KGS GROUP

KONTZAMANIS ▪ GRAUMANN ▪ SMITH ▪ MACMILLAN INC.
CONSULTING ENGINEERS & PROJECT MANAGERS

November 25, 2004

File No. 04-107-20

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

ATTENTION: Mr. John Elias, C.E.T.
Project Co-ordinator

RE: Geotechnical Investigation
Proposed Gate Chamber Expansion Aubrey PS
Final Letter Report

Dear Mr. Elias:

KGS Group was authorized by the City of Winnipeg Water and Waste Department to undertake a geotechnical site investigation and riverbank stability evaluation for the proposed gate chamber expansion at the Aubrey Street Pumping Station (PS). This letter details the results of our investigation including a summary of soil and groundwater conditions at the site, design considerations for temporary shoring, and a review of the project impacts on existing riverbank stability. The letter is suitable for submission to the City of Winnipeg Planning Property and Development Department in support of a Waterway Permit application.

1.0 BACKGROUND

The Aubrey PS is located along an inside bend on the north bank of the Assiniboine River at Aubrey Street and Palmerston Avenue. Existing facilities at the site consist of a pump house, lift station, gate chamber and two outfall pipes extending to the river. The existing gate chamber and main station are located approximately 31 and 38 m from the Regulated Summer River Level (RSRL) respectively. A general site plan is shown on attached KGS Group Drawing No. 04-0107-20 01.

The base of the existing gate chamber extends to approximately 8.7 m below grade (Elev. 222.8 m±) and consists of cast-in-place concrete walls and a slab foundation. Details of existing construction are shown of City of Winnipeg Water and Waste Dwg. 681-B.

The riverbank geometry consists of a relatively flat lying upper bank area at Elev. 231.75 m±. Below the upper bank area the riverbank slopes down at approximately 3H:1V to Elev. 228.0 m±. From Elev. 228.0 m± the bank slopes down at 8H:1V to the O.H.W.M. at Elev. 226.5 m± followed by a 2H:1V slope to the RSRL. The existing river channel bottom is relatively flat lying varying from Elev. 221.3 to 222.9 m.

STRUCTURAL▪GEOTECHNICAL▪ENVIRONMENTAL▪HYDRAULICS▪HYDROGEOLOGY▪MUNICIPAL▪MECHANICAL▪ELECTRICAL
3RD FLR.–865 WAVERLEY ST., WINNIPEG, MANITOBA, R3T 5P4 PH: (204) 896-1209 FAX: (204) 896-0754
560 SQUIER PLACE, THUNDER BAY, ONTARIO, P7B 6M2 PH: (807) 345-2233 FAX: (807) 345-3433

A combination of concrete rubble and limestone riprap erosion protection is located along the shoreline around pipe outlets and extends 2 m upstream and downstream. The upper bank area is covered with landscaped grass adjacent to the pump station followed by occasional mature trees and scrub brush along the mid bank area down to the river edge. Minor shoreline erosion was observed beyond the limits of the existing riprap, which is typical of the Assiniboine River.

As part of the original Pumping Station construction in 1956 a significant amount riverbank excavation (offloading) was performed along the upper bank area. Based on the excavation limits shown on the 1956 construction drawings (City of Winnipeg Water and Waste Drawing R187A) approximately 160 m^3 or 260,000 kg of material was removed. The previous excavation along the upper bank area is evident on topographic ground contours at the station (KGS Group Dwg. 04-0107-20 01) in comparison to the ground contours at the properties on either side.

2.0 PROPOSED DEVELOPMENT

A new cast-in-place concrete gate chamber approximately 3.2 m± wide by 3.25 m± long and 9.0 m± deep is to be constructed immediately north of the existing gate chamber as shown on Dwg. 04-0107-20 01. The new gate chamber will be located approximately 34 m from the RSRL. Temporary shoring will be required to support the sidewalls of the excavation during construction. All excavated material from the chamber shaft will be removed off site during construction resulting in a net offloading on the bank.

3.0 GEOTECHNICAL CONSIDERATIONS

In November, 2004 KGS Group supervised the drilling of one test hole (PN2) located approximately 7 m west of the proposed gate chamber as shown on Dwg. 04-0107-20 01. The drilling was performed using 125 mm solid stem augers to 6.1 m depth and 200 mm hollow stem augers below to till. A standpipe piezometer was installed within the underlying till to measure the groundwater elevation.

In August, 2004 KGS Group supervised the drilling of two test holes along the upper bank area at the Aubrey PS as part of the recently completed transformer installation project. The locations of the previously completed test holes are shown on Dwg. 04-0107-20 01. At test hole PN1 a standpipe piezometer was installed at 7.6 m depth within the alluvial clay. Detailed test hole logs are attached.

