●			
				G34	●			
				G35	●			
		- brown, firm below 1.5 m.		G36	●			
		- silty, light brown, soft, moist to wet, intermediate plasticity below 1.7 m		G37	●			
				G38	●			
				G39	●			
		END OF TEST HOLE AT 2.44 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 0.380 m, solid stem augers to 2.4						

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim	COMPLETION DEPTH: 2.44 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/3/14
PROJECT ENGINEER:	Page 1 of 1

PROJECT: Local street Package 14-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH14-07
LOCATION: Armstrong Avenue ;6 m South of North Curb		PROJECT NO.: 60312285
CONTRACTOR: Paddock Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS		UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)			
0		ASPHALT (thickness = 26 mm) GRAVEL (thickness = 167 mm)							
		CLAY (FILL)- some sand - dark brown to brown, - frozen to 1.5 m, moist when thawed - high plasticity		G24	●				
		CLAY - trace sand - dark brown, - frozen to 1.5 m, moist when thawed - high plasticity		G25	●	—		Clay: 75.4%, Silt: 22.3%, Sand: 2.3%, Gravel: 0.0%	
1				G26	●				1
				G27	●				
		- silty, soft , moist to wet below 1.5 m.		G28	●				
2				G29	●				2
		- firm to stiff, moist between 2.1 to 2.25 m.		G30	●				
				G31	●				
3		END OF TEST HOLE AT 2.44 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 0.380 m, solid stem augers to 2.4							

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim	COMPLETION DEPTH: 2.44 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/3/14
PROJECT ENGINEER:	Page 1 of 1

PROJECT: Local street Package 14-R-03 CLIENT: City of Winnipeg TESTHOLE NO: TH14-08
 LOCATION: Armstrong Avenue ;8 m South of North Curb PROJECT NO.: 60312285
 CONTRACTOR: Paddock 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
					◆ SPT (Standard Pen Test) ◆ (Blows/300mm)	■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)			
0		ASPHALT (thickness = 52 mm) CONCRETE (thickness = 127 mm)								
		CLAY (FILL) - some sand, trace organic - black to dark brown, - frozen to 1.8 m, moist when thawed - high plasticity								
		- sandy below 0.8 m		G16	●					
				G17	●					
1		CLAY- silty, trace sand - dark grey, - frozen to 1.8 m, moist when thawed - high plasticity								1
		- dark brown below 1.5 m		G18	●					
				G19	●					
		- dark brown below 1.5 m		G20	●					
		- firm to stiff below 1.8 m		G21	●					
				G22	●					
				G23	●					
3		END OF TEST HOLE AT 2.44 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 0.380 m, solid stem augers to 2.4.								

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim COMPLETION DEPTH: 2.44 m
 REVIEWED BY: Faris Khalil COMPLETION DATE: 2/3/14
 PROJECT ENGINEER: Page 1 of 1

PROJECT: Local street Package 14-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH14-09
LOCATION: Armstrong Avenue ;5 m South of North Curb		PROJECT NO.: 60312285
CONTRACTOR: Paddock Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS		UNDRAINED SHEAR STRENGTH		COMMENTS	DEPTH
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)				
0		ASPHALT (thickness = 26 mm) CONCRETE (thickness = 140 mm)								
		CLAY (FILL) - trace sand, trace oxidation - black to dark brown, - frozen to 1.5 m, moist when thawed - high plasticity		G8	●					
		CLAY -trace gravel - grey, - frozen to 1.5, moist when thawed - high plasticity		G9	●					
1		- brown below 1.0 m		G10	●					1
		- firm below 1.5 m.		G11	●					
				G12	●					
2		- firm to stiff below 2 m		G13	●					2
		- silty, light brown, soft to firm below 2.2 m		G14	●					
				G15	●					
		END OF TEST HOLE AT 2.44 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 0.305 m, solid stem augers to 2.4								

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim	COMPLETION DEPTH: 2.44 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/3/14
PROJECT ENGINEER:	Page 1 of 1

