

July 28, 2006

File No. 06-0107-11

City of Winnipeg  
Water and Waste Department  
1500 Plessis Road  
Winnipeg, Manitoba  
R3C 5G6

ATTENTION: Mr. Darcy Strandberg, C.E.T.  
Project Manager

RE: Site Investigation – Crane Avenue Outfall Gate Chamber  
2006 Outfall Gate Chamber Upgrading Program

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Dear Mr. Strandberg:

This letter summarizes the results of KGS Group's geotechnical site investigation at the Crane Avenue Outfall Gate Chamber including soil stratigraphy and groundwater monitoring.

This information is submitted further to our letter of Proposal for Engineering Services dated June 9<sup>th</sup>, 2006.

## 1.0 SITE INVESTIGATION

On June 21st, 2006 KGS Group supervised the drilling of one test hole (TH06-01) at the site located approximately 30 m east of the existing Pumping Station. The UTM coordinates of the test hole are noted on the test hole log, as measured by a handheld GPS unit. The test hole was drilled with the Acker MP5-T drilling rig contracted from Paddock Drilling Ltd. of Brandon, MB. The drilling was advanced using 125 mm solid stem augers to 15.85 m below the existing ground surface. Representative soil samples were collected directly off auger flights at 1.5 m intervals or at any change in soil stratigraphy. All samples were visually classified in the field according to the Unified Soil Classification System. Clay samples were tested with a field Torvane to evaluate consistency and estimate undrained shear strength. Upon completion of the drilling, the test hole was examined for indications of squeezing and seepage and a Casagrande tipped standpipe piezometer was installed in the glacial till layer.

A summary soil log incorporating all field observations and lab testing is attached to this letter.

## 2.0 STRATIGRAPHY

KGS Group's interpretation of the stratigraphy is based upon the test hole (TH06-01) drilled at the site. In general, the stratigraphy consists of topsoil over clay fill underlain by a clay of lacustrine origin over glacial till.

A thin layer of topsoil approximately 0.1 m± thick was found at the existing ground surface. Clay fill extended 0.2 m± below the topsoil. The fill was brown in color, moist, firm and crumbly in consistency, and contained trace amounts of sand and gravel. Underlying the fill a deposit of clay of lacustrine origin extended to a depth of 13.7 m± below ground surface. The clay was mottled brown to light brown in color and became grey at a depth of 6.4 m±, was moist, of high plasticity, firm to soft in consistency, with undrained shear strengths ranging from 45 kPa at the top to 10 kPa at the bottom of the strata (overall average 32 kPa). The clay contained trace amounts of silt and silt nodules. The lacustrine clay was underlain by clay till which was over silt till that extended to a depth of 15.85 m where power auger refusal occurred. The clay till was light grey in color, moist, soft in consistency, of intermediate plasticity, contained trace amounts of silt, sand and gravel and became dense below 14.33 m. The silt till was light grey, moist to dry, dense, and contained trace amounts of clay, sand and gravel. The clay at the site was soft to very soft and had high moisture contents below a depth of approximately 7m.

Squeezing of the test hole occurred below a depth of 10 m± during drilling. Upon completion of the test hole, water infiltration was observed at the bottom of the test hole from within the underlying till material, with a water level measured at 14.34 m below the ground surface.

### 3.0 GROUNDWATER CONDITONS

The groundwater level was measured a total of three (3) times. The first reading was taken immediately after the test hole was drilled and the groundwater level was 14.34 m below ground surface. The initial groundwater reading is generally lower than the actual till groundwater level as water infiltration takes time to reach equilibrium depending on the soil permeability. Subsequent groundwater readings of 7.93 m and 7.52 m below ground surface were taken on July 13<sup>th</sup> and July 17<sup>th</sup> of 2006, respectively.

Groundwater levels vary seasonally and in response to precipitation such that future groundwater conditions at the site may vary from those reported herein.

KGS Group thanks you for the opportunity to provide engineering services on this project. If you have any questions please contact the undersigned at 896-1209.