Stratigraphy

In general, the stratigraphy at the site consisted of clay fill overlying alluvial clays, silts, and sands underlaid by clay till. The clay fill extended to depths ranging from 1.0 to 1.5 m below ground surface and was likely placed during the original station construction.

Underlying the fill a deposit of alluvial silty clay containing layers of silt and fine to coarse grained sand extended to depths ranging from 11.8 to 12.2 m below existing ground surface. In general, the clay was of low to intermediate plasticity, soft to firm in consistency, very silty and

contained a trace to some fine grained sand, rootlets and organics throughout the deposit. Below 6.2 m depth at test hole PN2 numerous layers of silt and fine to coarse grained sand ranging from 0.1 to 0.5 m thick were found within the alluvial clay. At test hole TH-1 sandy silt was found between 7.6 and 8.1 m depth.

During the test hole drilling water infiltration and sloughing was observed within the silt and fine to coarse grained sand layers. Between 11 to 12 m± depth at test hole TH1 and PN2 sand blow-up occurred with the hollow stem augers during removal of the split spoon sampler which prevented sample recovery in this zone. The alluvium was underlaid by clay till at depths ranging from 11.9 to12.3 m below ground surface.

Based on review of the Geological Engineering Maps and Report for Urban Development of Winning, University of Manitoba 1983 the till stratum at the site likely ranges between 0.3 to 5.0 m thick and is underlaid by carbonate bedrock.

Groundwater Conditions

Groundwater conditions at the site are monitored by two casagrande standpipe piezometers installed within the alluvial clay at PN1 and within the clay till at PN2. A summary of the measured levels to date is outlined in Table 1 below. The piezometers are protected by above ground steel casings and could be used to monitor future groundwater levels at the site during final design and construction. Groundwater levels vary seasonally and in response to river levels and precipitation. Future groundwater conditions at the site may vary from those shown below.

TABLE 1

Date	PN1 (Alluvial Clay)		PN2 (Clay Till)		Assiniboine River Level see note 1
	Piezometric Level Below Grade	Elevation	Piezometric Level Below Grade	Elevation	
Aug. 17 / 04	Dry	-	not installed	-	224.39
Sept. 15 / 04	6.95 m	224.57 m	not installed	-	224.36
Nov. 12 / 04	6.97 m	224.55 m	6.89 m	224.61 m	224.94

Notes 1. Assiniboine River Level is based on linear interpolation of recorded levels from City of Winnipeg gauges located at the Osborne St. Bridge and St. James Bridge.

A determination of the groundwater levels within the carbonate aquifer below the till at the Aubrey PS was not part of the scope of work for this assessment. However we have attached groundwater level monitoring from the nearest provincial bedrock well GM65 Hillsboro House located at Portage Avenue and the Strathcona Street, which is 1.25 km northwest of the Pumping Station. Monitoring data from October 2001 to July 9, 2004 is shown on attached Sketch A. It should be noted that the bedrock well is located significantly further away from the Assiniboine River in comparison to the PS and may not be representative of actual groundwater levels at the site.

During the fall and winter months the piezometric level at GM 65 Hillsboro House has ranged from Elev. 225.5 to 227.0 m since 2001. Based on our experience with numerous surface investigations and groundwater level monitoring throughout Winnipeg the piezometric level in the till at the Aubrey Site could be at pressures close to the underlying bedrock aquifer.

Temporary Shoring

Temporary shoring will be required to support the side walls of the gate chamber excavation. Due to the depth of the excavation and close vicinity of the existing lift station and gate chamber strutted or braced walls are considered a suitable type of shoring. The detailed design of the temporary shoring depends upon the final geometry of the excavation, the type of shoring utilized, and construction details. Design considerations should include the following:

- The shoring should be designed to resist the lateral earth pressure of the clay fill and alluvium soils, groundwater pressures, surcharge load from construction equipment, and potential surcharge load from the existing pump station and lift station buildings. If the existing gate chamber wall is proposed to support the internal struts then a review of the structural capacity of the wall should be performed. During the test hole drilling caving and water infiltration was observed below 6.0 to 7.0 m depth from ground surface and should be expected during installation and removal of temporary shoring.

- An assessment of the potential for basal heave and blowout at the base of the excavation. To date the measured groundwater levels at the site in the alluvial clay and clay till and at the provincial bedrock well GM65 Hillsboro House (located 1.25 km northwest of the FPS) are above the proposed base of the gate chamber expansion. Analytically the base of the excavation will be at risk of basal heave and blowout during construction. Depending on the actual groundwater levels at the time of construction measures are recommended to counteract the risk of blowout, such as by temporary construction dewatering below the base of the proposed excavation, to lower the pressure in the till and potential pressure in the underlying carbonate aquifer.