PROJECT: Local street Package 14-R-03	CLIENT: City of Winnipeg	TESTHOLE NO: TH14-10
LOCATION: Armstrong Avenue ;2 m South of North Curb		PROJECT NO.: 60312285
CONTRACTOR: Paddock Drilling Ltd	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS		UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
					* Becker * ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) ■ Total Unit Wt ■ (kN/m ³)	+ Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa)			
0		ASPHALT (thickness = 38 mm) CONCRETE (thickness = 153 mm)							
		SAND (FILL) - gravelly, - black to dark brown - frozen to 1.5 m, moist when thawed		G1	●				
		CLAY (FILL) - trace sand - black to dark brown, - frozen to 1.5 m, moist when thawed - high plasticity		G2	●	—			
		CLAY - trace gravel - dark grey, - frozen to 1.5 m, moist when thawed - high plasticity		G3	●				
		- firm to stiff below 1.5 m		G4	●				
				G5	●				
		- brown ,intermediate plasticity below 2.1 m		G6	●				
		- stiff below 2.2 m		G7	●				
		END OF TEST HOLE AT 2.44 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 0.305 m, solid stem augers to 2.4							
								Clay: 77.1%, Silt: 20.4%, Sand: 2.5%, Gravel: 0.0%	

LOG OF TEST HOLE STREET PACKAGE 14-R-03 SEVEN OAKS AND ARMSTRONG.GPJ UMA WINN.GDT 3/5/14



LOGGED BY: Saba Ibrahim	COMPLETION DEPTH: 2.44 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 2/3/14
PROJECT ENGINEER:	Page 1 of 1

City of Winnipeg

Armstrong Avenue - Package 14-R-03

Geotechnical Investigation

Table 02- Summary of Laboratory Soil Testing

Test Hole No.	Testhole 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		
TH14-05	Armstrong Avenue ;8 m South of North Curb	Asphalt	45	None	n/a	Clay Fill	0.38-0.53	34.9									
						Clay	0.69-0.84	29.7	0.0	4.5	24.7	70.8	73.6	23.2	50.5		
						Clay	0.99-1.14	27.5									
		Concrete	140			Clay	1.30-1.45	28.2									
						Silty Clay	1.60-1.75	25.1									
						Silty Clay	1.91-2.06	23.9									
						Silty Clay	2.21-2.29	23.0									
Silty Clay	2.36-2.44	21.9															
TH14-06	Armstrong Avenue ; 2 m South of North Curb	Asphalt	25	None	n/a	Clay	0.23-0.38	30.8									
						Clay	0.53-0.69	30.8									
		Concrete	76			Clay	0.84-0.99	30.1									
						Clay	1.14-1.30	30.0									
						Clay	1.45-1.60	30.0									
						Silty Clay	1.75-1.91	23.8									
						Silty Clay	2.06-2.21	22.9									
Silty Clay	2.36-2.44	22.2															
TH14-07	Armstrong Avenue ; 6 m South of North Curb	Asphalt	26	None	n/a	Clay Fill	0.38-0.53	30.1									
						Clay	0.69-0.84	29.7	0.0	2.3	22.3	75.4	72.4	22.5	49.9		
		Concrete	167			Clay	0.99-1.14	29.5									
						Clay	1.30-1.45	29.3									
						Silty Clay	1.60-1.75	23.2									
						Silty Clay	1.91-2.06	22.2									
						Silty Clay	2.21-2.29	31.5									
Silty Clay	2.36-2.44	23.0															
TH14-08	Armstrong Avenue ; 8 m South of North Curb	Asphalt	52	None	n/a	Clay Fill	0.38-0.53	30.0									
						Clay Fill	0.69-0.84	26.6									
		Concrete	127			Silty Clay	0.99-1.14	29.7									
						Silty Clay	1.30-1.45	30.2									
						Silty Clay	1.60-1.75	29.9									
						Silty Clay	1.91-2.06	29.9									
						Silty Clay	2.21-2.29	32.7									
Silty Clay	2.36-2.44	33.3															

Test Hole No.	Testhole 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
TH14-09	Armstrong Avenue ;5 m South of North Curb	Asphalt	26	None	n/a	Clay Fill	0.38-0.53	34.5							
						Clay	0.69-0.84	30.2							
		Clay	0.99-1.14			29.2									
		Clay	1.30-1.45			29.6									
		Clay	1.60-1.75			28.7									
		Clay	1.91-2.06			32.0									
		Silty Clay	2.21-2.29			25.2									
		Silty Clay	2.36-2.44			26.2									
TH14-10	Armstrong Avenue ; 2 m South of North Curb	Asphalt	38	None	n/a	Sand (Fill)	0.23-0.38	40.1							
						Clay (Fill)	0.84-0.99	34.4	0.0	2.5	20.4	77.1	84	26.5	57.6
		Clay	1.14-1.30			35.1									
		Clay	1.45-1.60			34.7									
		Clay	1.75-1.91			34.6									
		Clay	2.06-2.21			32.6									
		Clay	2.29-2.44			30.0									