City of Winnipeg

RFP 429-2011–Design and Construction of the Public Works East Yard Complex at the Former Elmwood/Nairn Landfill Site

Appendix D. Background Information

Appendix D1

Public Works East Yards – Geotechnical Investigation

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

February 7, 2011

Ms. Bonnie Konzelman, P.Eng.
The City of Winnipeg
Planning, Property & Development Department
Municipal Accommodations Division
3rd Floor – 65 Garry Street
Winnipeg, Manitoba
R3C 4K4

Dear Bonnie:

Project No: 60146003 (4)

Regarding: Public Works East Yards – Geotechnical Investigation

This report presents the findings of a geotechnical site investigation undertaken by AECOM Canada Ltd. (AECOM) for the proposed development of the City of Winnipeg's Public Works East Yards. The site is situated on the south side of Thomas Avenue, between Chester Street and Keenleyside Street, as shown on Figure 01. The site development is at the conceptual stage, but it is expected to include several structures, surface parking, stormwater retention, material storage areas and other facilities.

The City of Winnipeg plans to adopt a design-build approach for the proposed development. The purpose of the site investigation is to provide general information for the subsurface conditions at the site. This report is provided for information purposes only. Additional site investigation and materials testing by the design-build team will likely be required to complete the design and the construction of the proposed facilities.

SITE INVESTIGATION

The subsurface investigation involved two separate components. The first component involved the installation of five (5) soil vapour monitoring wells (MW10-01 to MW10-05) on November 9, 2011. The second component involved the drilling of two (2) large diameter (350 mm) test holes to auger refusal (TH11-06 and TH11-07). The vapour monitoring wells were installed by Maple Leaf Drilling Ltd. These wells were installed to depths between 1.5 and 2.1 m in 125 mm test holes. The wells have been monitored for methane gas concentrations. The installation and monitoring results of the vapour monitoring wells are discussed in AECOM's report "Geotechnical Investigation – Methane Gas Monitoring" dated February 7, 2011.

The large diameter test holes were drilled by Subterranean (Manitoba) Ltd. on January 25, 2011. The UTM co-ordinate test holes were located using a hand-held GPS unit. The test holes (TH11-06 and TH11-07) and monitoring well (MW10-01 to MW10-05) locations are shown on Figure 01.

Geotechnical sampling included the collection of disturbed samples from auger cuttings, and relatively undisturbed samples from Shelby tubes. The samples were visually examined and tested in

AECOM's Material Testing Laboratory in Winnipeg. Laboratory tests included determination of moisture contents, density, and undrained shear strength.

Detailed test hole logs have been prepared for each test hole (Appendix A) to record the description and relative position of the soil strata, the location of the samples, and laboratory test results.

The following are descriptions of the subsurface conditions gathered from both components of the site investigation.

Subsurface Conditions

The stratigraphic layers encountered at the site included:

- Fill
- Organics/Topsoil
- Clay and Silt
- Silt
- Clay
- Till

A detailed description of the soil units is provided below:

Fill
Fill, 2.7 m thick, was encountered at the locations of TH11-06 and TH11-07. At MW10-05, the fill strata was 0.9 m thick, and at all other monitoring well locations, the drilling was advanced to depths between 1.5 and 2.3 m and terminated in the fill. The composition and the properties of the fill are highly variable. Several material types were identified in the fill material, including, but not limited to:

- Light brown sandy silt, with some gravel
- Intermediate to high plasticity silty clay
- Rubbled concrete
- Re-bar
- Bricks
- Rubbled asphalt pavement
- Organics

Some of these materials were identified visually at the ground surface. The small sampling volumes of the augers and large spacing between test holes do not allow for truly representative sampling of this type of heterogeneous material. It is also not possible to delineate the distribution or the proportion of individual material types. The fill was generally moist to wet and seepage was observed from the fill at the locations of MW10-02, TH11-06 and TH11-07. Where clay is encountered in the fill, the consistency ranged from very soft to stiff. Although very soft conditions were not identified at the exact test hole locations, a rubber tired loader sank to the axles due to soft surface conditions.

Organics and Topsoil
A layer of topsoil and organics less than 0.3 m thick was encountered below the fill in TH11-06 and TH11-07. The top of this layer was interpreted to be the interface between the fills and native soils. There was grass found along this interface, suggesting that fill may have been placed directly on the existing ground surface without any stripping or surface preparation.

Clay and Silt
A layer of grey clay and silt with trace sand was encountered immediately below the topsoil layer in both TH11-06 (1.1 m thick) and TH11-07 (0.8 m thick). The soil was generally moist, stiff and of intermediate plasticity.

Silt
A layer of light brown silt was encountered at MW09-05 and TH11-06 at depths of 0.9 m and 4 m, respectively. The silt was generally loose and moist to wet. Sloughing was observed in the silt layer.

At the location of MW10-05, no topsoil or native clay layers were identified above the silt layer.

Clay
A thick deposit of glaciolacustrine silty clay unit was encountered in TH11-06 and TH11-07 at a depth of 3.7 and 5.2 m, respectively. The clay was brown, and turned to grey with depth. The clay was moist and stiff but becoming firm to soft with increasing depth. The moisture content ranged from 43 to 60 percent. The undrained shear strength of three Shelby tube samples was measured to be between 37 and 40 kPa (based on unconfined compressive strength tests).

Till
Generally the till was sandy and contains some cobbles and some boulders in a silt matrix. Representative samples of the till deposit could not be retrieved because of some challenges with retaining the soil on the auger, and the fact that auger refused near the top of the till layer. It is unclear whether auger refusal was caused by boulders, bedrock, or very dense till.

Groundwater Conditions

Seepage was observed at MW10-02, TH11-06 and TH11-07 at depths shallower than 3 m. Seepage should be anticipated at all locations in the fill and/or the native silt layers. Surface water was observed at several areas across the site during the November 2010 site investigation. The drainage swale parallel to Thomas Avenue contained water at the time of the November 2010 site work. No piezometers have been installed at the site at this time. The soil vapour monitoring wells have been installed above the phreatic surface by design, and are not meant for monitoring groundwater levels.

Discussions

The highly variable and uncontrolled fill overlying most of the site presents an important consideration for site development. Because of the heterogeneous nature of the fill, and the limited number of test holes, the information in this report should not be used to make generalizations regarding the condition and nature of the fill.

During the site investigations in November 2010, and January 2011, equipment had difficulty traveling around the site because of soft ground conditions. However, there are some spots firm enough to be able to support vehicles and construction equipment. A tire mounted drill rig, a 4-wheel drive truck and front end loaders all got stuck at various times in either November 2010 or January 2011 because of soft ground conditions. The soft conditions may be exasperated by the wet conditions and high groundwater levels in the fall and winter of 2010-2011. The uncontrolled fill should not be relied upon to provide a competent bearing layer for engineered structures (road base, parking lots, building foundations, etc.).

The many partially buried pieces of rubble, and the uneven ground surface also make driving over the surface risky. The buried rubble will also present some challenges for ground preparation and ground improvements. Because of the variable nature of the fill, the high groundwater levels, and the presence of non-soil materials in the fill and wet silt layer, excavations are expected to present construction difficulties. Temporary shoring, flat slopes, groundwater control and construction dewatering will likely be required to protect excavation sides.

The site investigation completed by AECOM is limited in scope, further investigation will likely be required to support design development.

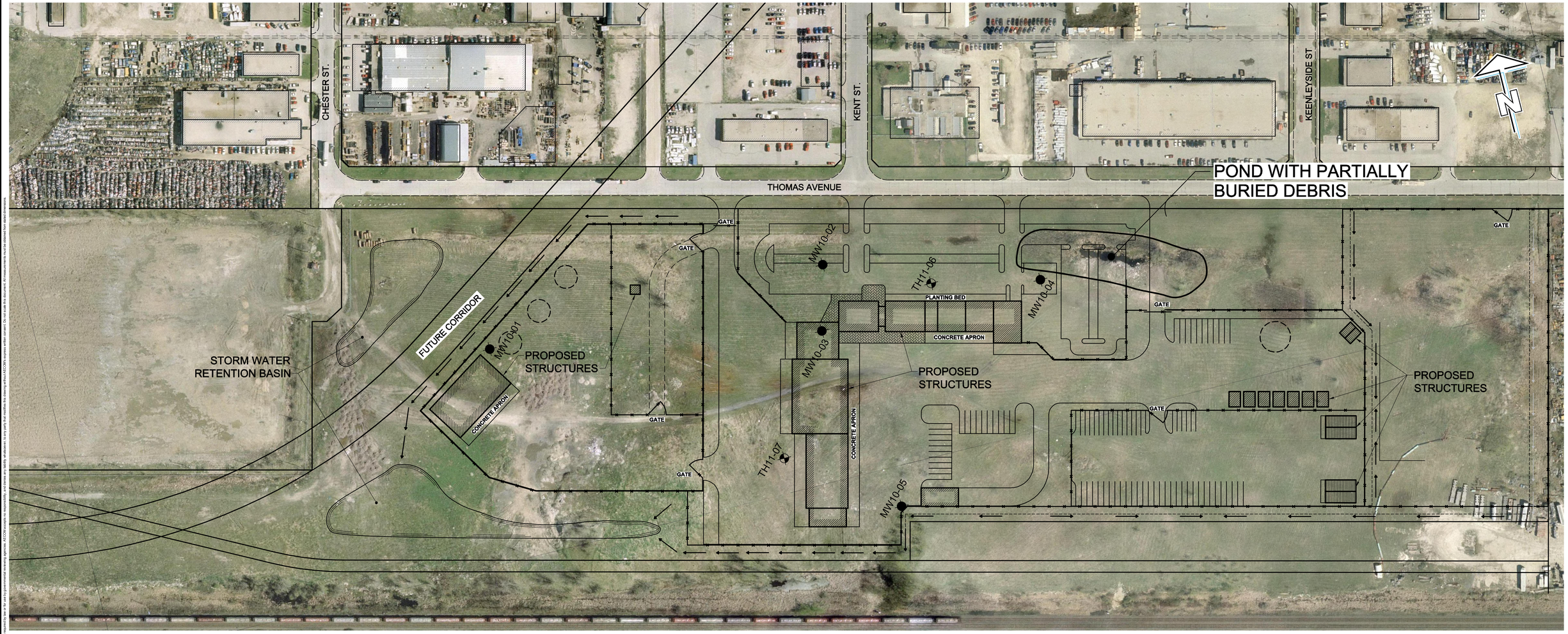
Sincerely,
AECOM Canada Ltd.

Reviewed By:

for Kendall Thiessen, P.Eng.
Geotechnical Engineer

Faris Khalil, P.Eng.
Manager, Geotechnical Engineering

KT:dh



0 12.5 25 37.5 m
SCALE 1:1250 (22x34)
1:2500 (11x17)

LEGEND

- VAPOUR MONITORING WELL
- TEST HOLE

COORDINATE TABLE:

ITEM	EASTING	NORTHING
MW10-01	637287	5529139
MW10-02	637512	5529140
MW10-03	637501	5529098
MW10-04	637648	5529096
MW10-05	637524	5528974
TH11-06	637578	5529111
TH11-07	637457	5529023

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The City of Winnipeg
Public Works East Yards

Test Hole Plan
Subsurface Investigation
Figure - 01

Appendix A
Test Hole Logs

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)		
	Fill		Bedrock (Limestone)		

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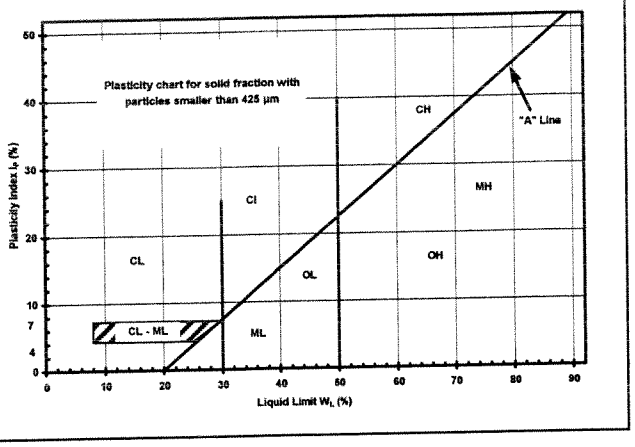
When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.



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: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-01**
LOCATION: N 5,529,139.0 E 637,287.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

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

BACKFILL TYPE: BENTONITE; GRAVEL; SLOUGH; GROUT; CUTTINGS; SAND

DEPTH (m)	USC	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	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	FILL			SILT (Fill) - clayey, some sand, some gravel - mottled light brown with dark brown, moist, loose to compact - low plasticity		G1					0
1				CLAY (Fill) - silty, trace sand, trace gravel - mottled grey and brown, moist, firm - intermediate to high plasticity							1
2	FILL			- gravel layer, wet at 1.5 m - greyish black below 1.5 m		G2					2
3				END OF TEST HOLE AT 2.3 m IN CLAY FILL. 1. Seepage from gravel layer. 2. No sloughing observed. 3. Installed 50 mm gas probe at 1.4 m, with 0.76 m of screen. Complete with above ground cover. Backfilled with sand to 0.51 m, and hydrated bentonite to ground surface.							3
4											4
5											

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LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.30 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 2010 PWEY TEST HOLE LOGS.GPJ UMA WINN.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-02**
LOCATION: N 5,529,140.0 E 637,512.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

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

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

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)	USC	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH
0	FILL			CLAY (Fill) - silty, trace sand, trace gravel - mottled light brown and grey, moist, firm to stiff - intermediate plasticity		G5			0
1									1
				- wet at 1.5 m					
2				END OF TEST HOLE AT 1.5 m IN CLAY FILL. 1. Seepage at 1.5 m. 2. No slouging observed. 2. Installed 50 mm gas probe at 1.4 m. Complete with 1.0 m of screen, and above ground cover. Backfilled with hydrate bentonite to 1.4 m, sand to 0.40 m, and hydrated bentonite to ground surface.					2
3									3
4									4
5									

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 1.50 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 2010 PWEY TEST HOLE LOGS.GPJ UMA WINN.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-03**
LOCATION: N 5,529,098.0 E 637,501.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

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

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	USC	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0	FILL			CLAY (Fill) - some sand, trace gravel - grey, moist, firm to stiff - intermediate plasticity		G6				
1	FILL			CLAY AND SILT (Fill) - trace sand, trace gravel - mottled brown, moist, firm - low to intermediate plasticity		G7				1
				- wet at 1.5 m END OF TEST HOLE AT 1.5 m IN CLAY FILL. 1. No sloughing observed. 2. No seepage observed. 3. Installed 50 mm gas probe at 1.4 m. Complete with 0.76 m of screen, and above ground cover. Backfilled with hydrated bentonite to 1.4 m, sand to 0.51 m, and hydrated bentonite to ground surface.						
2										2
3										3
4										4
5										

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

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 1.50 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 2010 PWEY TEST HOLE LOGS.GPJ UMA WINN.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-04**
LOCATION: N 5,529,096.0 E 637,648.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

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

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	USC	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	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				CLAY (Fill) - trace to some sand, trace gravel - grey, moist, firm - intermediate to high plasticity						0
1	FILL					G8				1
						G9				
2						T10		36		2
				END OF TEST HOLE AT 2.1 m IN CLAY FILL. 1. No sloughing observed. 2. No seepage observed. 3. Installed 50 mm gas probe at 1.5 m. Complete with 0.61 m of screen, and above ground cover. Backfilled with hydrated bentonite to 1.5 m, sand to 0.86 m, and hydrated bentonite to ground surface.					
3										3
4										4
5										

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 2010 PWEY TEST HOLE LOGS.GPJ UMA WINN.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-05**
LOCATION: N 5,528,974.0 E 637,524.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

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

BACKFILL TYPE: BENTONITE | GRAVEL | SLOUGH | GROUT | CUTTINGS | SAND

DEPTH (m)	USC	SOIL SYMBOL	SLOTTED PIEZOMETER	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	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	FILL			CLAY (Fill) - silty, trace sand, trace gravel - brown mottled, moist, firm - intermediate plasticity		G11					0
1	ML			SILT - light brown, moist, loose - low plasticity		G12					1
2				END OF TEST HOLE AT 2.1 m IN NATIVE SILT. 1. No sloughing observed. 2. No seepage observed. 3. Installed 50 mm gas probe at 1.7 m. Complete with 0.76 m of screen, and above ground cover. Backfilled with hydrate bentonite to 1.7 m, sand to 0.91 m, and hydrated bentonite to ground surface.							2
3											3
4											4
5											