- The design of any required temporary construction dewatering measures should include an evaluation of the potential settlement implications below the adjacent structures which are supported by foundations bearing directly on the alluvium soils. This includes the adjacent gate chamber, lift station, underground piping, and pumping station building.

- The vertical spacing of the internal struts should be designed and installed to minimize the potential for lateral and vertical soil movement, which could be detrimental to the existing infrastructure at the site.

- The removal of the temporary shoring and backfilling between the existing ground and the new gate chamber should be completed to minimize the potential for lateral and vertical ground movements.

- No stockpiling of excavated materials should be permitted adjacent to the excavation.

A registered professional engineer who is experienced with the design of braced excavations and the related soil and groundwater considerations should complete the shoring design.

Riverbank Stability Considerations

The existing riverbank at the Aubrey PS is considered by KGS Group to be relatively stable with no evidence of ongoing or historic instability. Our interpretation of the existing stability conditions is based on visual site inspection by KGS personal, review of stereo aerial photography and our experience at the site during the previously completed outfall pipe relining in 2001 and transformer installation in 2004.

As stated earlier approximately 160 m^3 or 260,000 kg of soil was removed along the upper bank area during the original station construction resulting in a significant improvement to overall bank stability. All excavated material from the gate chamber shaft will be removed offsite during construction resulting in net offloading within the limits of the chamber footprint. Considering the relative stable nature of the bank and net offloading, installation of the gate chamber will have no detrimental impact on overall bank stability.

A condition of the waterway permit should be that no stockpiling of material be permitted on the riverbank south of the existing PS.

4.0 SUMMARY

We have completed a geotechnical site investigation, evaluation of temporary shoring requirements and review of riverbank stability impacts for the proposed gate chamber expansion at the existing City of Winnipeg Aubrey Street PS.

The stratigraphy at the site consisted of clay fill over alluvial clays, silts, and sand underlaid by clay till. A 9.0 m± deep excavation will be required for the proposed gate chamber installation and temporary shoring consisting of strutted or braced walls is considered suitable for construction. Geotechnical design considerations relative to temporary shoring are included with this letter report. Installation of the gate chamber will result in a net offloading within the footprint and will have no detrimental impact on overall riverbank stability.

We thank you for the opportunity to provide engineering services on this project. If you have any questions please contact the undersigned at 896-1209 or Dr. Rob Kenyon, P. Eng. of our office.

Yours truly,

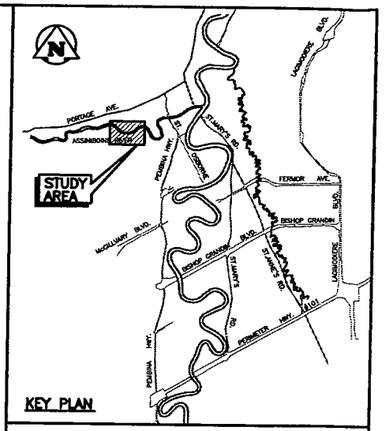
Chris Carroll, P. Eng.
Geotechnical Engineer

CC/jr

PROVINCE OF MANITOBA
CARROLL
REGISTERED PROFESSIONAL ENGINEER

Nov 25/04

24x36B



LEGEND

- 231 — EXISTING GROUND CONTOUR (m, GEODETIC)
- TH1 — TESTHOLE (KGS GROUP, 2004)
- PN1 — TESTHOLE WITH STANDPIPE PIEZOMETER (KGS GROUP, AUG. 23, 2004)
- PN2 — TESTHOLE WITH STANDPIPE PIEZOMETER (KGS GROUP, NOV. 8, 2004)
- CP2 — SURVEY CONTROL POINT (KGS GROUP SURVEY AUG. 23, 2004)
- R.S.R.L. — REGULATED SUMMER RIVER LEVEL (EL. 223.7 ±)
- X231.564 — SURVEY SPOT ELEVATION (KGS GROUP SURVEY AUG. 23, 2004)
- X222.900 — RIVER BOTTOM SOUNDINGS (KGS GROUP SURVEY AUG. 25, 2004)

NOTE:

1. SITE PLAN BASED ON KGS GROUP SURVEY FROM AUGUST 23, 2004 AND 1998 DIGITAL ORTHOGRAPHIC MAPPING.
2. THIS DRAWING IS FOR INFORMATION ONLY. SEE DETAILED CONSTRUCTION DRAWINGS FOR PRECISE LOCATION OF ALL STRUCTURES AND UNDERGROUND SERVICES.

