DYREGROV ROBINSON INC.
Consulting Geotechnical Engineers

101 - 1555 St. James Street
Winnipeg, MB R3H 1B5
TEL (204) 632-7252
FAX (204) 632-1442

June 16, 2015

File No. 153878

City of Winnipeg
Planning, Property & Development Department
Municipal Accommodations Division Project
Services Branch
4th floor, 185 King Street
Winnipeg, MB. R3B 1J1

Attn: Lou M. Chubenko, B.A., C.Tech.

Dear Mr. Chubenko:

RE: St. Vital Park – Summer Washroom Replacement Project
Geotechnical Investigation

As requested, Dyregrov Robinson Inc. (DRI) has undertaken a geotechnical investigation for the proposed summer washroom replacement project located in the St. Vital Park at 190 River Road in Winnipeg, MB. It is understood that the new washroom building will be supported on cast-in-place concrete friction piles. The purpose of the investigation was to evaluate the subsurface conditions in order to provide foundation design recommendations that meet the requirements of the current Manitoba Building Code. The work was authorized by the City of Winnipeg via P.O. Number 395953.

Field Investigation

The test hole was drilled to a depth of 9.7 m near the location of the proposed washroom facility by Paddock Drilling Ltd. using a truck mounted Acker MP8 drill rig equipped with 125 mm diameter solid stem augers. The test hole was backfilled with auger cuttings and bentonite chips. The excess auger cuttings were removed from the site.

The subsurface conditions were visually logged during drilling by DRI. Disturbed (auger cuttings) and undisturbed (Shelby tube) samples were recovered from the test hole and taken to our Soils Testing Laboratory for additional visual classification and testing. The laboratory testing consisted of determining moisture contents on all samples and measuring bulk unit weights and undrained shear strengths on the Shelby tube samples. The test hole log is attached and includes a description of the test hole location, subsurface conditions encountered, results of the laboratory testing, and notes regarding the observations made during drilling.

Subsurface Conditions

The soil stratigraphy encountered in the test hole, from site grade, consists of topsoil and silty clay. The test hole was not advanced into the glacial till. The surface of the glacial till deposit is known to be about 11.5 m below grade near the Duck Pond at the St. Vital Park

Silty Clay

Underlying the topsoil is an alluvial silty clay deposit. The clay was generally observed to be brown to mottled brown / grey to a depth of about 6 metres where it became grey. The silty clay is of high plasticity and moist with a consistency that is stiff. The undrained shear strengths ranged from about 40 to 90 kPa with an average around 65 kPa. The moisture contents of the silty clay are generally around 35 percent to a depth of 7 metres below which they are closer to 40 percent. At a depth of 9.7 m, a layer of alluvial sand was present at the bottom of the Shelby tube sample (Sample T9).

Test Hole Stability and Groundwater Conditions

Trace amounts of seepage were observed from 3 to 4.5 m. Upon removal of the Shelby tube sample collected at the base of the test hole (Sample T9), the test hole was open to a depth of 9.1 m and the water level was 5.8 m below grade. The groundwater seepage that occurred from the base of the test hole is attributed to a wet sand layer The groundwater conditions should be expected to vary seasonally, from year to year and possibly as a result of construction activities.

Foundation Recommendations

The subsurface conditions at this site are suitable for cast-in-place concrete friction piles.

Cast-In-Place Concrete Friction Piles

Cast-in-place concrete friction piles can be designed in accordance to the current Manitoba Building Code (i.e. NBC 2010) using the service limit state (SLS) shaft adhesion values provided in Table 1 below. A resistance factor of 0.4 was used to calculate the factored ULS design values. Under the SLS loads, pile settlements are expected to be around 6 mm inches with differential settlements between piles around 3 to 6 mm.

Table 1: Design Parameters for CIP Concrete Friction Piles

Depth Below Existing Site Grade (m)	SLS Shaft Adhesion (kPa)	Factored ULS Shaft Adhesion (kPa)
0 to 2.5 (see Note 1)	0	0
2.5 to 9.0	19.0	24.0

Note 1: *When determining effective pile lengths, the upper 2.5 m of the pile shaft below existing site grade or 1.5 m below crawl space level, whichever is deeper, should be ignored to account for potential for soil shrinkage away from the pile.*

The piles should not extend more than 9 m below the existing site grade to avoid contact with the wet sand layer that was encountered at a depth of 9.7 m to reduce the potential for groundwater seepage into the pile boring. Piles should have a minimum diameter of 406 mm and a minimum spacing of 3 pile diameters on centre. Where this spacing cannot be achieved DRI should be contacted for additional input.