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.10 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 2010 PWEY TEST HOLE LOGS.GPJ UMA WINN.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **TH11-06**
LOCATION: N 5,529,111.0 E 637,578.0		PROJECT NO.: 60146003
CONTRACTOR: Subterranean (MB) Ltd.	METHOD: Soilmec R208, 356 mm	ELEVATION (m):

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

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0									0
1	FILL		SILT (Fill) - clayey, some sand, trace gravel - mottled light brown to brown, moist - low plasticity		G13	17.7			1
					G14	27.1			
2	FILL		CLAY (Fill) - silty, trace sand, trace gravel - mottled brown and grey, moist, firm - intermediate to high plasticity		G15	31.8			2
3	OR		ORGANICS - silty, black, moist, grass, roots, trace glass						3
	CI		CLAY and SILT- trace sand, trace organics, grey, moist, firm, intermediate plasticity		T16	39.7			
4						26.3			4
	ML		SILT - some clay - mottled light brown and grey, moist to wet - low to no plasticity						
5									5
6			CLAY - silty - brown, moist, stiff - high plasticity - trace silt inclusions - grey below 6.1 m		G17	44.2			6
7					G18	49.1			7
8									8
					G19	44.9			
9									9
10					T20	47.2			10
11	CH								11
12					G21	43.6			12
			- firm below 12.2 m						
13					G22	51.2			13
14									14
15									15
					G23	59.4			
16									16
17	TILL		SILT (Till) - some sand, some gravel - light brown, moist						17
18			PRACTICAL AUGER REFUSAL AT 17.8 m IN SILT TILL. 1. Seepage from fill and silt layers. Water level at 9.75 at end of drilling. 2. Sloughing of organic and silt layer. Test hole open to 10.4 m at end of drilling. 3. No recovery below12.8 m because sample slides off augers due to water in test hole. 4. Backfilled with auger cuttings.						18
19									19
20									20
21									

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

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 17.83 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 2010 PWEY TEST HOLE LOGS.GPJ UMA WINN.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **TH11-07**
LOCATION: N 5,529,023.0 E 637,457.0		PROJECT NO.: 60146003
CONTRACTOR: Subterranean (MB) Ltd.	METHOD: Soilmec R208, 356 mm	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)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH
0	FILL		SILT (Fill) - sandy, some gravel, light brown - moist, low to no plasticity		G24	27.2		1
1	FILL		RUBBLE ASHPALT (Fill) - some clay, some silt, trace bricks, black, moist to wet					
2	FILL		CLAY and SILT (Fill) - some sand, some gravel, dark grey, moist to wet, stiff, intermediate plasticity		G25	34.6		2
3	OR		ORGANICS (topsoil) - some sand, black, moist		G26	32.8		3
	CI		CLAY and SILT - trace sand, grey, moist, stiff, intermediate plasticity					
4			CLAY - silty - brown, moist, stiff - high plasticity		G27	43.8		4
5								5
6				T28		53.6		6
7					G29	50.7		7
8			- becoming grey below 7.6 m					8
9			- firm beow 9.1 m		G30	49.9		9
10	CH							10
					G31	60.1		
11								11
12				T32		56.5		12
13								13
14								14
					G33	56.8		
15								15
16					G34	44.9		16
	TILL		- some till inclusions below 16.1 m					
17			SILT (Till) - some sand, some gravel, some cobbles		G35	27		17
			PRACTICAL AUGER REFUSAL AT 16.9 m IN SILT TILL.					
18			Notes: 1. Seepage from fill. Water level at 15.8 m at end of drilling. 2. Sloughing of fill between 2.1 and 2.9 m. Test hole open to 16.1 m at end of drilling. 3. Backfilled with auger cuttings.					18
19								19
20								20
21								

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 16.90 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

LOG OF TEST HOLE 2010 PWEY TEST HOLE LOGS.GPJ UMA WINN.GDT 2/7/11

Appendix D2

Public Works East Yards – Methane Gas Monitoring

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
www.aecom.com

204 477 5381 tel
204 284 2040 fax

February 7, 2011

Ms. Bonnie Konzelman, P.Eng.
The City of Winnipeg
Planning, Property & Development Department
Municipal Accommodations Division
3rd Floor, 65 Garry Street
Winnipeg, Manitoba
R3C 4K4

Dear Ms. Konzelman:

Project No: **60146003 (4.7)**

Regarding: **Public Works East Yards, Winnipeg, Manitoba**
Methane Gas Monitoring

AECOM Canada Ltd. (AECOM) is pleased to submit our report on the above referenced project. Should you require additional information, please contact Scott Chapman, M.Sc., P.Eng. directly at (204) 928-8471.

Sincerely,
AECOM Canada Ltd.

Ron Typliski, P.Eng.
Vice-President, Manitoba District
Canada West Region

SC:dh

INTRODUCTION

The City of Winnipeg (COW) is planning to develop the property situated on the south side of Thomas Avenue, between Chester Street and Keenleyside Street, in Winnipeg, Manitoba (the Site). The subject property is to be used by the City of Winnipeg as the Public Works East Yards. AECOM Canada Ltd. (AECOM) was retained by the City of Winnipeg to conduct a methane gas monitoring program in conjunction with the geotechnical site investigation at the Site. The purpose of the methane gas monitoring program was to establish background concentrations of methane gas in and around the proposed building location and identify any potential hazards related to methane gas concentrations present in soil vapour at the Site.

This letter report summarizes the methodology and results of the methane monitoring program completed at the Site. The geotechnical site investigation is detailed in a separate report.

The Site was previously used as the Nairn Avenue landfill for demolition waste. The area of investigation is focused on the central and western portions of the Site surrounding the potential building locations, as shown on Figure 1.

BACKGROUND

Studies completed by Underwood and McLellan (UMA 1977) showed measureable levels of methane gas in soil vapour monitoring wells installed and monitored for a brief period of time on the north side of Thomas Avenue between Stapleton Street and Chester Street. Some of these vapour monitoring wells produced gas concentrations in excess of 1% methane gas and one vapour monitoring well (#15) showed concentrations as high as 23% methane gas (soil vapour monitoring well #15 was located at the NW corner of Kent Street and Chester Street). The study concluded that refuse may be scattered across the area in pockets and was difficult to locate.

Subsequent to the 1977 UMA Study, the COW installed methane monitoring wells on the south side of Thomas Avenue in 1980. Monitoring records from COW vapour monitoring wells located near the junctions of Thomas Avenue and Kent Street as well as Thomas Avenue and Keenleyside Street did not indicate any detectable concentrations of methane from 1980 to as recently as 2008, suggesting the methane source was located on the north side of Thomas Avenue. There was no visible evidence of domestic organic waste material on the Site (south of Thomas Avenue) in the vicinity of the proposed buildings during previous sub-surface investigations undertaken by UMA and KGS. The investigations did indicate that there was a considerable amount of demolition waste (concrete, asphalt, ash) present at various locations over the Site. However, investigations completed by UMA in the mid 1970's, indicated the presence of domestic waste in the vicinity of the snow dump area to the east of the Site along with elevated landfill gas concentrations. Previous investigation also indicated a small area of partially buried debris (metal, wood, glass, plastic, a refrigerator, vehicle parts and carpet) was visible along a pond south of Thomas Avenue between Kent Street and Keenleyside Street. This area was identified as a potential source of landfill (methane) gas. A subsurface test pit investigation conducted by KGS in the immediate area south of the pond did not encounter any similar waste material which may indicate that the waste is confined to an isolated pocket which could be excavated as part of site development.

SCOPE OF WORK

The scope of work for the methane monitoring portion of the geotechnical investigation consists of engineering services to complete the following activities:

- Installation of five (5) soil vapour monitoring wells on the property in the vicinity of the proposed building.
- Logging the soil stratigraphy encountered during each monitoring well installation.
- Methane monitoring of each soil vapour monitoring well.
- Preparation of a letter report summarizing all findings.

METHODOLOGY

The following sections present the methodology used for the methane gas monitoring. AECOM conducted the installation of the soil vapour monitoring wells on November 9, 2010. Prior to the field investigation, AECOM personnel obtained utility clearances from Manitoba Hydro, MTS Allstream, Shaw Cable, TeraSpan Networks, CP Rail and a private utility locator. AECOM conducted the first round of methane monitoring on December 21, 2010.

Soil Vapour Monitoring Well Installation

A total of seven (7) test holes were advanced at the Site, of which five (5) were completed as soil vapour monitoring wells (MW10-01 through MW10-05) and two (2) were advanced as geotechnical test holes. The test holes that were completed as soil vapour monitoring wells were advanced to a maximum depth of 2.3 m (7.5 ft) below grade. The relative positions of the test holes and soil vapour monitoring wells are shown on Figure 1. The placement of soil vapour monitoring wells was based on the results of previous methane gas studies and the approximate building locations proposed in the conceptual plan for the Public Works East Yards. The test holes were drilled by Maple Leaf Drilling using a truck mounted B-24 rig with 125 mm diameter solid stem augers.

Screened pipe was used for the portion of the monitoring well within the vadose zone to allow methane gas, if present, to enter the well. The perforated portion of the monitoring well was approximately 0.8 m (2.5 ft) in length. The portion of the soil vapour monitoring well above the screened interval was constructed using solid PVC pipe and extended to approximately 0.8 m (2.5 ft) above grade. Each of the monitoring wells was completed with a screw-on top cap complete with a quick-connect fitting to allow ease of vapour monitoring. The soil vapour monitoring wells are accessed through an above ground metal cover. The test hole annulus surrounding the soil vapour monitoring well was filled with silica sand from the bottom of the screened section to just above the top of the screen to allow the passage of soil gases into the pipe. The remainder of the test hole annulus was filled with hydrated bentonite to form a seal above the sand pack and thus prevent the infiltration of atmospheric air into the soil vapour monitoring well. Details of the test hole advancement and vapour monitoring well screened interval are summarized in the table below:

Monitoring Well ID	Depth of Test Hole (m BGS)	Screened Interval (m BGS)
MW10-01	2.3	0.6 – 1.4
MW10-02	1.5	0.4 – 1.4
MW10-03	1.5	0.6 - 1.4
MW10-04	2.1	0.9 – 1.5
MW10-05	2.3	1.0 – 1.7

During test hole advancement, soil stratigraphy was logged. Graphical representations of each test hole, the encountered strata, and the installed soil vapour monitoring wells are provided as test hole logs in Appendix A.

Methane Monitoring Program

All five (5) of the soil vapour monitoring wells were included in the methane monitoring program. When appropriate, the recommendations and best practices of the "Scoping Assessment of Soil Vapour Monitoring Protocols for Evaluating Subsurface Vapour Intrusion into Indoor Air", prepared for the Canadian Council of Ministers of the Environment (2008), were incorporated into the development of the methane monitoring program.

The soil gas readings were taken with a GEM 2000 Landfill Gas Monitor. The intake line of the GEM 2000 was fitted with a male quick connect to match the female quick connect fitting on the cap of the soil vapour monitoring well. This allowed the GEM 2000 to be connected to the soil vapour monitoring well without removing the cap and prevented the introduction of atmospheric air. Readings from the GEM 2000 were reported as percent gas, which is the standard unit for describing methane gas concentrations. Following installation, the soil vapour monitoring wells were allowed a period of equilibration. To ensure monitoring of representative soil gas, each soil vapour monitoring well was purged of approximately three (3) times the well volume using the GEM 2000, prior to recording the final soil gas readings. Purging time was calculated using the average pump flow rate of the GEM 2000 and the well volume of each soil vapour monitoring well. Soil gas readings were taken once per minute during purging. Following purging, the final soil gas readings were recorded and the GEM 2000 was disconnected from the soil vapour monitoring well. The GEM 2000 was purged with atmospheric air for a minimum of thirty (30) seconds between each soil vapour monitoring well to remove any residual soil gases within the intake line.

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

As outlined in the previous section, AECOM field personnel followed pre-defined field procedures for quality control. These procedures ensured that representative samples were collected and that the risk of cross-contamination was minimized.

SELECTION OF APPLICABLE ENVIRONMENTAL QUALITY GUIDELINES

The City of Winnipeg developed its Standards and Guidelines for the Mitigation of Methane Gas at Buildings and Utilities and Guidelines for Construction on Landfill Sites, as a result of the adoption of the Methane Gas Policy by City Council. The aforementioned standards and guidelines designate Zones of Concern (Control Zones) of 15 m, 45 m and 90 m from the boundary of an active or inactive landfill within the City. Building Permits may be granted within these Zones of Concern provided that there are no significant amounts of gas indicated by test results; or where tests indicate there are significant amounts of gas, acceptable safety measures are incorporated. Although the City of Winnipeg does not specifically define “significant” gas concentrations, it is common practice to consider soil gas levels of 20% LEL (1% methane gas in air) or greater as significant for methane gas. Current industry standards typically categorize methane gas levels of 0.01 to 0.1% methane gas as requiring caution and 0 to 0.01% methane gas as trace amounts.

Under Section 14 of the Manitoba Waste Disposal Grounds Regulation 150/91, no dwelling may be constructed on or within 400 m of an active or abandoned waste disposal ground without ministerial approval.

For the purposes of this report, the methane gas monitoring results will be compared the aforementioned industry standards to categorize the potential hazard.

RESULTS

Soil Stratigraphy

All five (5) of the test holes completed as soil vapour monitoring wells consisted of a layer of fill material ranging in thickness from 0.9 m to the maximum depth investigated of 2.1 m. The fill layer was typically clayey silt, silty clay or clay with trace quantities of sand and gravel. Generally, this material was mottled brown in colour, moist, soft to firm, and ranged from low to high plasticity. The fill material was noted to become wet at a depth of 1.4 to 1.5 m below ground. A layer of native silt was encountered underlying the fill layer in test hole MW10-05 extending from a depth of 0.9 m to the maximum depth of investigation of 2.1 m. The native silt was light brown in colour, moist, and loose with low plasticity.

Methane Gas Concentrations

All methane gas readings recorded in each of the five (5) soil vapour monitoring wells were found to be below the detection limit of the GEM 2000 Landfill Gas Monitor (< 0.1% gas). The results of the methane monitoring are summarized in Tables 1 through 5.

DISCUSSION

All methane readings recorded were found to be below detection limits for each of the five (5) soil vapour monitoring wells and, consequently, below the industry standard of 1% methane gas which indicates hazardous or significant concentrations of methane gas. As such, no concerns with respect to methane gas concentrations were identified in the investigate area during the methane monitoring program.

CONCLUSIONS AND RECOMMENDATIONS

Based on the work completed at the Site by AECOM, methane gas readings were found to be below industry standards (< 0.1% gas) in all of the soil vapour monitoring wells installed at the Site. As such, no concerns with respect to methane gas concentrations were identified during the methane monitoring program.

As the results presented in this report were based on soil gas concentrations determined during one (1) methane monitoring event in December 2010, it is recommended that additional methane monitoring be conducted in spring and summer seasons to assess potential seasonal variability in soil gas methane concentrations.

If you have any questions or concerns, please feel free to contact Scott Chapman, M.Sc., P.Eng. at (204) 928-8471.

Sincerely,
AECOM Canada Ltd.

Prepared by:

Blair Robinson, E.I.T.
Environmental Engineer-In-Training
BR:dh
Encl.