0 3 6 9 12 15m

SCALE: 1:150 METRIC 24"x36"
1:300 METRIC 11"x17"

NO.	D / M / Y	DESCRIPTION	BY
0	25/11/04	ISSUED WITH FINAL LETTER REPORT	CC

REVISIONS / ISSUE

A. SECTION LETTER OR DETAIL NUMBER
B. DRAWING WHERE SECTION OR DETAIL IS DRAWN
OR
DRAWING WHERE SECTION OR DETAIL WAS INDICATED
— SECTION OR DETAIL SHOWN ON SAME DRAWING

KGS GROUP
CONSULTING ENGINEERS & PROJECT MANAGERS
WINNIPEG (204) 896-1209
THUNDER BAY (807) 345-2233

CLIENT: Winnipeg
THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

PROJECT:
AUBREY STREET PUMPING STATION
PROPOSED GATE CHAMBER EXPANSION

DWG. DESCRIPTION:
SITE PLAN

ENG. STAMP

DESIGNED: BY: CWC CHECKED: RKe
DRAWN: BY: WG CHECKED:
APPROVED:
SCALE: AS NOTED
DATE: NOVEMBER, 2004
KGS DWG. NO. 04-0107-20 01
CLIENT DWG. NO.
REV: 0

KGS FILE NO.: P:\Projects\2004\04-0107-20\Geo\Dwgs\Revision\04-0107-20-01Rev0.dwg
24"x36"/PLOT SCALE: 0.15

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SUMMARY LOG

HOLE NO. **PN-2**

CLIENT	CITY OF WINNIPEG
PROJECT	PROPOSED GATE CHAMBER EXPANSION
SITE	AUBREY STREET PUMPING STATION
LOCATION	7 m West of Gate Chamber
DRILLING METHOD	125 mm ø Solid Stem Auger, RM 30 Drill Rig (Hollow Stem below 6.10 m)

JOB NO.	04-107-20
GROUND ELEV.	231.50 m±
TOP OF PIPE ELEV.	232.41 m±
WATER ELEV.	224.61 m±
DATE DRILLED	8-Nov-04
UTM (NAD83)	N
	E

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION
231.35			TOPSOIL - Black, organic.
			CLAY FILL - Black, moist, trace sand, trace concrete.
	1		
			- Cinders below 1.22 m.
229.98			ALLUVIAL SILTY CLAY - Brown, dry, hard, low plasticity, crumbly.
	2		
	3		
			- Moist, stiff below 3.35 m.
	4		- Rootlets at 3.96 m.
			- Intermediate plasticity below 3.96 m.
226.62			
226.47	5		SAND - Brown, moist, poorly graded, medium grained.
			ALLUVIAL SILTY CLAY - Brown, moist, soft, intermediate plasticity.
	6		
225.25			
			CLAYEY SILT - Brown, moist.
224.90			- Some sand below 6.49 m.
			SILT - Brown, moist, firm.
224.40	7		- Wet, soft below 7.01 m.
			SAND - Grey, saturated, fine grained, trace silt, trace clay.
223.88			
223.58			SILTY SAND/SANDY SILT - Grey, saturated, soft.
223.39	8		INTERLAYERED SILT AND CLAY - Grey, wet, firm, with fine grained sand.
			INTERLAYERED SILT AND SAND - Grey, wet, soft, fine grained sand.
222.87			
222.78			SAND - Grey, free water flowing, fine grained.
	9		ALLUVIAL SILTY CLAY - Grey, wet, firm, with sand.
			- Fine grained sand layer (9.14 cm thick) at 9.45 m.
			- Dark grey, wet, stiff, intermediate plasticity at 9.63 m.

PIEZ. LOG/ INCLINOM. LOG

DEPTH (m)

SAMPLE — TYPE / NUMBER

Cu from Uncon. Comp. Test (kPa) ◇

Cu Torvane (kPa) ◆

PL MC LL

% - (kPa)

20 40 60 80 kPa

SAMPLE TYPE	Auger Grab	Split Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	B.NICOLL		17-11-04

GENERAL P:\PROJECTS\2004\048BFD~1\GEO\LOGS\04-107-20 LOGS.GPJ

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SUMMARY LOG

HOLE NO.
PN-2

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION
221.35			
221.14			**SAND** - Grey, free water, poorly graded, coarse grained.
220.83			**SILTY CLAY** - Dark grey, wet, stiff, intermediate plasticity.
220.68			**SAND** - Grey, free water, well graded.
220.53	11		**SILTY CLAY** - Grey, wet, firm.
220.34			**GRAVEL** - Grey, wet, hard drilling.
			NO RECOVERY
219.61			
219.31	12		**CLAY TILL** - Light grey, wet, soft.
			END OF HOLE AT 12.19 m

Notes:
1. Testhole drilled after 3 tries (first two had refusal at 1.22 m, the third had refusal at 1.52 m).
2. Drilled to 12.19 m, sand blew up to 11.28 m. Lifted augers to 11.28 m, re-drilled to 12.19 m.
3. Casagrande piezometer (PN-2) installed at 12.19 m. Completed with above ground surface lockable protective steel casing. Stick up height is 0.91 m above existing grade.
4. Testhole caved below 10.82 m after augers were removed.