Yours truly,

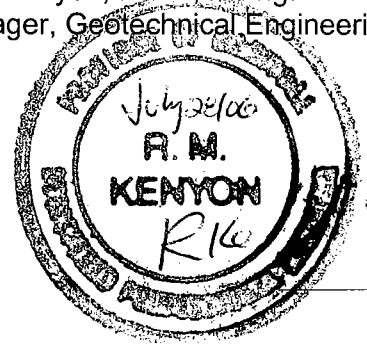
Reviewed by,



David Anderson, M. Sc., P. Eng.  
Geotechnical Engineering

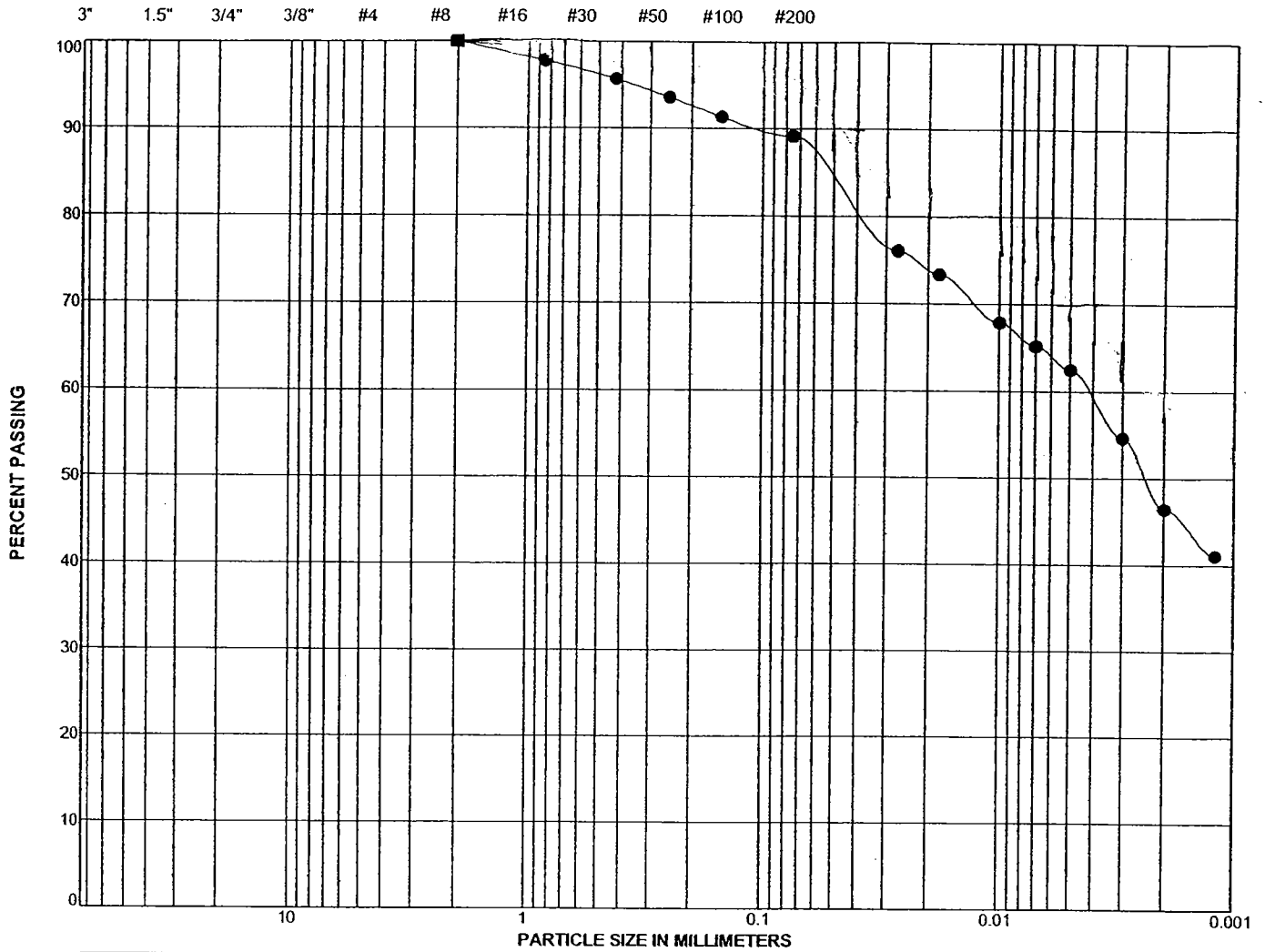
R.M. Kenyon, Ph.D., P. Eng.  
Manager, Geotechnical Engineering