Reviewed by:

Scott Chapman, M.Sc., P.Eng.
Environmental Project Engineer

PROVINCE OF MANITOBA
S. D.
CHAPMAN
Member
23198
Feb 7, 2011
REGISTERED PROFESSIONAL ENGINEER

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations")
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports
- may be based on information provided to Consultant which has not been independently verified
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued
- must be read as a whole and sections thereof should not be read out of such context
- was prepared for the specific purposes described in the Report and the Agreement
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

The Report is to be treated as confidential and may not be used or relied upon by third parties, except:

- as agreed in writing by Consultant and Client
- as required by law
- for use by governmental reviewing agencies

Consultant accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information ("improper use of the Report"), except to the extent those parties have obtained the prior written consent of Consultant to use and rely upon the Report and the Information. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

Appendix A
Test Hole Logs

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-01**
LOCATION: N 5,529,139.0 E 637,287.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		SILT (Fill) - clayey, some sand, some gravel - light brown mottled with dark brown, moist, loose to compact - low plasticity	■	G1			0
1		CLAY (Fill) - silty, trace sand, trace gravel - grey-brown mottled, moist, firm - intermediate to high plasticity	■	G2			1
2		- gravel layer, wet at 1.5 m - greyish black below 1.5 m					2
		END OF TEST HOLE AT 2.3 m IN CLAY FILL. 1. Seepage from gravel layer. 2. No sloughing. 3. Installed 50 mm gas probe at 1.4 m, with 0.76 m of screen. Complete with above ground cover.					
3		0.74 m of stickup. Backfilled with sand to 0.51 m, and hydrated bentonite to ground surface.					3
4							4
5							5
6							6
7							7
8							8
9							9
10							

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.29 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2010 PWEY TEST HOLE LOGS.GPJ UMA.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-02**
LOCATION: N 5,529,140.0 E 637,512.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		CLAY (Fill) - silty, trace sand, trace gravel - mottled light brown and grey, moist, firm to stiff - intermediate plasticity					0
1			■	G5			1
		- wet at 1.5 m					
2		END OF TEST HOLE AT 2.3 m IN CLAY FILL. 1. Seepage at 1.5 m. 2. Installed 50 mm gas probe at 1.4 m. Complete with 1.0 m of screen, 0.4 m of riser, 0.74 m of above ground stickup, and metal stickup cover. Backfilled with hydrate bentonite to 1.4 m, sand to 0.40 m, and hydrated bentonite to ground surface.					2
3							3
4							4
5							5
6							6
7							7
8							8
9							9
10							

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.29 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2010 PWEY TEST HOLE LOGS.GPJ UMA.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-03**
LOCATION: N 5,529,098.0 E 637,501.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		CLAY (Fill) - some sand, trace gravel - grey - intermediate plasticity	■	G6			0
1		CLAY AND SILT (Fill) - trace sand, trace gravel - brown, mottled, moist, firm - low to intermediate plasticity	■	G7			1
		- wet at 1.5 m END OF TEST HOLE AT 2.3 m IN CLAY FILL. 1. No water in hole. 2. No sloughing observed during drilling. 3. Not enough space to install gas probe. Moved 16 m south of original location for gas probe installation. 4. Installed 50 mm gas probe at 1.4 m. Complete with 0.76 m of screen, 0.64 m of riser, 0.74 m of above ground stickup, and stickup metal cover. Backfilled with hydrated bentonite to 1.4 m, sand to 0.51 m, and hydrated bentonite to ground surface.					
2							2
3							3
4							4
5							5
6							6
7							7
8							8
9							9
10							

ENVIRONMENTAL (VAPOUR ONLY) 2010 PWEY TEST HOLE LOGS.GPJ UMA.GDT 2/7/11

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.29 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-04**
LOCATION: N 5,529,096.0 E 637,648.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		CLAY (Fill) - trace to some sand, trace gravel - grey, moist, firm - high plasticity	■	G8			0
1			■	G9			1
2		END OF TEST HOLE AT 2.1 m IN CLAY FILL. 1. Installed 50 mm gas probe at 1.5 m. Complete with 0.61 m of screen, 0.91 m of riser, 0.74 m of above ground stickup, and metal stickup cover. Backfilled with hydrated bentonite to 1.5 m, sand to 0.86 m, and hydrated bentonite to ground surface.					2
3							3
4							4
5							5
6							6
7							7
8							8
9							9
10							

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.29 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2010 PWEY TEST HOLE LOGS.GPJ UMA.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **MW10-05**
LOCATION: N 5,528,974.0 E 637,524.0		PROJECT NO.: 60146003
CONTRACTOR: Maple Leaf Drilling Ltd.	METHOD: B-24, 125 mm SS Augers.	ELEVATION (m):

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		CLAY (Fill) - silty, trace sand, trace gravel - moist, firm - intermediate plasticity	■	G11			0
1		SILT (Native) - light brown, moist, loose - low plasticity	■	G12			1
2		END OF TEST HOLE AT 2.1 m IN NATIVE SILT. 1. Not enough space to install gas probe. Moved nearby for gas probe installation. 2. Installed 50 mm gas probe at 1.7 m. Complete with 0.76 m of screen, 0.74 m stickup, and stickup metal cover. Backfilled with hydrate bentonite to 1.7 m, sand to 0.91 m, and hydrated bentonite to ground surface.					2
3							3
4							4
5							5
6							6
7							7
8							8
9							9
10							

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 2.29 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 11/9/10
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2010 PWEY TEST HOLE LOGS.GPJ UMA.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **TH11-06**
LOCATION: N 5,529,111.0 E 637,578.0		PROJECT NO.: 60146003
CONTRACTOR: Subterranean (MB) Ltd.	METHOD: Soilmec R208, 356 mm	ELEVATION (m):

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

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		SILT (Fill) - clayey, some sand, trace gravel - mottled light brown to brown, moist - low plasticity		G13			0
1							1
				G14			
2		CLAY (Fill) - silty, trace sand, trace gravel - mottled brown and grey, moist, firm, medium to high plasticity					2
				G15			
3		ORGANICS - silty, black, moist, grass, roots, trace glass					3
		CLAY and SILT- trace sand, trace organics, grey, moist, firm, medium plasticity		T16			
4		SILT - some clay - mottled light brown and grey, moist to wet - low to no plasticity					4
5							5
		CLAY - silty - brown, moist, stiff - high plasticity - trace silt inclusions - grey below 6.1 m		G17			
6							6
7				G18			7
8							8
				G19			
9							9
10				T20			10
11							11
				G21			
12		- firm below 12.2 m					12
13				G22			13
14							14
15							15
				G23			
16							16
17		SILT (Till) - some sand, some gravel - light brown, moist					17
18		PRACTICAL AUGER REFUSAL AT 17.8 m IN SILT TILL. 1. Seepage from fill and silt layers. Water level at 9.75 at end of drilling. 2. Sloughing of organic and silt layer. Test hole open to 10.4 m at end of drilling. 3. No recovery below12.8 m because sample slides off augers due to water in test hole. 4. Backfilled with auger cuttings.					18
19							19
20							20
21							

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 17.83 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2010 PWEY TEST HOLE LOGS.GPJ UMA.GDT 2/7/11

PROJECT: Public Works East Yards	CLIENT: The City of Winnipeg	TESTHOLE NO: **TH11-07**
LOCATION: N 5,529,023.0 E 637,457.0		PROJECT NO.: 60146003
CONTRACTOR: Subterranean (MB) Ltd.	METHOD: Soilmec R208, 356 mm	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ☰ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	⊗ Vapour Reading ⊗ (ppm) 10 100 1000	COMMENTS	DEPTH (m)
0		SILT (Fill) - sandy, some gravel, light brown - moist, low to no plasticity					0
1			■	G24			1
		RUBBLE ASHPALT (Fill) - some clay, some silt, trace bricks, black, moist to wet					
2		CLAY and SILT (Fill) - some sand, some gravel, dark grey, moist to wet, stiff, intermediate plasticity	■	G25			2
3		ORGANICS (topsoil) - some sand, black, moist	■	G26			3
		CLAY and SILT - trace sand, grey, moist, stiff, intermediate to high plasticity					
4		CLAY - silty - brown, moist, stiff - high plasticity					4
5			■	G27			5
6			▥	T28			6
7							7
			■	G29			
8		- becoming grey below 7.6 m					8
9			■	G30			9
		- firm beow 9.1 m					
10							10
11			■	G31			11
12							12
			▥	T32			
13							13
14							14
15			■	G33			15
16			■	G34			16
		- some till inclusions below 16.1 m					
		SILT (Till) - some sand, some gravel, some cobbles	■	G35			
17		PRACTICAL AUGER REFUSAL AT 16.8 m IN SILT TILL.					17
		Notes: 1. Seepage from fill. Water level at 15.8 m at end of drilling. 2. Sloughing of fill between 2.1 and 2.9 m. Test hole open to 16.1 m at end of drilling. 3. Backfilled with auger cuttings.					
18							18
19							19
20							20
21							

AECOM

LOGGED BY: Kendall Thiessen	COMPLETION DEPTH: 16.92 m
REVIEWED BY: Faris Khalil	COMPLETION DATE: 1/25/11
PROJECT ENGINEER: Kendall Thiessen	Page 1 of 1

ENVIRONMENTAL (VAPOUR ONLY) 2010 PWEY TEST HOLE LOGS.GPJ UMA.GDT 2/7/11

Figures

LEGEND

- VAPOUR MONITORING WELL
- TEST HOLE

COORDINATE TABLE:

ITEM	EASTING	NORTHING
MW10-01	637287	5529139
MW10-02	637512	5529140
MW10-03	637501	5529098
MW10-04	637648	5529096
MW10-05	637524	5528974
TH11-06	637578	5529111
TH11-07	637457	5529023

AECOM

The City of Winnipeg
Public Works East Yards

Test Hole Plan
Subsurface Investigation
Figure - 01

Tables

Table 1. Methane Monitoring Results - MW10-01

Date	Time (mins)	Methane CH_4 (%)	Methane CH_4 (% LEL)	Other Soil Gases CO_2 (%)	Other Soil Gases O_2 (%)	Other Soil Gases Balance (%)
12/21/10	0	0.0	0.0	0.0	21.0	79.0
12/21/10	1	0.0	0.0	0.0	21.1	78.9
12/21/10	2	0.0	0.0	0.0	21.2	78.8
12/21/10	3	0.0	0.0	0.0	21.3	78.7
12/21/10	4	0.0	0.0	0.0	21.4	78.6
12/21/10	5	0.0	0.0	0.0	21.5	78.5
12/21/10	6	0.0	0.0	0.0	21.6	78.4
12/21/10	7	0.0	0.0	0.0	21.6	78.4
12/21/10	8	0.0	0.0	0.0	21.6	78.4
12/21/10	9	0.0	0.0	0.0	21.7	78.3
12/21/10	10	0.0	0.0	0.0	21.7	78.3
12/21/10	11	0.0	0.0	0.0	21.7	78.3
12/21/10	12	0.0	0.0	0.0	21.7	78.3
12/21/10	13	0.0	0.0	0.0	21.7	78.3
12/21/10	14	0.0	0.0	0.0	21.7	78.3
12/21/10	15	0.0	0.0	0.0	21.7	78.3
12/21/10	16	0.0	0.0	0.0	21.7	78.3
12/21/10	17	0.0	0.0	0.0	21.7	78.3
12/21/10	18	0.0	0.0	0.0	21.7	78.3
12/21/10	19	0.0	0.0	0.0	21.7	78.3
12/21/10	20	0.0	0.0	0.0	21.7	78.3
12/21/10	21	0.0	0.0	0.0	21.7	78.3
12/21/10	22	0.0	0.0	0.0	21.6	78.4
12/21/10	23	0.0	0.0	0.0	21.6	78.4
12/21/10	24	0.0	0.0	0.0	21.6	78.4
12/21/10	25	0.0	0.0	0.0	21.6	78.4
12/21/10	26	0.0	0.0	0.0	21.6	78.4
12/21/10	27	0.0	0.0	0.0	21.6	78.4
12/21/10	28	0.0	0.0	0.0	21.5	78.5
Industry Standard Methane Gas Levels						
Trace		0 - 0.01	-	-	-	-
Cautious		0 - 0.1	-	-	-	-
Hazardous/Significant		0.1 - 1	-	-	-	-

XX	Trace levels of Methane Gas
XX	Cautious levels of Methane Gas
XX	Hazardous/Signicant levels of Methane Gas

Table 2. Methane Monitoring Results - MW10-02

		Methane		Other Soil Gases		
Date	Time (mins)	CH_4 (%)	CH_4 (% LEL)	CO_2 (%)	O_2 (%)	Balance (%)
12/21/10	0	0.0	0.0	0.6	19.7	79.7
12/21/10	1	0.0	0.0	0.6	19.7	79.7
12/21/10	2	0.0	0.0	0.6	19.7	79.7
12/21/10	3	0.0	0.0	0.6	19.8	79.6
12/21/10	4	0.0	0.0	0.6	19.9	79.5
12/21/10	5	0.0	0.0	0.6	19.9	79.5
12/21/10	6	0.0	0.0	0.6	20.0	79.4
12/21/10	7	0.0	0.0	0.6	20.0	79.4
12/21/10	8	0.0	0.0	0.6	20.1	79.3
12/21/10	9	0.0	0.0	0.6	20.1	79.3
12/21/10	10	0.0	0.0	0.6	20.2	79.2
12/21/10	11	0.0	0.0	0.6	20.3	79.1
12/21/10	12	0.0	0.0	0.6	20.3	79.1
12/21/10	13	0.0	0.0	0.6	20.3	79.1
12/21/10	14	0.0	0.0	0.6	20.4	79.0
12/21/10	15	0.0	0.0	0.6	20.4	79.0
12/21/10	16	0.0	0.0	0.6	20.4	79.0
12/21/10	17	0.0	0.0	0.6	20.4	79.0
12/21/10	18	0.0	0.0	0.6	20.5	78.9
12/21/10	19	0.0	0.0	0.6	20.5	78.9
12/21/10	20	0.0	0.0	0.6	20.5	78.9
12/21/10	21	0.0	0.0	0.6	20.5	78.9
12/21/10	22	0.0	0.0	0.6	20.5	78.9
12/21/10	23	0.0	0.0	0.6	20.5	78.9
12/21/10	24	0.0	0.0	0.6	20.6	78.8
12/21/10	25	0.0	0.0	0.6	20.6	78.8
12/21/10	26	0.0	0.0	0.6	20.6	78.8
12/21/10	27	0.0	0.0	0.6	20.6	78.8
12/21/10	28	0.0	0.0	0.6	20.6	78.8
Industry Standard Methane Gas Levels						
Trace		0 - 0.01	-	-	-	-
Cautious		0 - 0.1	-	-	-	-
Hazardous/Significant		0.1 - 1	-	-	-	-

XX	Trace levels of Methane Gas
XX	Cautious levels of Methane Gas
XX	Hazardous/Signicant levels of Methane Gas

Table 3. Methane Monitoring Results - MW10-03

		Methane		Other Soil Gases		
Date	Time (mins)	CH_4 (%)	CH_4 (% LEL)	CO_2 (%)	O_2 (%)	Balance (%)
12/21/10	0	0.0	0.0	1.1	12.8	86.1
12/21/10	1	0.0	0.0	1.1	13.0	85.9
12/21/10	2	0.0	0.0	1.1	13.4	85.5
12/21/10	3	0.0	0.0	1.0	14.0	85.0
12/21/10	4	0.0	0.0	1.0	14.1	84.9
12/21/10	5	0.0	0.0	0.9	14.5	84.6
12/21/10	6	0.0	0.0	0.9	14.5	84.6
12/21/10	7	0.0	0.0	0.9	15.0	84.1
12/21/10	8	0.0	0.0	0.9	15.1	84.0
12/21/10	9	0.0	0.0	0.9	15.2	83.9
12/21/10	10	0.0	0.0	0.8	15.5	83.7
12/21/10	11	0.0	0.0	0.9	15.4	83.7
12/21/10	12	0.0	0.0	0.8	15.6	83.6
12/21/10	13	0.0	0.0	0.8	15.9	83.3
12/21/10	14	0.0	0.0	0.8	15.8	83.4
12/21/10	15	0.0	0.0	0.8	16.0	83.2
12/21/10	16	0.0	0.0	0.8	16.0	83.2
12/21/10	17	0.0	0.0	0.8	16.0	83.2
12/21/10	18	0.0	0.0	0.8	16.3	82.9
12/21/10	19	0.0	0.0	0.8	16.4	82.8
12/21/10	20	0.0	0.0	0.8	16.6	82.6
12/21/10	21	0.0	0.0	0.8	16.6	82.6
12/21/10	22	0.0	0.0	0.7	16.7	82.6
12/21/10	23	0.0	0.0	0.7	16.8	82.5
12/21/10	24	0.0	0.0	0.7	17.0	82.3
12/21/10	25	0.0	0.0	0.7	16.8	82.5
12/21/10	26	0.0	0.0	0.8	16.6	82.6
12/21/10	27	0.0	0.0	0.8	16.9	82.3
12/21/10	28	0.0	0.0	0.8	16.9	82.3
Industry Standard Methane Gas Levels						
Trace		0 - 0.01	-	-	-	-
Cautious		0 - 0.1	-	-	-	-
Hazardous/Significant		0.1 - 1	-	-	-	-

XX	Trace levels of Methane Gas
XX	Cautious levels of Methane Gas
XX	Hazardous/Signicant levels of Methane Gas