PIEZ. LOG/ INCLINOM. LOG

DEPTH (m)	SAMPLE TYPE	SAMPLE NUMBER
		14
		15
10.52		16
10.82		17
		18
11.89		
12.19		19

Cu from Uncon. Comp. Test (kPa) ◇
Cu Torvane (kPa) ◆
PL MC LL
% - (kPa)
20 40 60 80 kPa

SAMPLE TYPE Auger Grab Split Barrel

CONTRACTOR Paddock Drilling Ltd.
INSPECTOR B.NICOLL
APPROVED
DATE 17-11-04

KGS GROUP

SUMMARY LOG

HOLE NO. **TH-1**

CLIENT	CITY OF WINNIPEG	JOB NO.	04-107-15
PROJECT	PROPOSED TRANSFORMER INSTALLATION	GROUND ELEV.	231.52 m
SITE	AUBREY PUMPING STATION	TOP OF PVC ELEV.	232.35 m
LOCATION	3 m South of SW Corner of Lift Station	WATER ELEV.	
DRILLING METHOD	200 mm ø Hollow Stem Auger, RM 30 Drill Rig, Continuous Sampling	DATE DRILLED	17-Aug-04

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT blows/0.15 m▲ / CONE blows/0.15 m△ (20 40 60)	Cu from Uncon. Comp. Test (kPa) ◇ / Cu TORVANE (kPa) ◆ (20 40 60 80)	PL MC LL (%) (20 40 60 80)
231.4				TOPSOIL								
231				CLAY FILL - Black, moist, stiff, low plasticity, trace gravel, trace silt, trace oxidation.								
230.5	1					0.9		1				
230		5		SILTY CLAY (ALLUVIAL)- Brown, moist, stiff, intermediate plasticity (close to plastic limit), trace rootlets, trace silt seams (<1 mm thick), trace oxidation.				3	75			
	2			- Trace rootlets from 1.5 to 2.03 m.				4	20			
				- Trace organic matter from 2.03 to 2.54 m.				5	23			
229				- Trace silt nodules below 2.5 m.				6	80			
	3	10		- Increased moisture content below 3.05 m.				7	95			
228				- Trace rootlets from 3.05 to 4.06 m.				8	100			
	4			- Fine grained sand layer (light brown, loose, poorly graded) from 3.96 to 4.06 m.				9	100			
227		15		- Trace fine grained sand below 4.1 m.				10	100			
	5			- Fine grained sand layer (light brown, loose, poorly graded) from 4.89 to 5.16 m.				11	100			
226				- Soft from 5.59 to 5.74 m. (Tv = 9.8 kPa)		5.8		12	100			
	6	20		- Firm from 5.74 to 6.39 m. (Tv = 68.6 kPa)								
				- Firm from 6.10 to 6.39 m. (Tv = 53.9 kPa)		6.4		13	100			
225				- Soft from 6.39 to 6.53 m. (Tv = 19.6 kPa)								
				- Firm from 6.53 to 6.60 m. (Tv = 53.9 kPa)				14	100			
	7			- Mottled grey-brown, soft, increased fine grained sand content below 6.40 m.								
				- Firm from 7.11 to 7.62 m.		7.3		15	100			
224				- Fine grained sand lenses (~13 mm thick) at 7.21, 7.32, 7.40 and 7.47 m. Free water in the sand lenses.		7.6						
223.9		25		SANDY SILT - Brown, mottled grey-brown, moist, soft, trace rootlets, trace to no clay. Free water on entire sample.				16	100			
	8			- Grey at 8.0 m.								
				- Lean clay to sandy silt, grey, moist, soft, trace oxidation, trace organic matter below 8.13 m.				17	100			
223												
222.9				SILTY CLAY (ALLUVIAL)- Dark grey, firm, intermediate plasticity.				18	100			
	9	30		- Mottled black-grey from 8.84 to 9.14 m.								
				- Dark grey to black, moist, stiff below 9.14 m.				19	15			
222												
				- Firm, trace fine grained sand, trace silt below 9.65 m.				20	100			
				- Fine grained sand lens (black, loose, poorly graded) from 9.86 to 9.96								

SAMPLE TYPE: Auger Grab | Split Barrel | Split Spoon

CONTRACTOR: Paddock Drilling Ltd.