RD/



SIEVE ANALYSIS

HYDROMETER ANALYSIS



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

SYMBOL	HOLE	DEPTH (m)	SAMPLE #	% GRAVEL	% SAND	% SILT	% CLAY	% SILT & CLAY	Cu	Cc	CLASSIFICATION
●	TH06-01	13.6	S9	0.0	10.8	42.7	46.5	89.2			

Notes:



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WATER AND WASTE  
DEPARTMENT

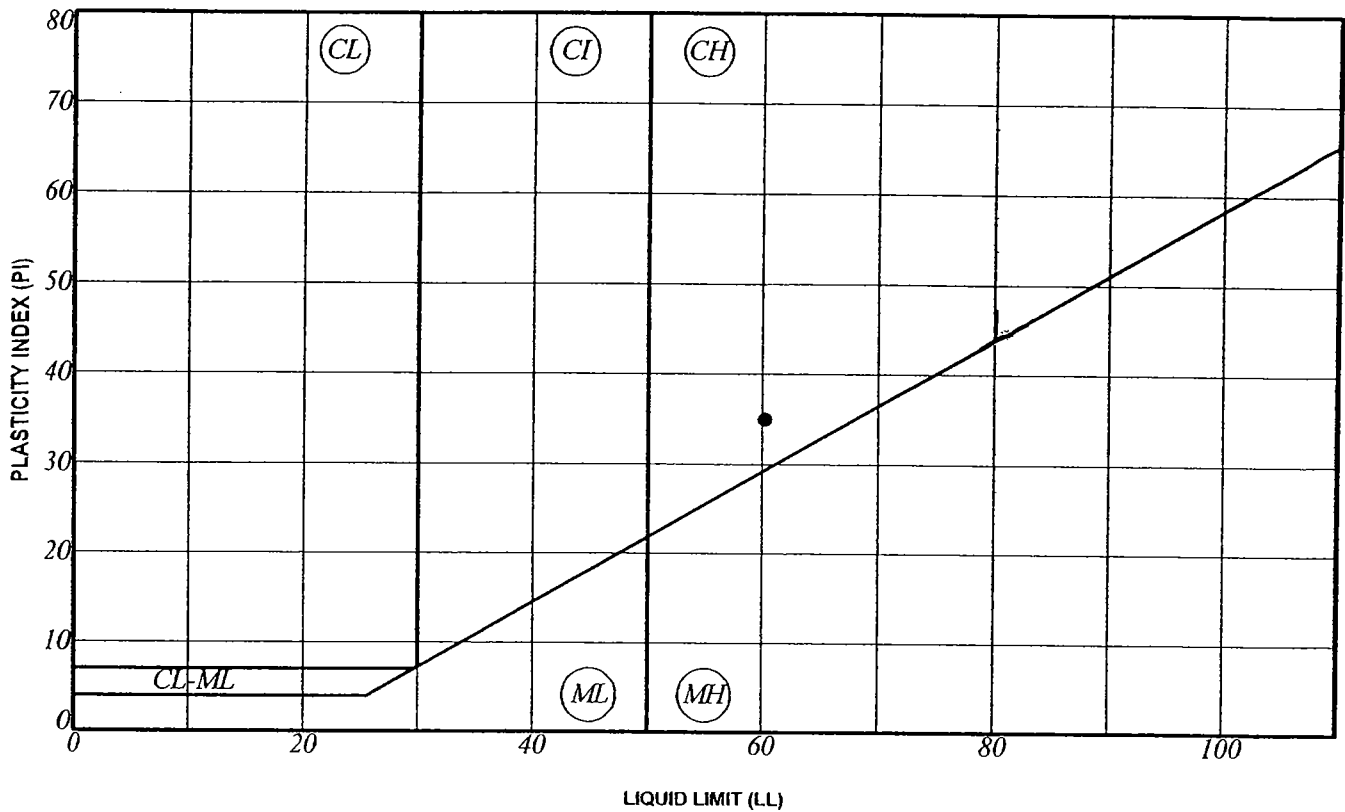
GATE CHAMBER UPGRADES

GRAIN SIZE ANALYSES

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Figure 1A

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SYMBOL	HOLE	DEPTH (m)	SAMPLE #	LL	PL	PI	% SAND	% SILT	% CLAY	% MC	CLASSIFICATION
●	TH06-01	13.6	S9	60	25	35	10.8	42.7	46.5	42.3	CH

Notes:

- ML - Low Plasticity Silt
- MH - High Plasticity Silt
- CL-ML - Silty Clay
- CL - Low Plasticity Clay
- CI - Intermediate Plasticity Clay
- CH - High Plasticity Clay
- LL - Liquid Limit
- PL - Plastic Limit
- PI - Plasticity Index
- MC - Moisture Content

Notes:

<b>KGS GROUP</b>	<b>CITY OF WINNIPEG - WATER AND WASTE</b>	
	GATE CHAMBER UPGRADES	
<b>A-LINE PLOT</b>		
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A-LINE PLOT (MAY 2003) 06-107-11.GPJ GEN. ET. M. GDT. 7/12/06

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** GATE CHAMBER UPGRADES  
**SITE** Crane Avenue Gate Chambers  
**LOCATION** 30 m East of Lift Station @ Crane and South Drive  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP5-T

**JOB NO.** 06-107-11  
**GROUND ELEV.**  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 21-Jun-06  
**UTM (m)** N 5,522,379 Approx.  
 E 633,719 Approx.

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	Cu TORVANE (kPa) ◆			
	(m)	(ft)							DYNAMIC CONE (N) blows/ft △	PL	MC	LL	
									40 80 120	20 40 60 80			