Table 4. Methane Monitoring Results - MW10-04

		Methane		Other Soil Gases		
Date	Time (mins)	CH_4 (%)	CH_4 (% LEL)	CO_2 (%)	O_2 (%)	Balance (%)
12/21/10	0	0.0	0.0	0.5	17.0	82.5
12/21/10	1	0.0	0.0	0.5	17.3	82.2
12/21/10	2	0.0	0.0	0.5	17.4	82.1
12/21/10	3	0.0	0.0	0.5	17.4	82.1
12/21/10	4	0.0	0.0	0.5	17.4	82.1
12/21/10	5	0.0	0.0	0.5	17.4	82.1
12/21/10	6	0.0	0.0	0.4	17.6	82.0
12/21/10	7	0.0	0.0	0.4	17.7	81.9
12/21/10	8	0.0	0.0	0.4	17.6	82.0
12/21/10	9	0.0	0.0	0.5	17.7	81.8
12/21/10	10	0.0	0.0	0.5	17.8	81.7
12/21/10	11	0.0	0.0	0.5	17.9	81.6
12/21/10	12	0.0	0.0	0.5	18.0	81.5
12/21/10	13	0.0	0.0	0.5	18.1	81.4
12/21/10	14	0.0	0.0	0.5	18.1	81.4
12/21/10	15	0.0	0.0	0.5	18.2	81.3
12/21/10	16	0.0	0.0	0.6	18.3	81.1
12/21/10	17	0.0	0.0	0.6	18.4	81.0
12/21/10	18	0.0	0.0	0.6	18.4	81.0
12/21/10	19	0.0	0.0	0.6	18.5	80.9
12/21/10	20	0.0	0.0	0.6	18.5	80.9
12/21/10	21	0.0	0.0	0.6	18.6	80.8
12/21/10	22	0.0	0.0	0.6	18.6	80.8
12/21/10	23	0.0	0.0	0.6	18.7	80.7
12/21/10	24	0.0	0.0	0.6	18.7	80.7
12/21/10	25	0.0	0.0	0.7	18.8	80.5
12/21/10	26	0.0	0.0	0.7	18.8	80.5
12/21/10	27	0.0	0.0	0.7	18.9	80.4
12/21/10	28	0.0	0.0	0.7	18.9	80.4
12/21/10	29	0.0	0.0	0.7	18.9	80.4
12/21/10	30	0.0	0.0	0.7	19.0	80.3
12/21/10	31	0.0	0.0	0.7	19.0	80.3
12/21/10	32	0.0	0.0	0.7	19.0	80.3
Industry Standard Methane Gas Levels						
Trace		0 - 0.01	-	-	-	-
Cautious		0 - 0.1	-	-	-	-
Hazardous/Significant		0.1 - 1	-	-	-	-

XX	Trace levels of Methane Gas
XX	Cautious levels of Methane Gas
XX	Hazardous/Signicant levels of Methane Gas

Table 5. Methane Monitoring Results - MW10-05

		Methane		Other Soil Gases		
Date	Time (mins)	CH_4 (%)	CH_4 (% LEL)	CO_2 (%)	O_2 (%)	Balance (%)
12/21/10	0	0	0	0.2	20.7	79.1
12/21/10	1	0	0	0.1	20.8	79.1
12/21/10	2	0	0	0.1	20.9	79.0
12/21/10	3	0	0	0.1	20.9	79.0
12/21/10	4	0	0	0.1	21.0	78.9
12/21/10	5	0	0	0.1	21.1	78.8
12/21/10	6	0	0	0.1	21.1	78.8
12/21/10	7	0	0	0.1	21.2	78.7
12/21/10	8	0	0	0.1	21.2	78.7
12/21/10	9	0	0	0.1	21.3	78.6
12/21/10	10	0	0	0.1	21.3	78.6
12/21/10	11	0	0	0.1	21.3	78.6
12/21/10	12	0	0	0.1	21.3	78.6
12/21/10	13	0	0	0.1	21.4	78.5
12/21/10	14	0	0	0.1	21.4	78.5
12/21/10	15	0	0	0.1	21.4	78.5
12/21/10	16	0	0	0.1	21.4	78.5
12/21/10	17	0	0	0.1	21.4	78.5
12/21/10	18	0	0	0.1	21.3	78.6
12/21/10	19	0	0	0.1	21.3	78.6
12/21/10	20	0	0	0.1	21.3	78.6
12/21/10	21	0	0	0.1	21.3	78.6
12/21/10	22	0	0	0.1	21.3	78.6
12/21/10	23	0	0	0.1	21.3	78.6
12/21/10	24	0	0	0.2	21.2	78.6
12/21/10	25	0	0	0.2	21.2	78.6
12/21/10	26	0	0	0.1	21.2	78.7
12/21/10	27	0	0	0.1	21.2	78.7
12/21/10	28	0	0	0.1	21.2	78.7
12/21/10	29	0	0	0.1	21.2	78.7
12/21/10	30	0	0	0.1	21.2	78.7
12/21/10	31	0	0	0.1	21.2	78.7
12/21/10	32	0	0	0.1	21.2	78.7
12/21/10	33	0	0	0.1	21.2	78.7
12/21/10	34	0	0	0.1	21.2	78.7
12/21/10	35	0	0	0.2	21.2	78.6
Industry Standard Methane Gas Levels						
Trace		0 - 0.01	-	-	-	-
Cautious		0 - 0.1	-	-	-	-
Hazardous/Significant		0.1 - 1	-	-	-	-

XX	Trace levels of Methane Gas
XX	Cautious levels of Methane Gas
XX	Hazardous/Signicant levels of Methane Gas

Appendix D3

Public Works East Yards Relocation – Traffic Impact Assessment

AECOM

City of Winnipeg

Public Works East Yards Relocation
Traffic Impact Assessment

Prepared by:

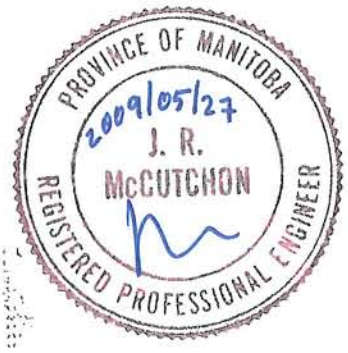
AECOM Canada Ltd.
200 – 2100 8th Street East, Saskatoon, SK, Canada S7H 0V1
T 306.955.3300 F 306.955.0044 www.aecom.com

Project Number:

0265-386-06

Date:

May 27, 2009



APEGM
Certificate of Authorization
Earth Tech Canada Inc.
No. 730 Date: 2009/05/27

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- must be read as a whole and sections thereof should not be read out of such context;
- were prepared for the specific purposes described in the Report and the Agreement;
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AECOM

AECOM
99 Commerce Drive, Winnipeg, MB, Canada R3P 0Y7
T 204.477.5381 F 204.284.2040 www.aecom.com

May 27, 2009

Project Number: 0265-386-06

City of Winnipeg
Civic Accommodations Division
Planning, Property and Development Department
3rd Floor, 65 Garry Street
Winnipeg, Manitoba R3C 4K4

Attention: Ms. Bonnie Konzelman
Contract Coordinator

Dear Ms. Konzelman:

Re: Traffic Impact Assessment for Public Works East Yards Relocation

We are pleased to submit the final report for the City of Winnipeg *Public Works East Yards Relocation Traffic Impact Assessment (TIA)*.

The study was carried out under the direction of Mr. Nathan Gray, P.Eng., PTOE of our Saskatoon office and reviewed by Mr. James R. McCutchon, P.Eng., Senior Transportation Engineer in our Transportation Division.

The study has addressed the traffic impacts on key adjacent roadways due to the proposed relocation of the Public Works East Yards to the lands south of Thomas Avenue and west of Panet Road in the City of Winnipeg.

If we can be of any further assistance to you with regard to any aspect of this study or future work related to the study, please do not hesitate to call.

Sincerely,
AECOM Canada Ltd.

James R. McCutchon, P.Eng.
Senior Transportation Engineer, Transportation
james.mccutchon@aecom.com

JRM:ejm
Encl.
cc: Mr. Nathan Gray – AECOM
Mr. Don Hester – AECOM

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Signature Page

Report Prepared By:

Lee Thomas, Engineer-in-Training

Report Reviewed By:

Nathan Gray, P.Eng., PTOE
James R. McCutchon, P.Eng.

Executive Summary

The City of Winnipeg is examining the feasibility of relocating the Public Works East Yards to the lands south of Thomas Avenue and west of Panet Road. The potential site would allow for the amalgamation of five different City Public Works Divisions in one complex. AECOM was commissioned to complete the *Public Works East Yards Relocation Traffic Impact Assessment (TIA)* to determine the increase in traffic volumes on key adjacent roadways.

As part of the study, the City of Winnipeg required a review of the signalized intersections on Nairn Avenue between Lagimodiere Boulevard and Archibald Street, as well as the unsignalized intersections at Foster Street and at Stapleton Street. The signalized intersection of Archibald Street and Mission Avenue, as well as the unsignalized intersection of Mission Avenue and Panet Road, were also reviewed. Current and five-year forecast corridor traffic operations were analyzed to measure the impact of site development.

The existing Nairn Avenue corridor and adjacent study intersections currently operate under congested conditions during the peak periods of the typical weekday. Most intersections have movements operating at a LOS C to LOS D, with severely constrained movements either operating at LOS E or failure.

The proposed site will generate a maximum of approximately 450 trips during the morning peak hour and 355 trips during the afternoon peak hour onto the City of Winnipeg road network. There are four intersections along Nairn Avenue that can be utilized by site traffic, which minimizes the impact of the additional traffic on the study intersections.

The results of the TIA indicate that the proposed site plan can be incorporated into the existing road network with negligible impacts above the normal background growth rates on Nairn Avenue. A potential south connection from Thomas Avenue to the adjacent Mission Street (via the Foster Street railway underpass) was examined as a secondary access point and would likely provide minimal benefit to the key intersections along Nairn Avenue, including at Watt Street and at Lagimodiere Boulevard.

It is recommended that the Public Yards East site be approved to develop at the proposed location based on the review of traffic impacts. Further, the following items are recommended for consideration by the City of Winnipeg in order to address concerns with existing conditions, and future operations as traffic continues to increase along the Nairn Avenue corridor with or without site development.

- *Further study to examine alternatives to provide additional capacity at Lagimodiere Boulevard and Regent Avenue.*
- *Safety review at the intersection of Nairn Avenue and Watt Street to examine the westbound approach.*
- *Traffic signal timing along Nairn Avenue be monitored to ensure sufficient green time is provided to side streets, where possible during the morning and afternoon peak hours.*
- *The intersection of Nairn Avenue and Stapleton Street be periodically monitored by the City of Winnipeg to determine if and where the intersection ranks on the City's list of potential traffic signalization locations.*

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1. Introduction

The City of Winnipeg is examining the feasibility of relocating the Public Works East Yards to the lands south of Thomas Avenue and west of Panet Road. The potential site would allow for the amalgamation of five different City Public Works Divisions in one complex. AECOM was commissioned to complete the *Public Works East Yards Relocation Traffic Impact Assessment (TIA)* to determine the increase in traffic volumes on key adjacent roadways.

As part of the study, the City of Winnipeg required a review of the signalized intersections on Nairn Avenue between Lagimodiere Boulevard and Archibald Street, as well as the unsignalized intersections at Foster Street and at Stapleton Street. The signalized intersection of Archibald Street and Mission Avenue, as well as the unsignalized interseciton of Mission Avenue and Panet Road, are also to be included in the review. Current and five-year forecast corridor traffic operations were analyzed using Synchro 7.0.

The *Public Works East Yards Relocation TIA* will identify traffic impacts resulting from the proposed relocation and potential remedial measures to mitigate these impacts. Improvements may be a combination of geometric, traffic control and signal timing modifications.

2. Current Traffic Operations

2.1 Existing Traffic Volumes

The study area for the *Public Works East Yards Relocation TIA* is illustrated in Figure 1.

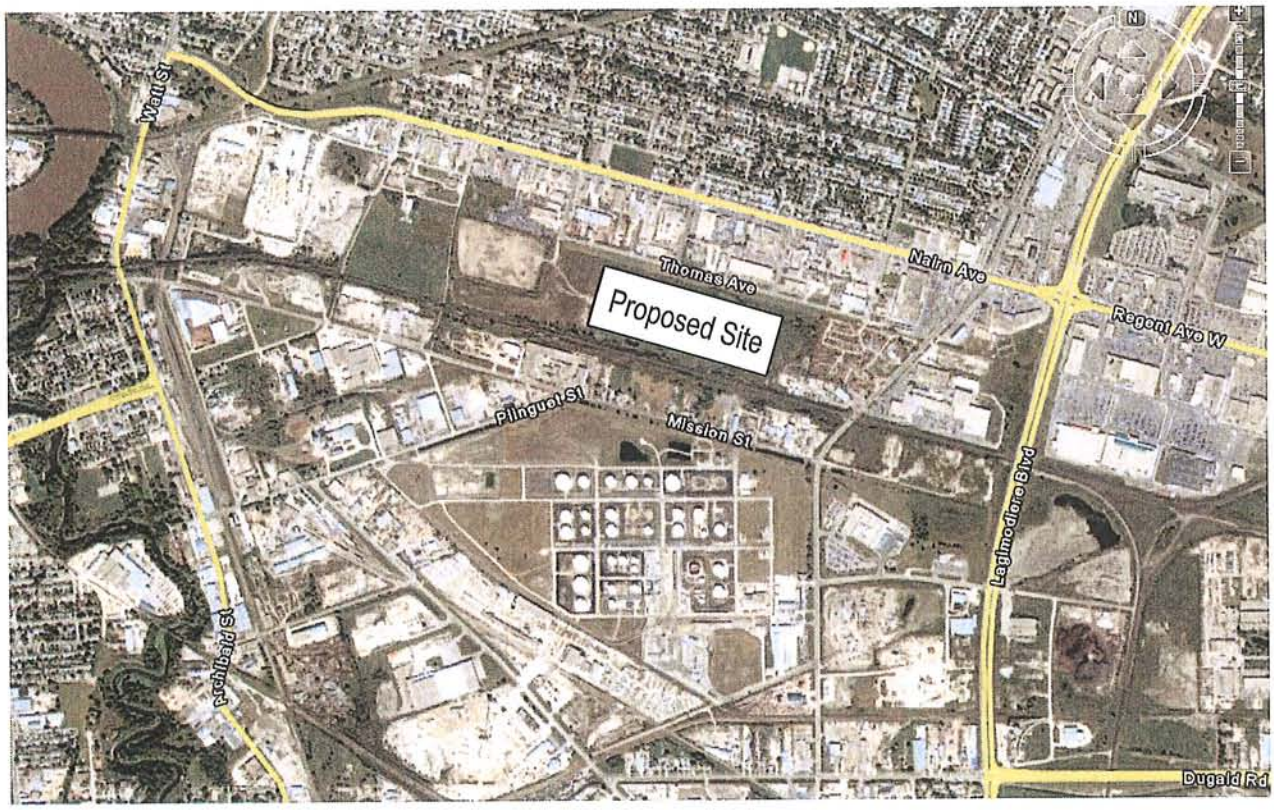
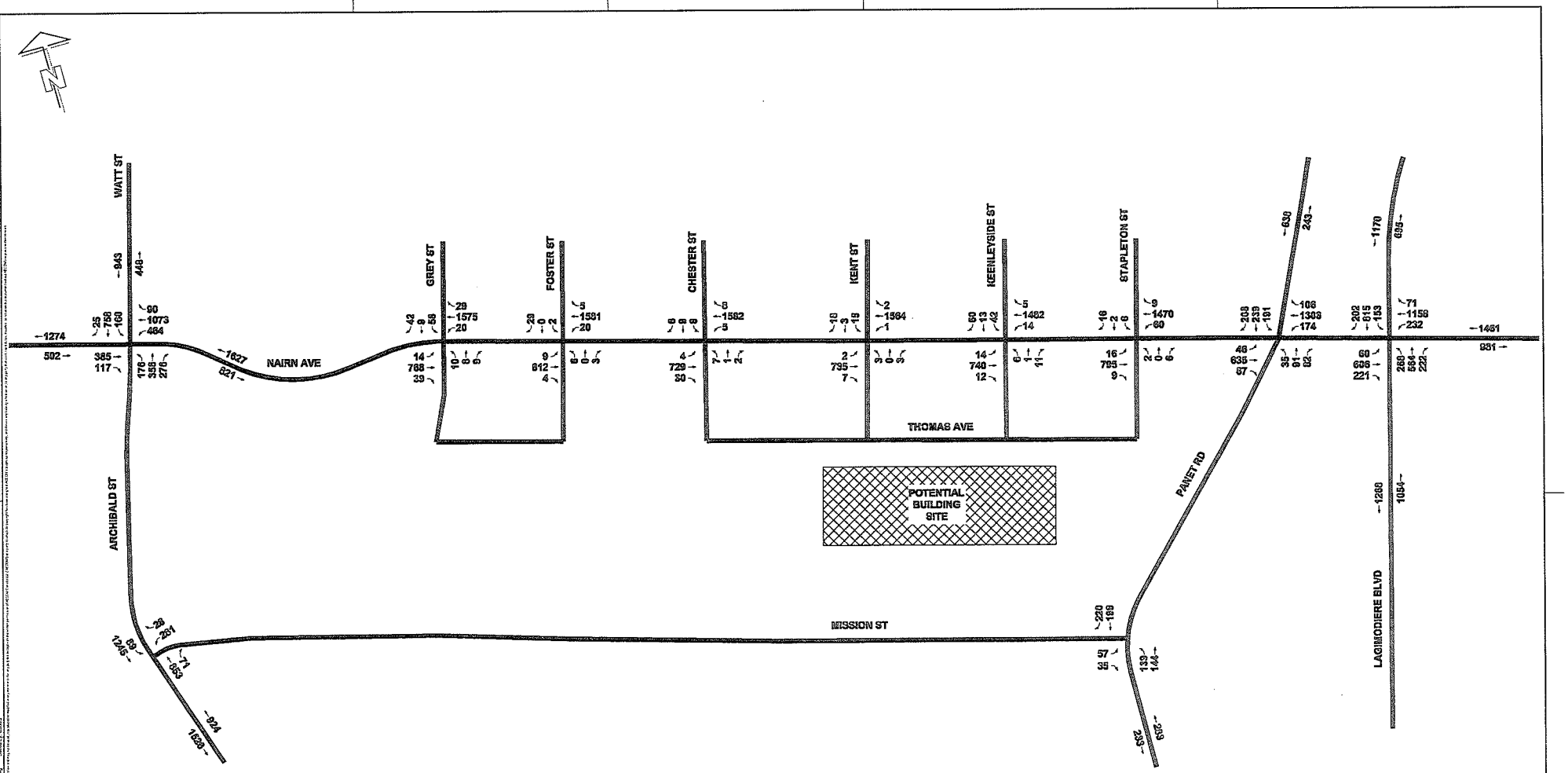


Figure 1. Site Context

Intersection traffic counts were completed along Nairn Avenue from Panet Road to Watt Street, as well as at the intersections of Lagimodiere Boulevard and Regent Avenue, and Archibald Street and Mission Street during a two-week period from March 3rd to March 12th, 2009. The morning and afternoon peak hours of operation are summarized in Figures 2 and 3, respectively.