INSPECTOR: D. ANDERSON

APPROVED

DATE: 08-09-04

SPT_FT_M_CALC P:\PROJECTS\2004\04-0107-15\GEO\LOGS\04-107-15 LOGS.GPJ

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SUMMARY LOG

HOLE NO. **TH-1**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT blows/0.15 m▲ / CONE blows/0.15 m△	Cu from Uncon. Comp. Test (kPa) ◇ / Cu TORVANE (kPa) ◆ / PL MC LL %
221				- Dark grey, mottled black-dark grey, soft, trace organic matter below 10.15 m.							
220.9	11	35		Grain Size Distribution: Gravel (0%), Sand (10.7%), Silt (63.5%) and Clay (25.8%) at 10.15 m.				21	100		
220.3				**CLAYEY SAND** - Black, free water, soft, low plasticity, well graded sand, trace clay, trace clam shell pieces.				22	15		
220				**NO RECOVERY** - Sample washing out.				23	NR		
219.3	12	40						24	NR		
219.2				**SAND** - Dark grey, free water, loose, well graded.						▲3	
219				**CLAY TILL** - Light grey, moist, soft, low plasticity, trace fine and coarse grained gravel, trace sand, trace silt.				25	94	▲3	
218.4	13							27	100	▲3	
				AUGER REFUSAL AT 13.11 m				26	66	n = 9	
218		45									
	14			Notes:							
217				1. Installed Casagrade standpipe piezometer 3.0 m southeast of TH-1.							
	15	50									
216											
	16										
215		55									
	17										
214											
	18	60									
213											
	19										
212											
		65									
	20										
211											
	21										
		70									
210											

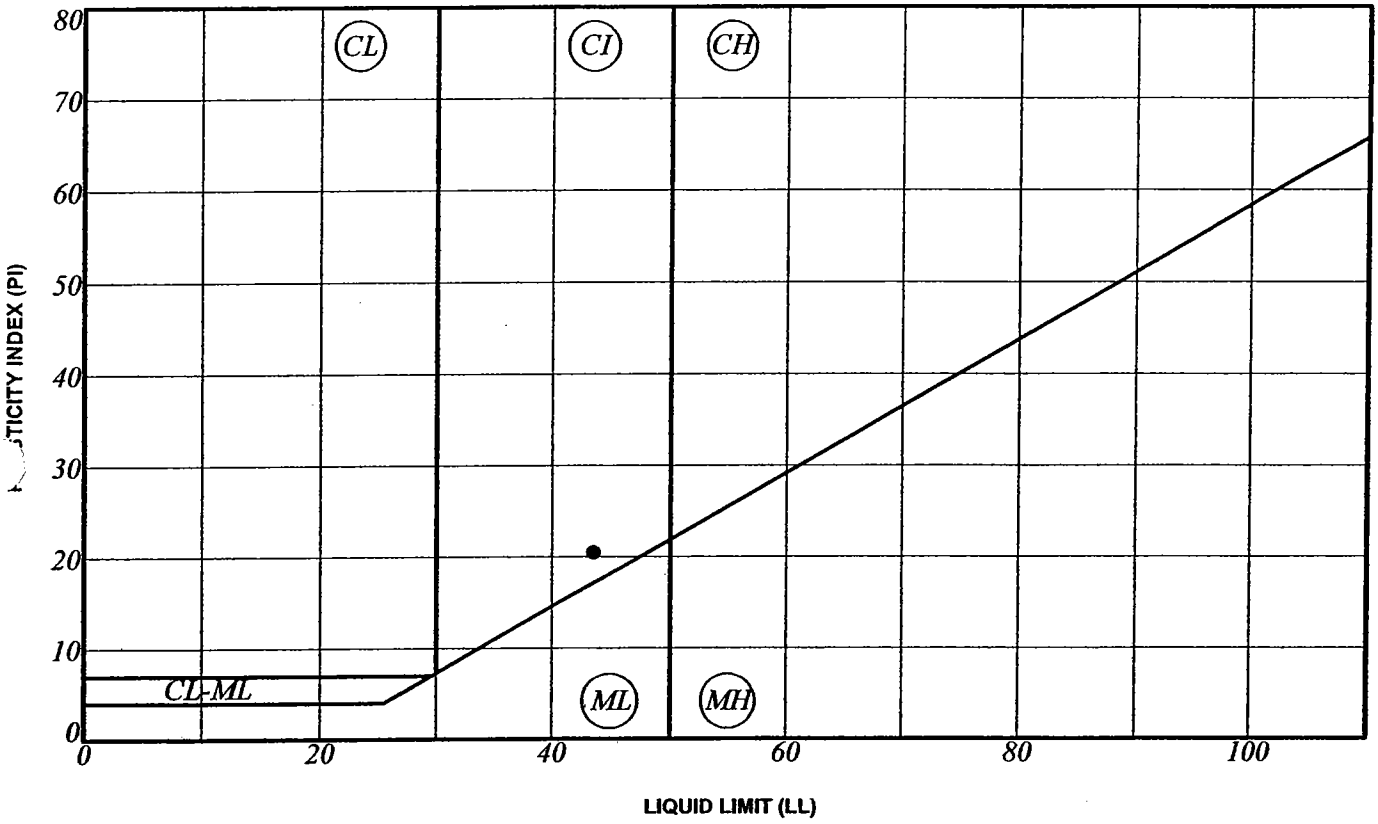
SAMPLE TYPE ⚅ Auger Grab ▮ Split Barrel ☒ Split Spoon

CONTRACTOR Paddock Drilling Ltd.