Some groundwater seepage should be expected from the alluvial clay during pile installation. Concrete should be placed immediately after the pile holes are drilled to avoid water accumulation at the bottom of the hole. Temporary steel sleeves should be on site and used where sloughing/caving of the pile borings occur and/or if groundwater seepage is encountered. Water pumps may be required to dewater some pile holes.

Piles that are subjected to freezing conditions must be protected from potential frost heave effects by using minimum pile lengths of 7.5 m and installing full length reinforcement. The use of flat lying rigid insulation, such as Styrofoam HI, can also be used to minimize frost penetration into the soil around the piles if the minimum pile length cannot be achieved. A greased, polyethylene wrapped sonotube can be placed around the upper 1.8 m of the pile shaft to act as a bond breaker and provide additional protection against frost heave.

Other

A void separation of at least 150 mm should be provided under grade beams and pile caps. A vapour barrier should be provided below grade beams and pile caps to minimize the potential for long term moisture changes within the underlying clay soils.

The potential for sulphate attack in Winnipeg is considered to be severe. It is recommended that all concrete in contact with clay soil should be manufactured with sulphate-resistant cement in accordance with the Manitoba Building Code.

Closure

This report was prepared based on our understanding of the proposed summer washroom building at St. Vital Park and the subsurface conditions encountered in the test hole drilled at the site. Subsurface conditions are inherently variable and should be expected to vary from those encountered in the test hole.

This report was prepared for the exclusive use of the City of Winnipeg and their agents for the design of the proposed summer washroom building foundations at the St. Vital Park located at 190 River Road in Winnipeg, MB. The information and recommendations contained in this report shall not be used by any third parties for any other projects. The findings and recommendations in this report have been prepared in accordance with generally accepted geotechnical engineering principles and practise. No other warranty, expressed or implied, is provided.

Please contact the undersigned if we can be of further assistance.

DYREGROV ROBINSON INC.

Gil Robin

Gil Robinson, M.Sc., P.Eng.
President, Senior Geotechnical Engineer
gilrobinson@drgeotechnical.com

PROVINCE OF MANITOBA
GR
G.G.B.
ROBINSON
16 June 2015
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
Dyregrov Robinson Inc.
No. 86 **Date:** 16 June 2015

EXPLANATION OF TERMS & SYMBOLS

Description				TH 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 ORGANIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Glacial Till		Bedrock (Igneous)	
	Concrete		Clay Shale		Bedrock (Limestone)	**DYREGROV ROBINSON INC.** CONSULTING GEOTECHNICAL ENGINEERS
	Fill				Bedrock (Undifferentiated)	

FRACTION		PARTICLE SIZE (mm)	
		Min.	Max.
Boulders		>300	
Cobbles		75	300
Gravel	Coarse	19	75
	Fine	4.75	19
Sand	Coarse	2.0	4.75
	Medium	0.425	2.0
	Fine	0.075	0.425
Silt (non-plastic) or Clay (plastic)		< 0.075 mm	

RELATIVE PROPORTIONS (by weight)	
Percent	Descriptor
>35%	main fraction
35 - 50	"and"
20 – 35	Adjective e.g. silty, clayey
10 – 20	"some"
1 - 10	"trace"

Soil Classification Example

Clay 50% (main fraction), Silt 25%, Sand 17%, Gravel 8%

Clay – silty, some sand, trace gravel

TERMS and SYMBOLS

Laboratory and field tests are identified as follows:

Unconfined Comp.: undrained shear strength (kPa or psf) derived from unconfined compression testing.

Torvane: undrained shear strength (kPa or psf) measured using a Torvane

Pocket Pen.: undrained shear strength (kPa or psf) measured using a pocket penetrometer.

Unit Weight bulk unit weight of soil or rock (kN/m^3 or pcf).

SPT – N Standard Penetration Test: The number of blows (N) required to drive a 51 mm O.D. split barrel sampler 300 mm into the soil using a 63.5 kg hammer with a free fall drop height of 760 mm.

DCPT Dynamic Cone Penetration Test. The number of blows (N) required to drive a 50 mm diameter cone 300 mm into the soil using a 63.5 kg hammer with a free fall drop height of 760 mm.