Current corridor operations were examined within Synchro 7.0 by combining the morning and afternoon peak hour traffic volumes with existing traffic signal timing plans. Being critical commuter arterials within the City of Winnipeg, Nairn Avenue, Archibald Street and Lagimodiere Boulevard operate under heavily congested conditions during the peak hours. Existing corridor operations are summarized for the morning peak hour and for the afternoon peak hour in Table 1 and Table 2, respectively.

Definitions for level of service (LOS), volume to capacity ratios (v/c) and intersection capacity utilization (ICU) are presented in Appendix B.

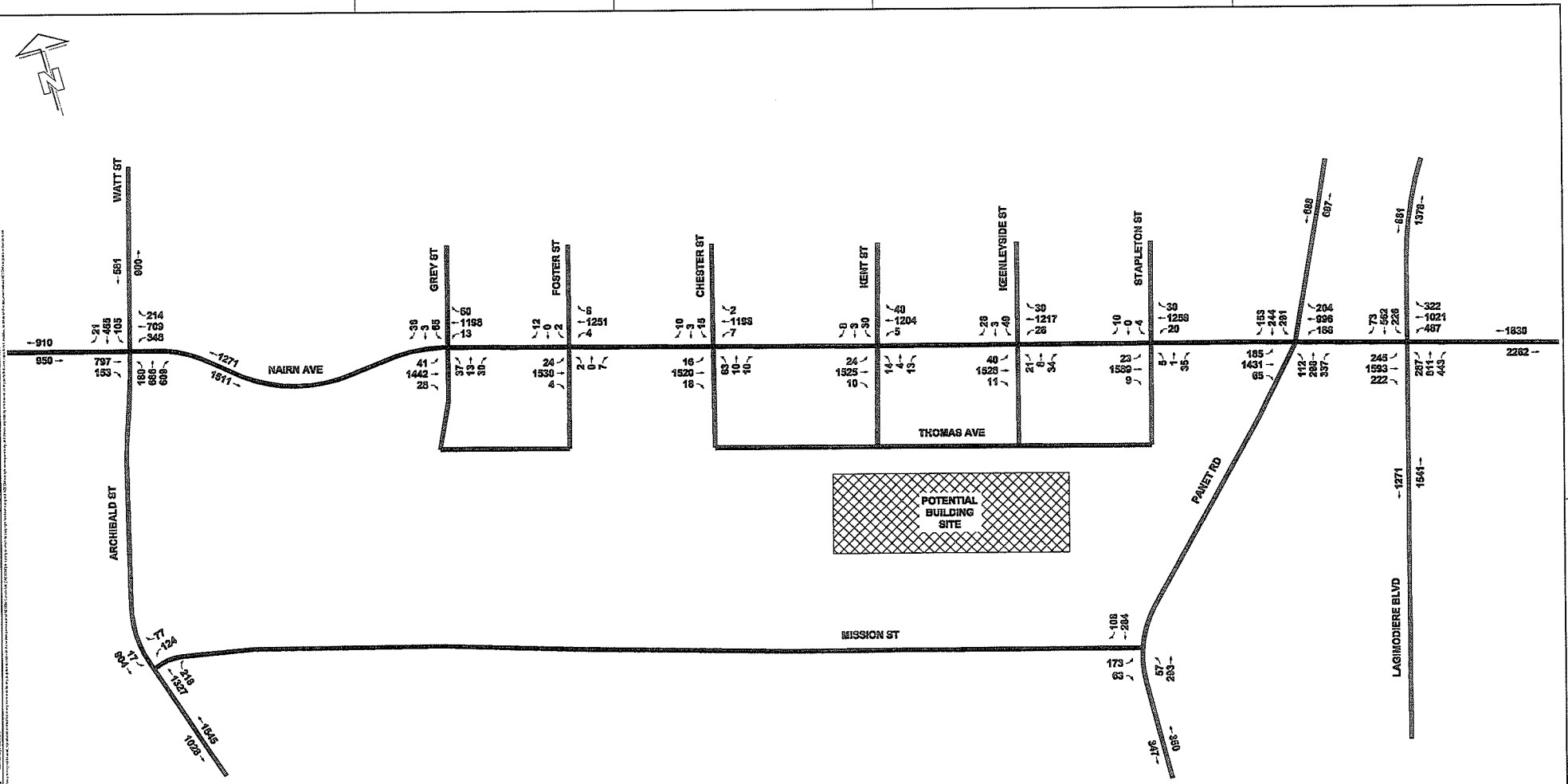


City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Existing Morning Peak Hour Traffic

AECOM

Figure - 2



City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Existing Afternoon Peak Hour Traffic

AECOM

Figure - 3

Table 1. Existing Morning Peak Hour Corridor Traffic Operations

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lagimodiere Blvd & Regent Ave												
Movement LOS	D	C	A	E	D	A	D	C	A	D	C	B
V/C	0.32	0.52	0.42	0.65	0.77	0.14	0.64	0.35	0.34	0.53	0.55	0.36
Intersection LOS / ICU	C / 68%											
Nairn Ave & Panet Rd												
Movement LOS	A		B	A	A	A	C	E	B	D	D	A
V/C	0.19		0.28	0.39	0.46	0.12	0.17	0.52	0.37	0.69	0.42	0.49
Intersection LOS / ICU	B / 59%											
Nairn Ave & Stapleton St - Unsignalized												
Movement LOS	B	A	A	A	A	A		C	C		F	
V/C	0.04	0.34	0.18	0.08	0.63	0.32		0.03	0.03		0.27	
ICU LOS / ICU	B / 61%											
Nairn Ave & Keenleyside St												
Movement LOS	A		A	A		A		C	B		D	C
V/C	0.07		0.29	0.03		0.56		0.04	0.05		0.31	0.26
Intersection LOS / ICU	A / 73%											
Nairn Ave & Kent St												
Movement LOS	A		A	A		A		D	C		C	
V/C	0.01		0.26	0.00		0.54		0.02	0.02		0.21	
Intersection LOS / ICU	A / 60%											
Nairn Ave & Chester St												
Movement LOS	A		A	A		A		C			C	
V/C	0.02		0.25	0.01		0.53		0.06			0.13	
Intersection LOS / ICU	A / 59%											
Nairn Ave & Foster St - Unsignalized												
Movement LOS	B	A	A	A	A	A		E	E		C	
V/C	0.03	0.35	0.18	0.03	0.67	0.34		0.09	0.09		0.13	
ICU LOS / ICU	A / 54%											
Nairn Ave & Grey St												
Movement LOS	A		A	A		A		C	B		D	
V/C	0.1		0.32	0.05		0.63		0.10	0.05		0.57	
Intersection LOS / ICU	A / 65%											
Nairn Ave & Watt St												
Movement LOS		D		F	E	A	C	C	A	C	D	
V/C		0.72		1.32	1.05	0.12	0.68	0.42	0.47	0.45	0.95	
Intersection LOS / ICU	E / 91%											
Archibald St & Mission St												
Movement LOS					D				A		B	
V/C					0.80				0.42		0.72	
Intersection LOS / ICU	B / 95%											
Mission St & Panet Rd - Unsignalized												
Movement LOS		C					A	A			A	
V/C		0.25					0.14	0.14			0.27	
ICU LOS / ICU	A / 54%											

Table 2. Existing Afternoon Peak Hour Corridor Traffic Operations

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Lagimodiere Blvd & Regent Ave												
Movement LOS	E	F	C	E	C	A	E	D	B	E	D	A
V/C	0.66	1.06	0.40	0.89	0.58	0.45	0.75	0.77	0.75	0.73	0.57	0.2
Intersection LOS / ICU	E / 86%											
Nairn Ave & Panet Rd												
Movement LOS	C	D		C	D	C	C	E	B	F	C	A
V/C	0.62	0.80		0.73	0.50	0.3	0.38	0.86	0.68	1.07	0.27	0.3
Intersection LOS / ICU	D / 87%											
Nairn Ave & Stapleton St - Unsignalized												
Movement LOS	B	A	A	B	A	A	C		C	C		
V/C	0.05	0.68	0.34	0.05	0.54	0.29	0.08		0.08	0.05		
ICU LOS / ICU	B / 61%											
Nairn Ave & Keenleyside St												
Movement LOS	B		B	A		A	D		B	D		B
V/C	0.15		0.62	0.11		0.47	0.16		0.15	0.31		0.12
Intersection LOS / ICU	B / 74%											
Nairn Ave & Kent St												
Movement LOS	A		A	A		A	D		B	D		
V/C	0.08		0.54	0.02		0.44	0.11		0.07	0.27		
Intersection LOS / ICU	A / 70%											
Nairn Ave & Chester St												
Movement LOS	A		A	A		A	D			C		
V/C	0.06		0.57	0.04		0.44	0.46			0.14		
Intersection LOS / ICU	A / 58%											
Nairn Ave & Foster St - Unsignalized												
Movement LOS	B	A	A	B	A	A	D		D	C		
V/C	0.05	0.65	0.33	0.01	0.53	0.27	0.05		0.05	0.06		
ICU LOS / ICU	B / 59%											
Nairn Ave & Grey St												
Movement LOS	A		A	A		A	D		B	D		
V/C	0.17		0.55	0.07		0.47	0.32		0.14	0.57		
Intersection LOS / ICU	A / 65%											
Nairn Ave & Watt St												
Movement LOS	F			F	B	A	C	D	C	C		C
V/C	1.18			1.15	0.73	0.26	0.57	0.75	0.87	0.43		0.61
Intersection LOS / ICU	D / 88%											
Archibald St & Mission St												
Movement LOS					D				A		A	
V/C					0.63				0.66		0.43	
Intersection LOS / ICU	B / 64%											
Mission St & Panet Rd - Unsignalized												
Movement LOS		D					A	A				A
V/C		0.67					0.05	0.05				0.25
ICU LOS / ICU	B / 64%											

The Lagimodiere Boulevard and Regent Avenue intersection is identified to operate at an overall LOS C in the morning peak hour with a LOS E for the westbound left-turn movement. All left-turn movements operate at LOS E during the afternoon peak hour and the eastbound through movement exceeds available capacity, causing it to fail. Several movements, as well as the overall intersection, exceed 80 percent capacity during the afternoon peak hour, indicating inadequate ability to accommodate existing peak hour traffic demands.

Though the intersection of Nairn Avenue and Panet Road is identified at LOS E for the northbound through movement during the morning peak hour, the overall intersection operates at LOS B with eastbound and westbound movements identified at LOS A. The northbound throughs (LOS E) and southbound left-turns (LOS F) are the critical movements during the afternoon peak hour and have an ICU exceeding 80 percent.

With the exception of the northbound movement at Stapleton Street which operates at LOS F, current north/south traffic demands are adequately accommodated by the current signal phasing on Nairn Avenue between Stapleton Street and Chester Street during the morning peak hour of operations. All north/south movements along the same portion of Nairn Avenue are well-accommodated during the afternoon peak hour, with LOS ranging from LOS B for through movements to LOS D for left-turn movements.

The intersections along Nairn Avenue at Foster Street and at Grey Street operate at LOS A during the morning peak hour. However, the northbound through and left-turn movements at Foster Street operate at LOS E during this time period. These intersections operate at LOS B and LOS A, respectively, with northbound shared through and left turn movements operated at LOS D during the afternoon peak hour.

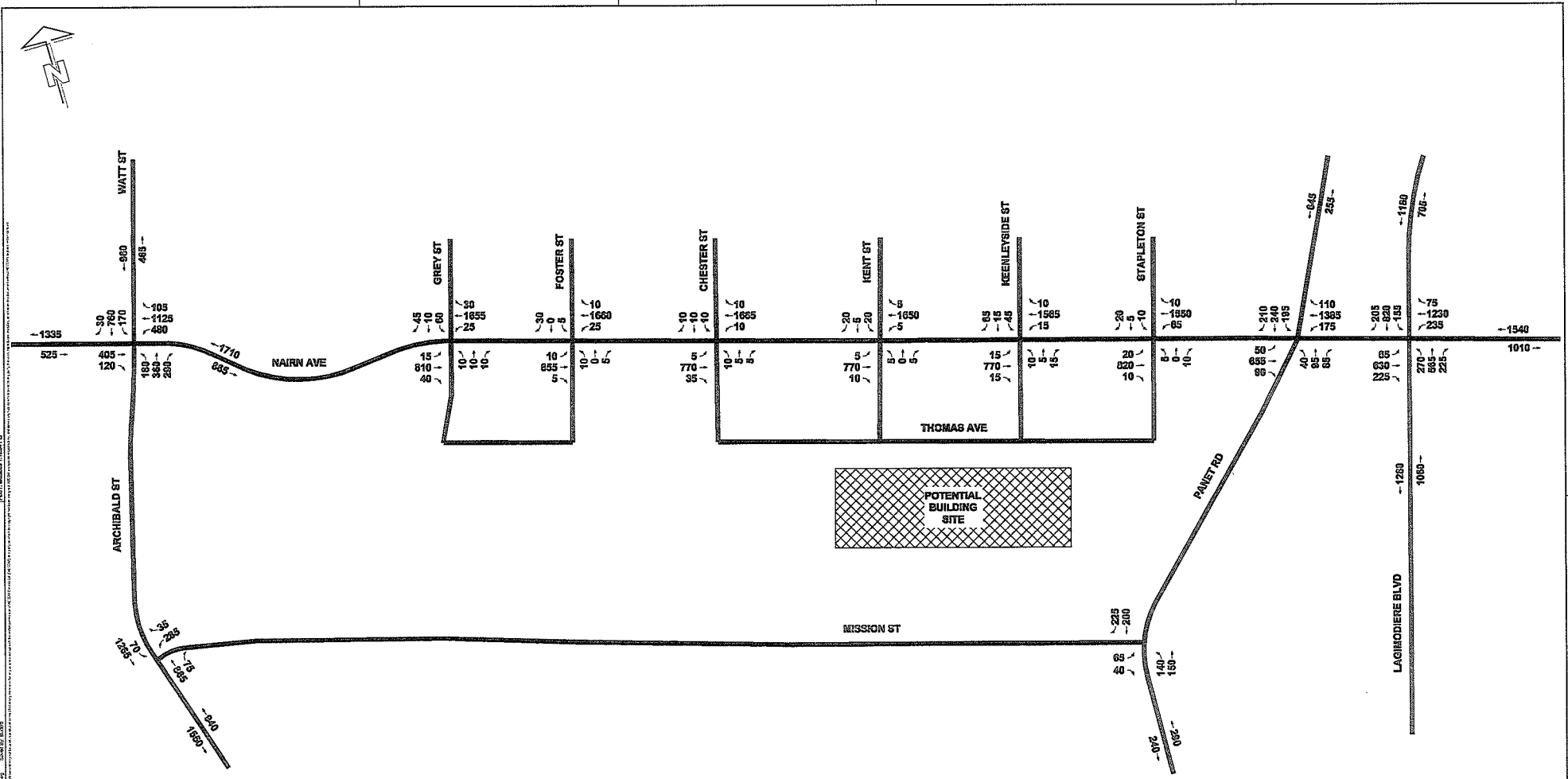
The intersection of Nairn Avenue and Watt Street is reaching the limit of available capacity during both the morning and afternoon peak hours, with an ICU of 91 percent during the morning peak and 88 percent during the afternoon peak. The eastbound and westbound approaches are the critical legs based on the anticipated level of service during the morning and afternoon peak hours.