INSPECTOR D. ANDERSON

APPROVED

DATE 08-09-04



SYMBOL	HOLE	DEPTH (m)	SAMPLE #	LL	PL	PI	% SAND	% SILT	% CLAY	% MC	CLASSIFICATION
●	TH-1	10.1	21	44	23	21	30.7	43.4	25.9	38.0	CI

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

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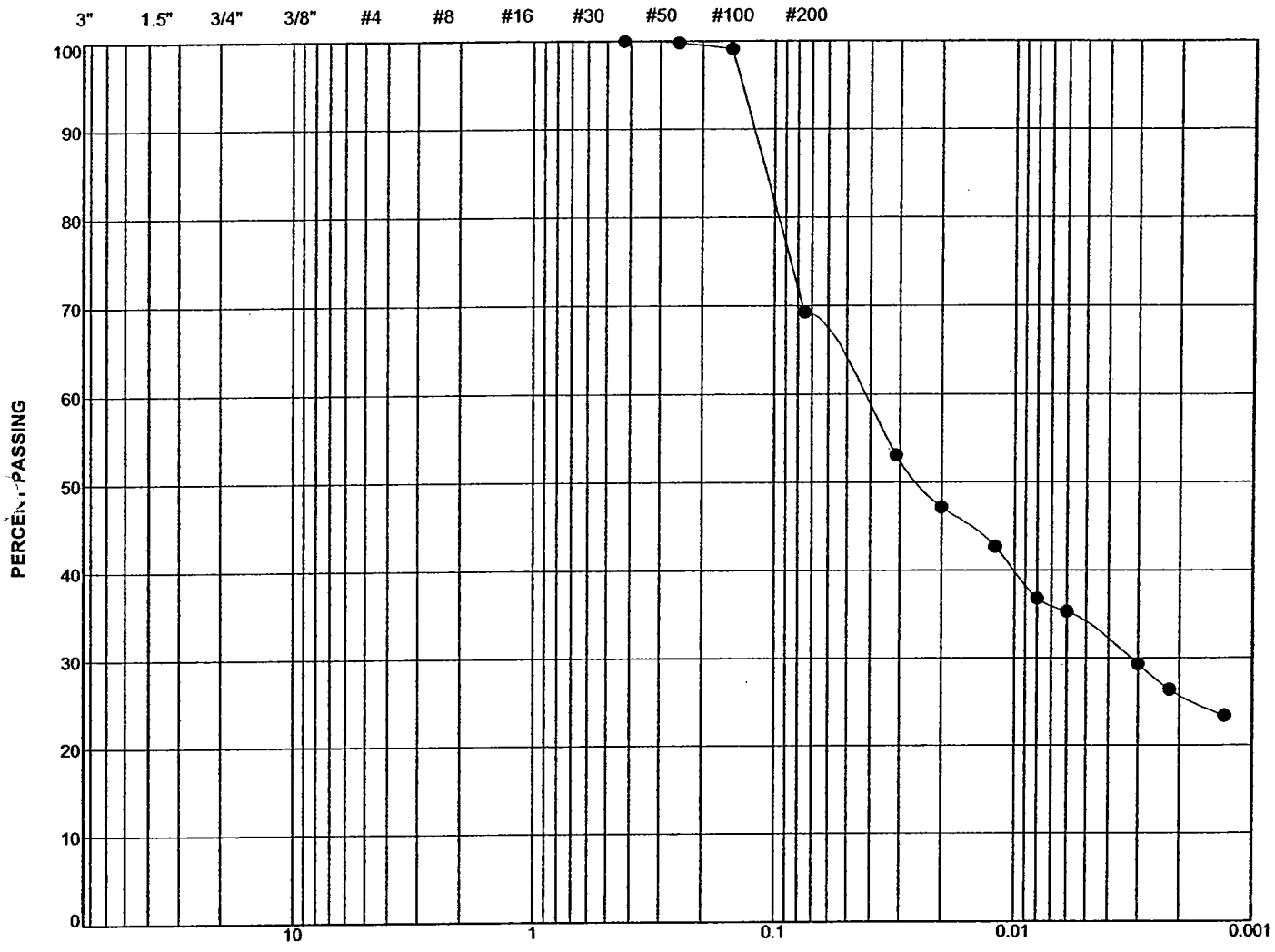
CITY OF WINNIPEG