				<b>TOPSOIL (OL)</b>									
				<b>CLAY FILL (CL)</b> - Brown, moist, firm, low plasticity, trace silt, trace sand, trace gravel, crumbly.									
				<b>CLAY (CH)</b> - Mottled brown to light brown, moist, firm, high plasticity, trace silt, lacustrine origin.									
1							S1						
5													
2													
3		10					S2						
4													
5		15					S3						
6		20					S4						
7				- Grey, softer, trace silt nodules below 6.40 m.									
8		25					S5						
9		30					S6						

SPT & TORVANE 2 P:\PROJECTS\2006\06-0107-11\GEO\LOGS\06-107-11.GPJ

SAMPLE TYPE  Auger Grab  Split Spoon

CONTRACTOR **Paddock Drilling Ltd.** INSPECTOR **D. ANDERSON**

APPROVED *Rke* DATE 7/26/06

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu TORVANE (kPa) ◆												
									PL	MC	LL										
35																					
40																					
45			<b>CLAY TILL (CI)</b> - Light grey, moist, soft, intermediate plasticity, trace silt, trace sand, trace gravel. - Becoming more dense below 14.33 m.		12.8	S7															
50			<b>SILT TILL (ML)</b> - Light grey, moist to dry, dense, trace clay, trace sand, trace gravel.		14.6	S8															
55					14.9	S9															
60					15.8	S10															
65						S11	78														
70																					

**END OF HOLE AT 15.85 m**

Note:  
 1. Water level at 14.34 m below ground after drilling.  
 2. Casagrande Tip Standpipe installed at 14.94 m, with an above ground casing and 0.91 m stickup.  
 3. Test hole sloughed into a depth of 14.9 m and was squeezing below 10.00 m.

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SAMPLE TYPE  Auger Grab  Split Spoon

CONTRACTOR **Paddock Drilling Ltd.** INSPECTOR **D. ANDERSON**

APPROVED *Rke* DATE **7/26/06**