The intersection of Archibald Street and Mission Street operates at an ICU of 95 percent during the morning peak, but has improved overall operation during the afternoon peak hour with an ICU of 64 percent. The Mission Street and Panet Road intersection is identified to operate acceptably during both peak hours.

2.2 Five-Year Background Traffic Volumes

The five-year background traffic was estimated utilizing a 1.05 five-year growth rate from the Nairn overpass. The resulting traffic growth was carried eastbound and westbound through the Nairn Avenue corridor to Lagimodiere Avenue and is summarized in Figures 4 and 5 for the morning and afternoon peak hours.

The background traffic growth equates to 45 vph added to eastbound traffic and 85 vph added to westbound traffic on Nairn Avenue during the morning peak hour. Similarly, 80 vph was added to eastbound traffic and 65 vph added to westbound traffic on Nairn Avenue during the afternoon peak hour. Some traffic was assumed to also enter and exit along Nairn Avenue at the study intersections as other non-site development continues during the five-year study timeframe. Five-year background corridor operations are summarized for the morning peak hour and for the afternoon peak hour in Table 3 and Table 4, respectively.

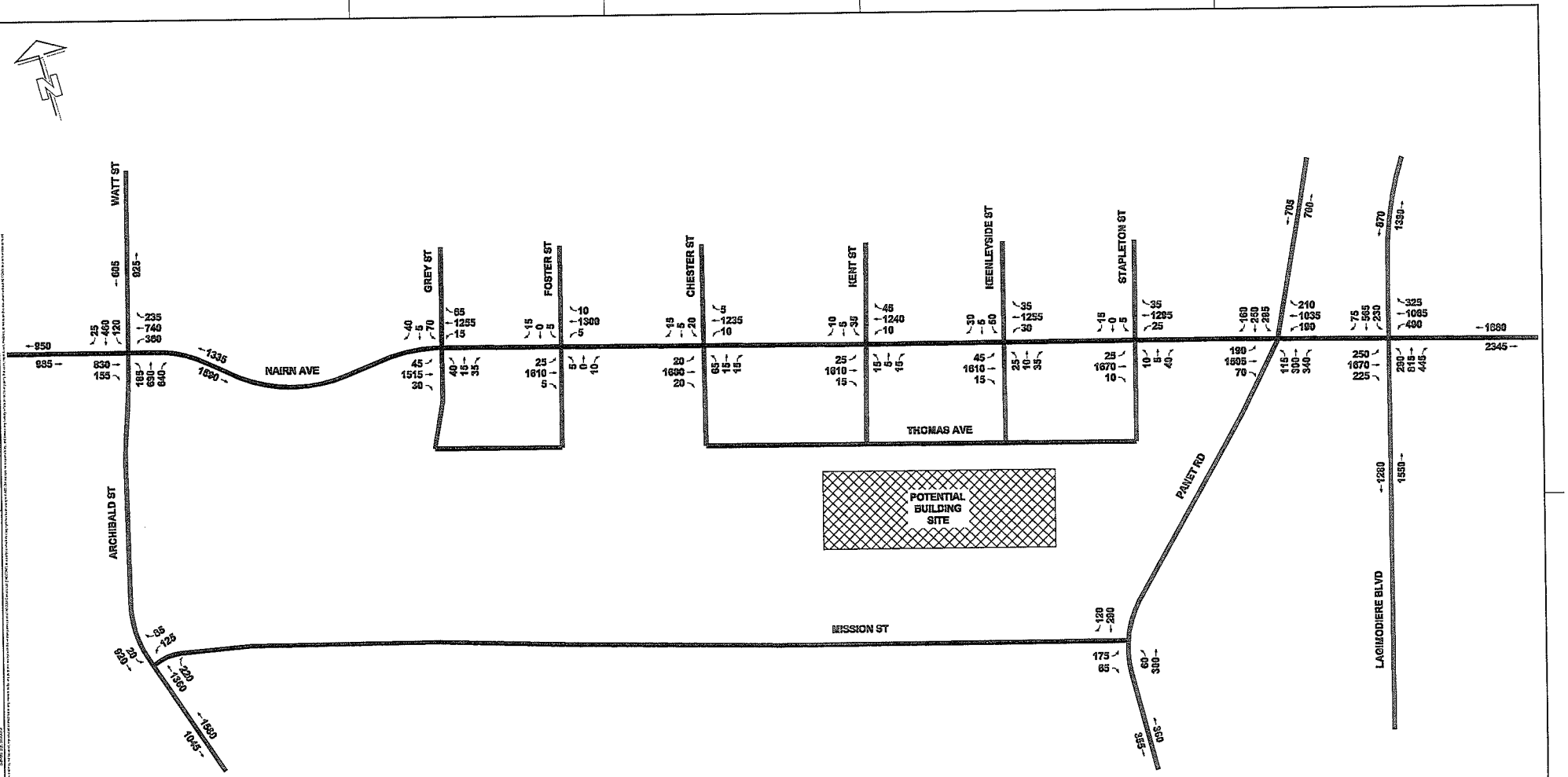


City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Morning Peak Hour Background Traffic Growth

AECOM

Figure - 4



City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Afternoon Peak Hour Background Traffic Growth

AECOM

Figure - 5

Table 3. Morning Peak Hour Five-Year Background Growth Traffic Operations

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	D	C	A	E	D	A	D	C	A	D	D	B
V/C	0.36	0.53	0.42	0.66	0.79	0.14	0.64	0.36	0.35	0.54	0.57	0.37
Intersection LOS / ICU	C / 70%											
Nairn Ave & Panet Rd												
Movement LOS	A		B	A	A	A	C	E	B	D	D	A
V/C	0.22		0.29	0.41	0.49	0.12	0.19	0.53	0.37	0.71	0.41	0.49
Intersection LOS / ICU	B / 61%											
Nairn Ave & Stapleton St												
Movement LOS	B	A	A	B	A	A		D	D		F	
V/C	0.05	0.35	0.18	0.09	0.66	0.34		0.09	0.09		0.62	
ICU LOS / ICU	C / 65%											
Nairn Ave & Keenleyside St												
Movement LOS	A		A	A		A		C	B		D	C
V/C	0.09		0.31	0.03		0.60		0.08	0.07		0.33	0.29
Intersection LOS / ICU	A / 75%											
Nairn Ave & Kent St												
Movement LOS	A		A	A		A		D	C		C	
V/C	0.03		0.27	0.01		0.58		0.03	0.03		0.26	
Intersection LOS / ICU	A / 63%											
Nairn Ave & Chester St												
Movement LOS	A		A	A		A		C			C	
V/C	0.03		0.28	0.02		0.58		0.11			0.16	
Intersection LOS / ICU	A / 61%											
Nairn Ave & Foster St												
Movement LOS	C	A	A	A	A	A		E	E		D	
V/C	0.03	0.36	0.19	0.04	0.71	0.36		0.14	0.14		0.22	
ICU LOS / ICU	B / 60%											
Nairn Ave & Grey St												
Movement LOS	A		A	A		A		C	B		D	
V/C	0.12		0.34	0.06		0.67		0.10	0.05		0.58	
Intersection LOS / ICU	A / 67%											
Nairn Ave & Watt St												
Movement LOS		D		F	E	A	C	C	A	C		D
V/C		0.75		1.37	1.10	0.14	0.70	0.42	0.49	0.48		0.93
Intersection LOS / ICU	E / 94%											
Archibald St & Mission St												
Movement LOS					D				A		B	
V/C					0.83				0.43		0.74	
Intersection LOS / ICU	B / 97%											
Mission St & Panet Rd												
Movement LOS		C					A	A			A	
V/C		0.30					0.14	0.14			0.27	
ICU LOS / ICU	B / 56%											

Table 4. Afternoon Peak Hour Five-Year Background Growth Traffic Operations

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	E	F	C	E	C	A	E	D	B	E	D	A
V/C	0.67	1.11	0.40	0.90	0.61	0.45	0.76	0.77	0.76	0.74	0.57	0.21
Intersection LOS / ICU	E / 88%											
Nairn Ave & Panet Rd												
Movement LOS	C	D		C	D	C	C	E	C	F	D	A
V/C	0.65	0.85		0.74	0.52	0.30	0.39	0.86	0.69	1.09	0.28	0.31
Intersection LOS / ICU	D / 89%											
Nairn Ave & Stapleton St												
Movement LOS	B	A	A	C	A	A	D		D	C		
V/C	0.05	0.71	0.36	0.07	0.55	0.30	0.25		0.25	0.07		
ICU LOS / ICU	B / 63%											
Nairn Ave & Keenleyside St												
Movement LOS	B	B		A	A		D		B	D		B
V/C	0.18	0.67		0.15	0.49		0.19		0.15	0.32		0.13
Intersection LOS / ICU	B / 77%											
Nairn Ave & Kent St												
Movement LOS	A	A		A	A		D		B	D		
V/C	0.09	0.57		0.06	0.45		0.12		0.08	0.32		
Intersection LOS / ICU	A / 72%											
Nairn Ave & Chester St												
Movement LOS	A	A		A	A		D			C		
V/C	0.08	0.60		0.07	0.46		0.46			0.19		
Intersection LOS / ICU	A / 60%											
Nairn Ave & Foster St												
Movement LOS	B	A	A	B	A	A	E		E	D		
V/C	0.05	0.69	0.35	0.01	0.55	0.28	0.14		0.14	0.12		
ICU LOS / ICU	B / 61%											
Nairn Ave & Grey St												
Movement LOS	A	A		A	A		D		B	D		
V/C	0.21	0.61		0.10	0.53		0.32		0.16	0.59		
Intersection LOS / ICU	A / 67%											
Nairn Ave & Watt St												
Movement LOS	F			F	B	A	C	D	D	C		C
V/C	1.23			1.29	0.80	0.29	0.57	0.79	0.95	0.49		0.59
Intersection LOS / ICU	E / 91%											
Archibald St & Mission St												
Movement LOS				D				A		A		
V/C				0.64				0.68		0.45		
Intersection LOS / ICU	B / 65%											
Mission St & Panet Rd												
Movement LOS		E					A	A			A	
V/C		0.71					0.06	0.06			0.26	
ICU LOS / ICU	C / 65%											

The Lagimodiere Boulevard and Regent Avenue intersection maintains an overall LOS C in the morning peak hour with LOS E for the westbound left-turn. All left-turn movements operate at LOS E during the afternoon peak hour with the eastbound through movement exceeding available capacity with the addition of the five-year background traffic growth.

The intersection of Nairn Avenue and Panet Road maintains overall LOS B during the morning peak hour and LOS D during the afternoon peak hour. The northbound through (LOS E), southbound left-turn (LOS F) and eastbound through/right-turn (LOS D) have V/C ratios exceeding 0.8 during the afternoon peak hour.

The southbound movement maintains LOS F at Stapleton Street during the morning peak hour with ICU increasing from 27 to 62 percent. Though an overall LOS C was maintained during the afternoon peak hour, northbound service decreases from LOS C to LOS D during both peak hours of operation.

The intersections along Nairn Avenue between Keenleyside Street and Grey Street maintain an overall LOS A during the morning and afternoon peak hours. However, the intersection of Nairn Avenue and Foster Street decrease from an overall LOS A to LOS B during the morning peak hour, while maintaining an overall LOS B during the afternoon peak hour. Additionally, the southbound movement at Foster Street decreases from LOS C to LOS D during both peak periods.

The westbound through movement at the intersection of Nairn Avenue and Watt Street maintains LOS B during the afternoon peak hour, but reaches an ICU of 80 percent. The northbound right-turn movement drops from LOS C to LOS D during the same period, with an increase in ICU from 87 to 95 percent. The intersection also drops from an overall LOS D to LOS E during the afternoon, with ICU increasing from 88 to 91 percent.

The eastbound movement at the intersection of Mission Street and Panet Road drops from LOS D to LOS E during the afternoon peak hour, with an increase in ICU from 67 to 71 percent. Additionally, the overall LOS B decreases to LOS C with the addition of the five-year background traffic during the afternoon peak hour.

3. Site Impacts

3.1 Trip Generation

Current Public Works operations were assessed in order to determine existing traffic generation for the following divisions and agencies:

- Streets Maintenance Division
- Centralized Parks Services Division
- East Area Parks, Parks and open Spaces Division
- Bridge Operations Division
- Safety and Equipment Operator Training Division
- Fleet Management Agency

The operations review assessed the number of personnel (and parking spots), as well as the work vehicles, equipment and visitors (and visitor parking spots) in order to determine the typical daily traffic demands for each division and agency. The average vehicle trips per day are outlined in Table 5 for the potential relocation. Based on the daily vehicle trips outlined in Table 5, personal vehicle trips (i.e.: personnel traveling to and from work) account for more than half of all trips generated by the potential site.

Table 5. Average Daily Traffic Generation by Division/Agency

	Vehicle Type	Avg. Daily Trips in Summer*	Avg. Daily Trips in Winter
Streets Maintenance	Personal	185	155
	Visitor	10	10
	Equipment	140	55
East Area Parks	Personal	130	40
	Trucks	55	15
	Equipment	55	15
Centralized Parks	Personal	75	-
	Trucks	25	-
	Equipment	25	-
Bridge Operations	Personal	20	15
	Trucks (incl. Crane)	10	10
Equipment Training	Personal	110	110
	Visitor	60	60
Fleet Management	Personal	20	20
Subtotal	*Personal*	*540*	*340*
	Visitor	*70*	*70*
	Trucks	*90*	*25*
	Equipment	*220*	*70*
TOTAL		**920**	**505**

Notes: Trips rounded to the nearest five.
** Summer trips based on average operations from May to October*

Further review indicates that the peak arrival time for personal vehicles ranges from 7:00 to 8:00 a.m. and the peak departure time ranges from 4:00 to 5:00 p.m. Peak arrival and departure times for trucks and equipment are varied throughout the day, but the majority of departures appear to occur from 7:30 to 8:30 a.m. with most arrivals occurring between 2:30 and 4:45 p.m. Peak trips are summarized in Table 6 based on the corresponding arrival and departure times.

Table 6. Peak Morning and Afternoon Trips by Vehicle Type

Vehicle Type	Peak Period	Peak Trips (Summer)	Peak Trips (Winter)
Personal (incl. Visitor)	7:00 – 8:00 a.m. (Arrival)	300	205
	4:00 – 5:00 p.m. (Departure)	280	190
Trucks & Equipment	7:30 – 8:30 a.m. (Departure)	150	45
	3:45 – 4:45 p.m. (Arrival)	75	20

Notes: Trips rounded to the nearest five.

The peak hours for the site traffic correspond to the peak hours of the study intersections, within approximately 0.5 hours before or after. Therefore, it was approximated that the above site traffic would be on the road network during the peak hours of 7:15 am to 8:15 am and 3:45 am to 4:45 pm.

3.2 Trip Distribution and Assignment

Though the exact location of the site is presently undefined, it is assumed that the new Public Works East Yards traffic would primarily utilize Keenleyside Street, Kent Street and Chester Street for north/south access to and from Nairn Avenue. Since the orientation of each operating division within the site is also presently undefined, the distribution of personal, truck and equipment trips is assumed to be analogous between the three main streets. Additionally, a small portion trips are anticipated on Stapleton Street for further north/south access.