M/C insitu soil moisture content in percent

PL Plastic limit, moisture content in percent

LL Liquid limit, moisture content in percent

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

Su (kPa)	Su (psf)	CONSISTENCY
<12	250	very soft
12 – 25	250 – 525	soft
25 – 50	525 – 1050	firm
50 – 100	1050 – 2100	stiff
100 – 200	2100 – 4200	very stiff
200	4200	hard

The SPT - N of non-cohesive soil is related to compactness condition as follows:

N – Blows / 300 mm	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50 +	very dense

References:

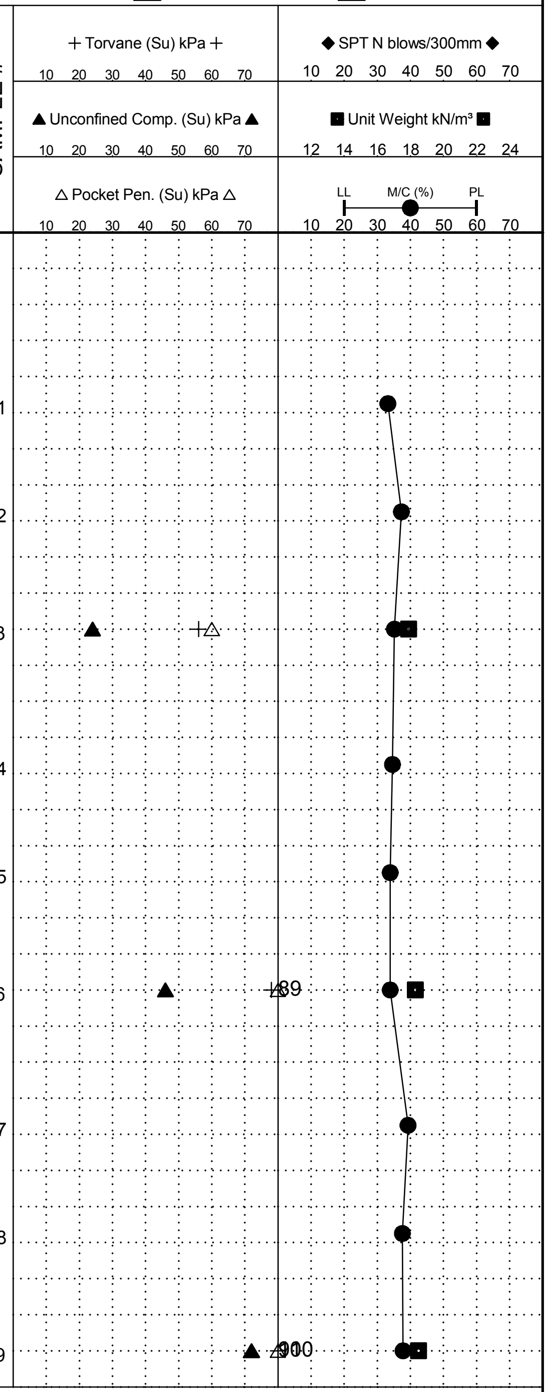
ASTM D2487 – Classification of Soils For Engineering Purposes (Unified Soil Classification System)

Canadian Foundation Engineering Manual, 4th Edition, Canadian Geotechnical Society, 2006

PROJECT: St. Vital Park Washroom Replacement	CLIENT: City of Winnipeg	TESTHOLE NO: 1
LOCATION: 30 m north and 12.5 m west of north west corner of existing washroom		PROJECT NO.: 153878
CONTRACTOR: Paddock Drilling Ltd.	METHOD: ACKER MP8- 125mm SS augers	ELEVATION (m):

SAMPLE TYPE	GRAB	SHELBY TUBE	SPLIT SPOON	BULK	NO RECOVERY	CORE
BACKFILL TYPE	BENTONITE	GRAVEL	SLOUGH	GROUT	CUTTINGS	SAND

ELEVATION (m)	DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
			CLAY - silty, trace organics (50 mm thick) - black, moist		
			CLAY - silty - brown - stiff, moist		
	1		- high plasticity, trace gypsum inclusions, trace silt inclusions		
				GRAB	G1
	2				
				GRAB	G2
	3		- mottled brown and grey below 3.5 m	SHELBY TUBE	T3
	4				
				GRAB	G4
	5			GRAB	G5
	6		- grey and wet below 6 m - trace sand	SHELBY TUBE	T6
	7				
			- trace organics below 7.6 m	GRAB	G7
	8			GRAB	G8
	9		sand at bottom of Shelby tube (Sample T9)	SHELBY TUBE	T9



END OF TEST HOLE AT 9.1 m IN CLAY

Notes:
1. Trace seepage from 3 to 4.5 m (auger wet)
2. Drill to 9.1 m, pushed Shelby tube from 9.1 to 9.7 m
3. Upon completion of drilling test hole open to 9.1 m and water level 5.8 m below grade.
4. Test hole backfilled with bentonite chips and auger cuttings.

DYREGROV ROBINSON INC.
Consulting Geotechnical Engineers

LOGGED BY: JR	COMPLETION DEPTH: 9.75 m
REVIEWED BY: GR	COMPLETION DATE: 09/06/15
PROJECT ENGINEER: Gil Robinson	