PROPOSED TRANSFORMER INSTALLATION

A-LINE PLOT

Sept 2004	Figure 1	Page 1 of 1

SIEVE ANALYSIS | HYDROMETER ANALYSIS

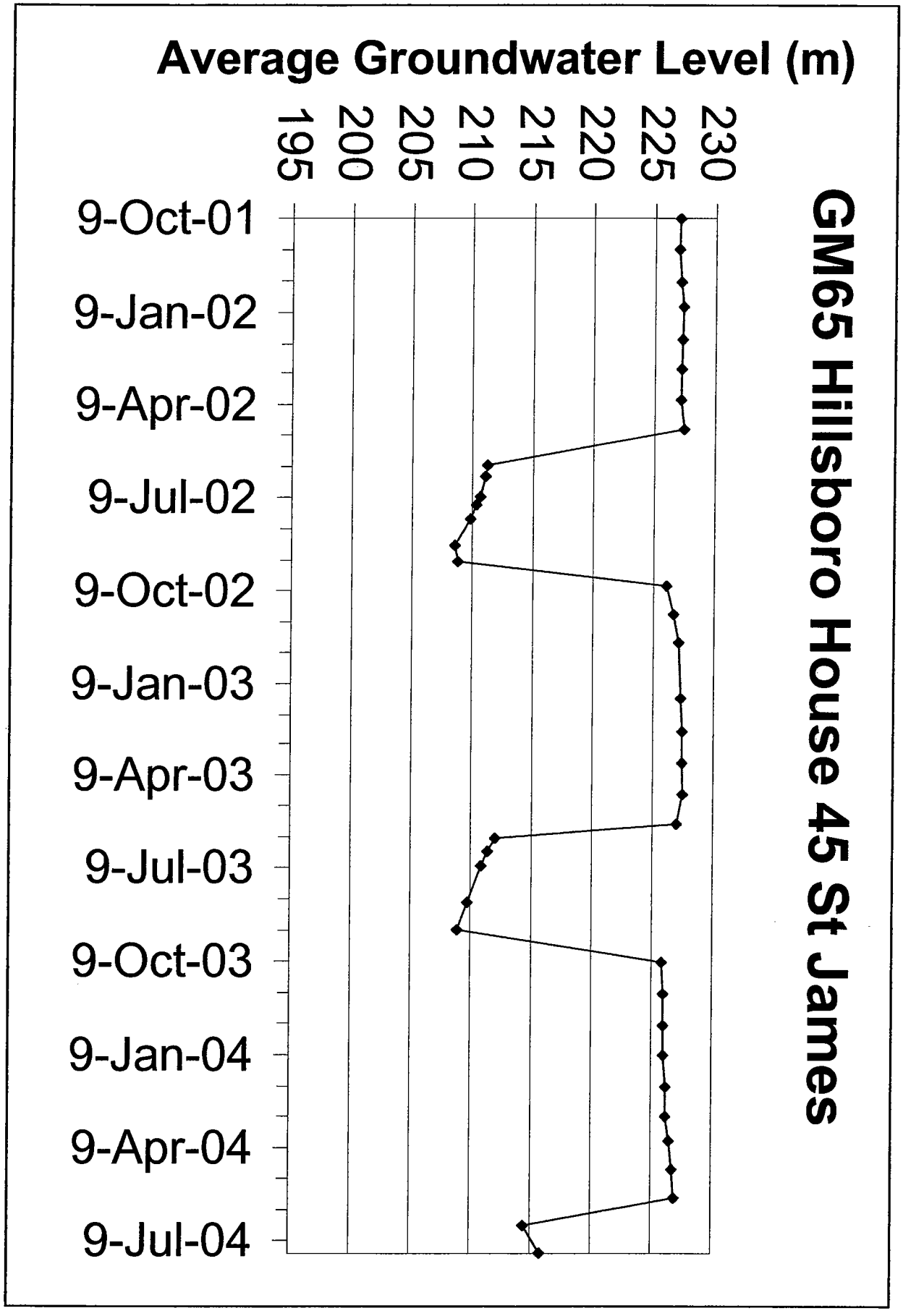


GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

SYMBOL	HOLE	DEPTH (m)	SAMPLE #	% GRAVEL	% SAND	% SILT	% CLAY	% SILT & CLAY	Cu	Cc	CLASSIFICATION
●	*TH-1*	*10.1*	*21*	*0.0*	*30.7*	*43.4*	*25.9*	*69.3*			*CI*

KGS GROUP	CITY OF WINNIPEG	
PROPOSED TRANSFORMER INSTALLATION		
GRAIN SIZE ANALYSES		
Sept 2004	Figure 2	Page 1 of 1

SIEVEANA 04-107-15 LOGS.GPJ 08-09-04



Sketch A

- Monitoring Data Obtained From