The potential Public Works East Yards site is situated such that the majority of City of Winnipeg population is located to the west, north and south of the site. Trip distribution for traffic commuting to and from the relocated site was obtained by dividing the City of Winnipeg into quadrants with the potential relocation site in the centre. It was estimated that approximately 25 percent of the population, and therefore trips, would have origins and destinations within the north quadrant, 25 percent in the south quadrant, 40 percent in the west quadrant, and the remaining 10 percent in the east quadrant. The resulting personal trip distribution is:

- North quadrant: 75 vph entering site in AM peak, 70 vph exiting in PM peak
- West quadrant: 120 vph entering site in AM peak, 115 vph exiting in PM peak
- South quadrant: 75 vph entering site in AM peak, 70 exiting in PM peak
- East quadrant: 30 vph entering site in AM peak, 25 exiting in PM peak

The following assignment for personal trips was assumed based on a cursory review of the major road networks leading to the relocated site:

- Regent Avenue West would be the primary connection to the east quadrant.
- Lagimodiere Boulevard would be a north/south connection for a large portion of traffic from the north, west and south quadrants.
- Archibald Street would be a north/south connection for approximately one third of the south quadrant, as well as a small portion of traffic from the west quadrant.
- Watt Street would be a north/south connection for a large portion of north quadrant traffic, as well as a small portion of west quadrant traffic.
- Panet Road would accommodate a small portion of north quadrant traffic, as would Keenleyside Street.
- Nairn Avenue, west of the study area, would accommodate a small portion of west quadrant traffic.

Truck and equipment trips from the relocated Public Works East Yards were assigned as follows:

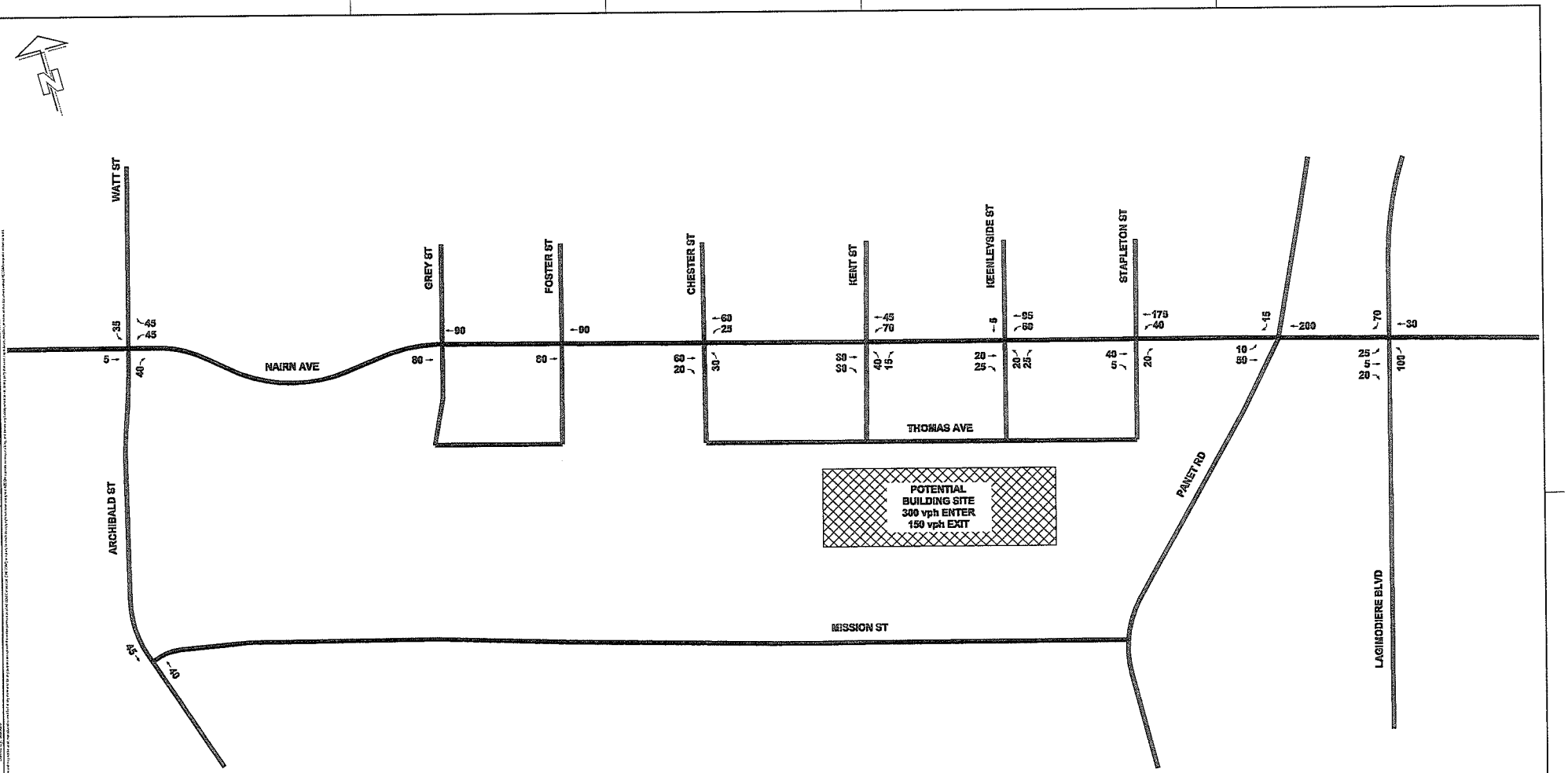
- 30 percent of trips would utilize Archibald Street for immediate south access;
- 30 percent of trips would utilize Watt Street for immediate north access;
- 5 percent would utilize Panet for minor north access, and;
- 35 percent would utilize the intersection of Lagimodiere Boulevard and Regent Avenue to gain access to destinations further north, south and east.

Figures 6 and 7 illustrate the anticipated weekday morning and afternoon peak period trips generated by the relocated Public Works East Yards for summer period of operation (i.e.: worst-case scenario).

Local site entry and exit is divided between Chester Street, Kent Street, Keenleyside Street and Stapleton Street. However, the majority of local site traffic is anticipated to utilize Kent Street and Keenleyside Street due to the direct access provided between these intersections and the assumed relocation site. The largest impact from traffic relocation is noted for the northbound left-turn movement from Lagimodiere Boulevard in the morning peak hour and the eastbound right-turn corresponding return movement during the afternoon peak hour. As such, the intersection of Nairn Avenue and Panet Road experiences the most concentrated increase in eastbound and westbound through traffic prior to its dispersal through the corridor.

3.3 Forecast Traffic Volumes

The Public Works East Yards relocated trip assignment was combined with the five-year background traffic growth to estimate full corridor demands in five years upon site relocation, as summarized in Figures 8a and 9a, respectively.

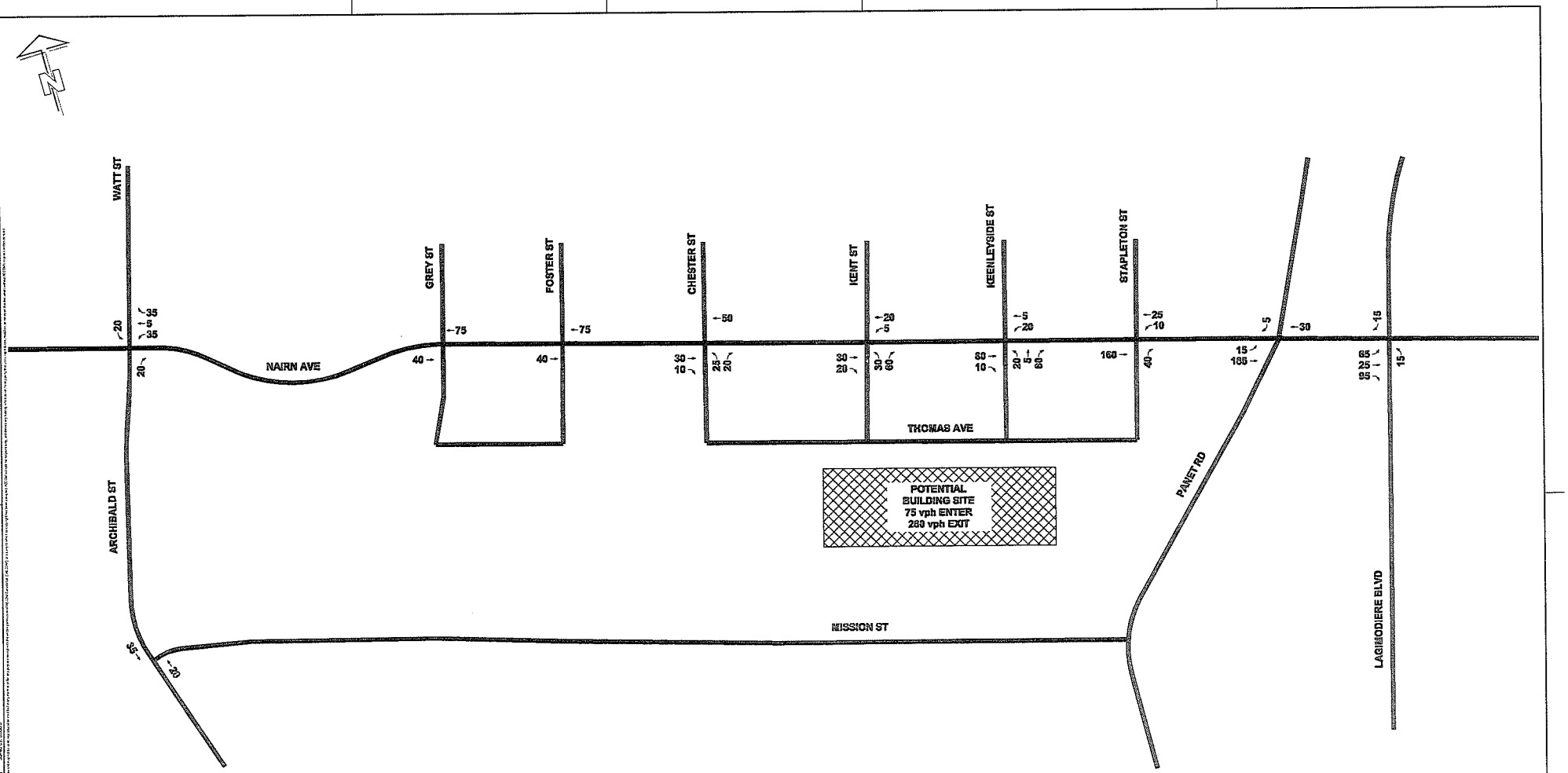


City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Site Relocation Morning Peak Hour Traffic Assignment

AECOM

Figure - 6

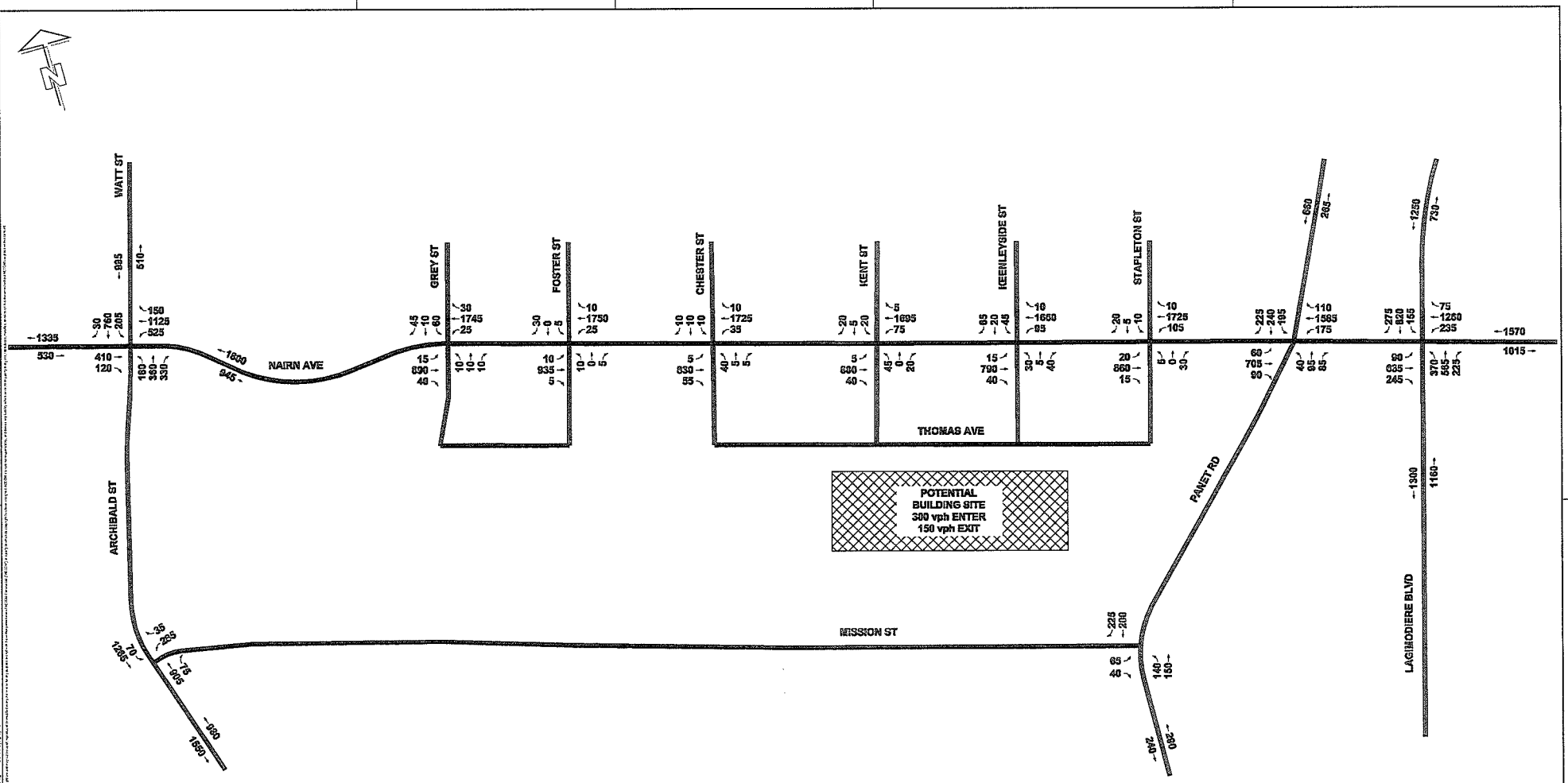


City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Site Relocation Afternoon Peak Hour Traffic Assignment

AECOM

Figure - 7

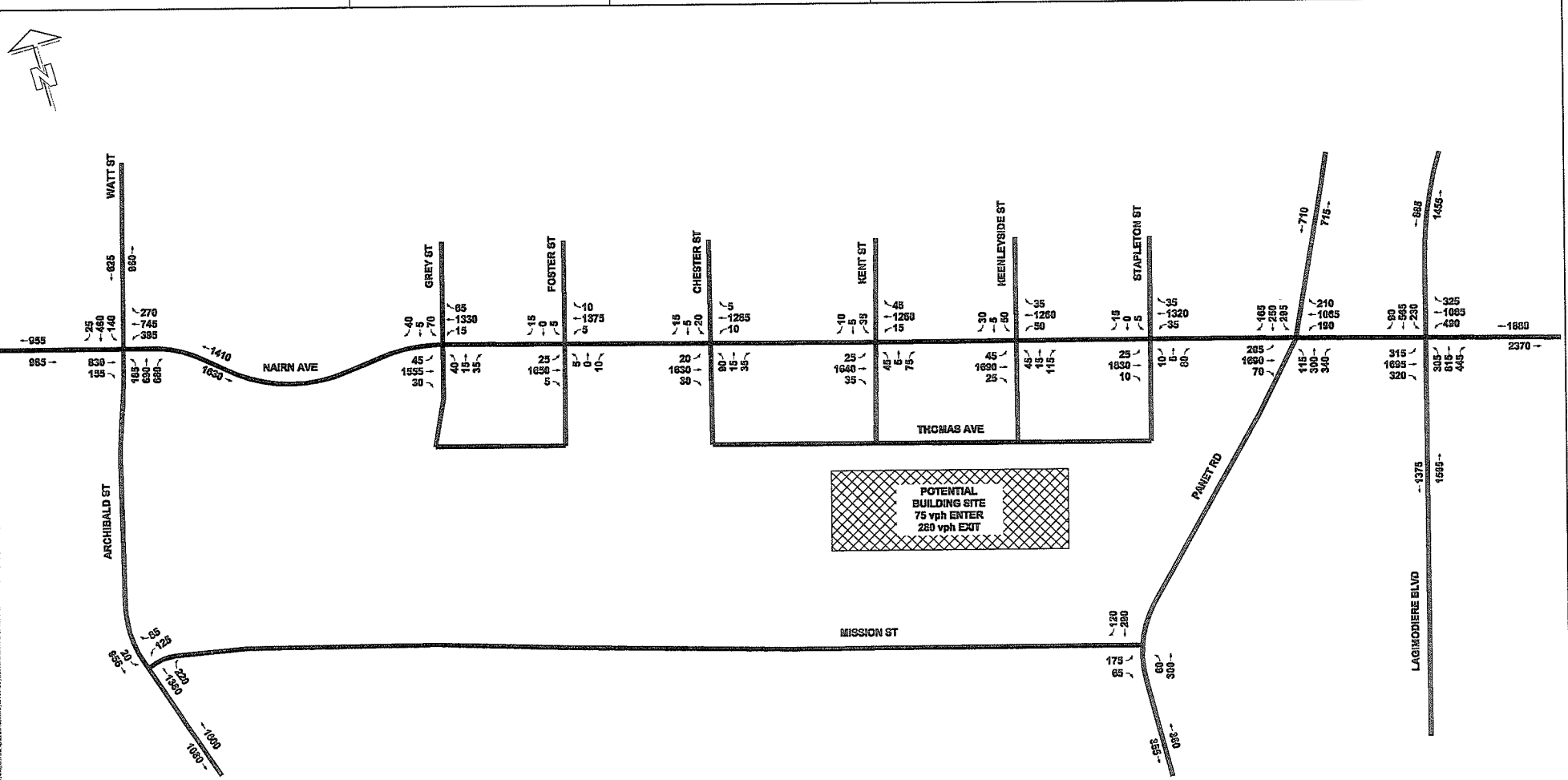


City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Five-Year Forecast Morning Peak Hour Traffic

AECOM

Figure - 8a



City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

Five-Year Forecast Afternoon Peak Hour Traffic

AECOM

Figure - 9a

4. Capacity Analysis of Forecast Traffic Volumes

4.1 Base Scenario

An operational analysis of the study intersections was conducted using the five-year forecast traffic volumes, which adds site traffic to the five-year background traffic volumes. This assessment is an estimate of how the network will operate with full development of the Public Works East Yards site in a five-year timeframe.

The operational analysis, summarized in Tables 5 and 6 for morning and afternoon peak hours, respectively, indicate that the corridor will experience moderate impacts from development of the Public Works East Yards site. The analysis also maintained the existing peak hour signal timing plans.

For reference, a comparison of corridor operations for existing traffic volumes versus forecast traffic volumes may be referenced in Appendix C.

The more significant impacts noted in the forecast morning peak hour operations upon comparing Table 3 and Table 5 include:

- *Lagimodiere Boulevard and Regent Avenue* – eastbound left-turn decreases from LOS D to LOS E, and overall intersection operation decreases from LOS C to LOS D
- *Nairn Avenue and Panet Road* – none to report
- *Nairn Avenue and Stapleton Street* – northbound approach maintains LOS F, but v/c increases from 0.62 to 0.96. Eastbound left turn decreases from LOS B to LOS C
- *Nairn Avenue and Keenleyside Street* – northbound shared through and left turn movement decreases from LOS C to LOS D, and intersection ICU increases from 75 to 97 percent with LOS A
- *Nairn Avenue and Kent Street* – intersection ICU increases from 63 to 79 percent with LOS A
- *Nairn Avenue and Chester Street* – northbound approach decreases from LOS C to LOS D
- *Nairn Avenue and Foster Street* – none to report
- *Nairn Avenue and Grey Street* – none to report
- *Nairn Avenue and Watt Street* – none to report
- *Archibald Street and Mission Street* – none to report
- *Mission Street and Panet Road* – none to report

A somewhat reduced level of service and loss of capacity during the morning peak hour results from a combination of mildly increased northbound traffic demands as assumed site vehicles and equipment leaves the Public Works Yards for the day and site generated traffic enters the site (i.e.: employees starting shift).

Table 5. Forecast Morning Peak Hour Corridor Traffic Operations

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	E	C	A	E	D	A	D	C	A	D	D	C
V/C	0.50	0.49	0.42	0.73	0.84	0.15	0.73	0.36	0.36	0.54	0.65	0.56
Intersection LOS / ICU	D / 73%											
Nairn Ave & Panet Rd												
Movement LOS	B		B	A	A	A	C	E	B	D	D	A
V/C	0.31		0.31	0.43	0.56	0.12	0.19	0.53	0.37	0.71	0.41	0.51
Intersection LOS / ICU	B / 65%											
Nairn Ave & Stapleton St												
Movement LOS	C	A	A	B	A	A		C	C		F	
V/C	0.06	0.37	0.19	0.15	0.74	0.37		0.13	0.13		0.96	
ICU LOS / ICU	C / 70%											
Nairn Ave & Keenleyside St												
Movement LOS	A		A	A		A		D	B	D		C
V/C	0.11		0.36	0.20		0.63		0.20	0.17	0.36		0.30
Intersection LOS / ICU	A / 97%											
Nairn Ave & Kent St												
Movement LOS	A		A	A		B		D	B		C	
V/C	0.03		0.31	0.17		0.62		0.27	0.11		0.26	
Intersection LOS / ICU	A / 79%											
Nairn Ave & Chester St												
Movement LOS	A		A	A		A		D			C	
V/C	0.03		0.31	0.08		0.60		0.30			0.15	
Intersection LOS / ICU	A / 63%											
Nairn Ave & Foster St												
Movement LOS	C	A	A	B	A	A		E	E		D	
V/C	0.03	0.40	0.20	0.04	0.75	0.38		0.15	0.15		0.24	
ICU LOS / ICU	B / 62%											
Nairn Ave & Grey St												
Movement LOS	A		A	A		A		C	B		D	
V/C	0.15		0.37	0.07		0.71		0.10	0.05		0.59	
Intersection LOS / ICU	A / 70%											
Nairn Ave & Watt St												
Movement LOS		D		F	E	A	C	C	A	C		D
V/C		0.76		1.49	1.11	0.20	0.70	0.43	0.53	0.57		0.93
Intersection LOS / ICU	E / 94%											
Archibald St & Mission St												
Movement LOS					D				A		B	
V/C					0.83				0.44		0.74	
Intersection LOS / ICU	B / 97%											
Mission St & Panet Rd												
Movement LOS		C					A	A			A	
V/C		0.30					0.14	0.14			0.27	
ICU LOS / ICU	B / 56%											

The more significant impacts noted in the forecast afternoon peak hour operations upon comparing Table 4 and Table 6 include:

- *Lagimodiere Boulevard and Regent Avenue* – eastbound left-turn decreases from LOS E to LOS F and V/C ratio increases to 0.84 from 0.67
- *Nairn Avenue and Panet Road* – the eastbound shared through and right turn movement increases in V/C ratio from 0.85 to 0.95
- *Nairn Avenue and Stapleton Street* – intersection operation decreases from LOS B to LOS C
- *Nairn Avenue and Keenleyside Street* – eastbound through and right movements decrease from LOS B to LOS C
- *Nairn Avenue and Kent Street* – northbound combined through and right movement decreases from LOS B to LOS C
- *Nairn Avenue and Chester Street* – none to report
- *Nairn Avenue and Foster Street* – northbound approach improves from LOS E to LOS D due to changes in east/west vehicle arrival patterns allowing more gaps in traffic
- *Nairn Avenue and Grey Street* – none to report
- *Nairn Avenue and Watt Street* – none to report
- *Archibald Street and Mission Street* – none to report
- *Mission Street and Panet Road* – none to report

Similar to the forecast operations during the morning peak hour, there is a somewhat reduced level of service and loss of capacity along the study corridor due to site vehicles and equipment returning at the end of the day to the proposed site, as well as employees exiting the Public East Yards.

Note that the trip assignment does not assume Panet Road or Mission Street will be utilized to access or egress the proposed site. The rationale was to examine the worst-case scenario on Nairn Avenue for the critical intersections along this corridor. If traffic flows along Nairn Avenue are not acceptable to the drivers using the Public Yards East trucks and equipment (this is subject to driver preference), it is possible that Panet Road would be utilized to access Lagimodiere Boulevard via Dugald Road to the south or that Mission Street would be used as an alternative to Nairn Avenue to access Watt Street or Archibald Street.

Table 6. Forecast Afternoon Peak Hour Corridor Traffic Operations

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	F	F	D	E	C	A	E	D	B	E	D	A
V/C	0.84	1.13	0.54	0.90	0.61	0.46	0.79	0.77	0.75	0.74	0.57	0.24
Intersection LOS / ICU	E / 88%											
Nairn Ave & Panet Rd												
Movement LOS	C	D		C	D	C	C	E	C	F	D	A
V/C	0.71	0.95		0.74	0.54	0.31	0.39	0.86	0.69	1.09	0.28	0.31
Intersection LOS / ICU	D / 93%											
Nairn Ave & Stapleton St												
Movement LOS	B	A	A	C	A	A	D		D	C		
V/C	0.05	0.78	0.40	0.12	0.56	0.30	0.31		0.31	0.09		
ICU LOS / ICU	C / 69%											
Nairn Ave & Keenleyside St												
Movement LOS	B	C		A	A		D		B	D		B
V/C	0.21	0.79		0.26	0.52		0.34		0.4	0.33		0.13
Intersection LOS / ICU	B / 79%											
Nairn Ave & Kent St												
Movement LOS	A	A		A	A		D		C	D		
V/C	0.10	0.62		0.10	0.48		0.31		0.39	0.32		
Intersection LOS / ICU	A / 74%											
Nairn Ave & Chester St												
Movement LOS	A	A		A	A		D			C		
V/C	0.10	0.67		0.09	0.52		0.59			0.16		
Intersection LOS / ICU	A / 64%											
Nairn Ave & Foster St												
Movement LOS	B	A	A	C	A	A	D		D	C		
V/C	0.06	0.70	0.35	0.01	0.59	0.30	0.10		0.10	0.10		
ICU LOS / ICU	B / 62%											
Nairn Ave & Grey St												
Movement LOS	A	A		A	A		D		B	D		
V/C	0.24	0.63		0.10	0.56		0.32		0.16	0.59		
Intersection LOS / ICU	A / 68%											
Nairn Ave & Watt St												
Movement LOS	F			F	B	A	C	D	D	C		C
V/C	1.23			1.53	0.84	0.34	0.55	0.77	0.98	0.55		0.56
Intersection LOS / ICU	E / 93%											
Archibald St & Mission St												
Movement LOS				D				A		A		
V/C				0.65				0.69		0.47		
Intersection LOS / ICU	B / 66%											
Mission St & Panet Rd												
Movement LOS	E						A	A			A	
V/C	0.71						0.06	0.06			0.26	
ICU LOS / ICU	C / 65%											

4.2 South Connection to Mission Street

At the request of the City of Winnipeg's Traffic Management Branch, a direct connection to Mission Street from Thomas Avenue was investigated. This connection would utilize the existing Foster Street railway underpass. Figures 8b and 9b illustrate the revised trip distribution applied to the network and the corresponding forecast traffic volumes.

Tables 7 and 8 present a capacity analysis of the morning and afternoon peak hours of operation for this network configuration for comparison with the network operations outlined in the previous section (i.e. base scenario identified in Tables 5 and 6).

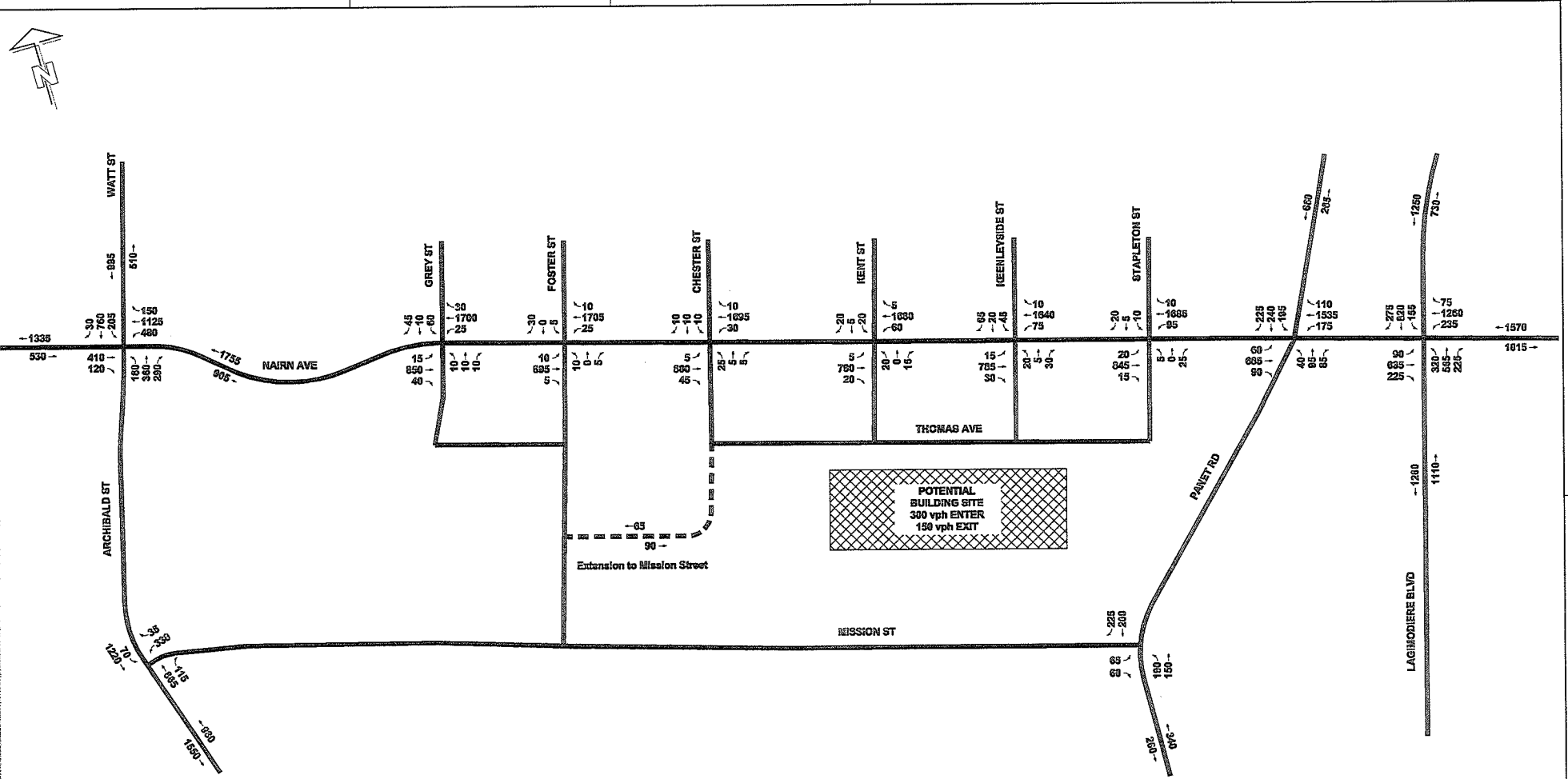
The more significant impacts noted in the modified forecast morning peak hour operations upon comparing Table 7 and Table 5 include:

- *Nairn Avenue and Stapleton Street* – southbound approach maintains LOS F, but v/c decreases from 0.96 to 0.83.
- *Nairn Avenue and Keenleyside Street* – intersection ICU improves from 97 to 81 percent, but no change in overall level of service
- *Nairn Avenue and Kent Street* – intersection ICU improves from 79 to 67 percent but no change in overall level of service
- *Archibald Street and Mission Street* – westbound approach decreases from LOS D to LOS E, with V/C ratio decreasing from 0.83 to 0.90

The more significant impacts noted in the modified forecast afternoon peak hour operations upon comparing Table 8 and Table 6 include:

- *Nairn Avenue and Keenleyside Street* – eastbound through and right movements increase from LOS C to LOS B with V/C ratio improving from 0.79 to 0.70
- *Nairn Avenue and Foster Street* – northbound decreases from LOS D to LOS E due to changes in east/west vehicle arrival patterns reducing gaps in traffic. Westbound left turn improves from LOS C to LOS B

The addition of a south connector road to Mission Street has little impact on peak hour corridor traffic operations along Nairn Avenue due to the relatively small portion site-related diverting traffic. Further, the two key intersections along the Nairn Avenue, including Watt Street and Lagimodiere Boulevard are not anticipated to achieve a reduction in overall capacity or level of service.



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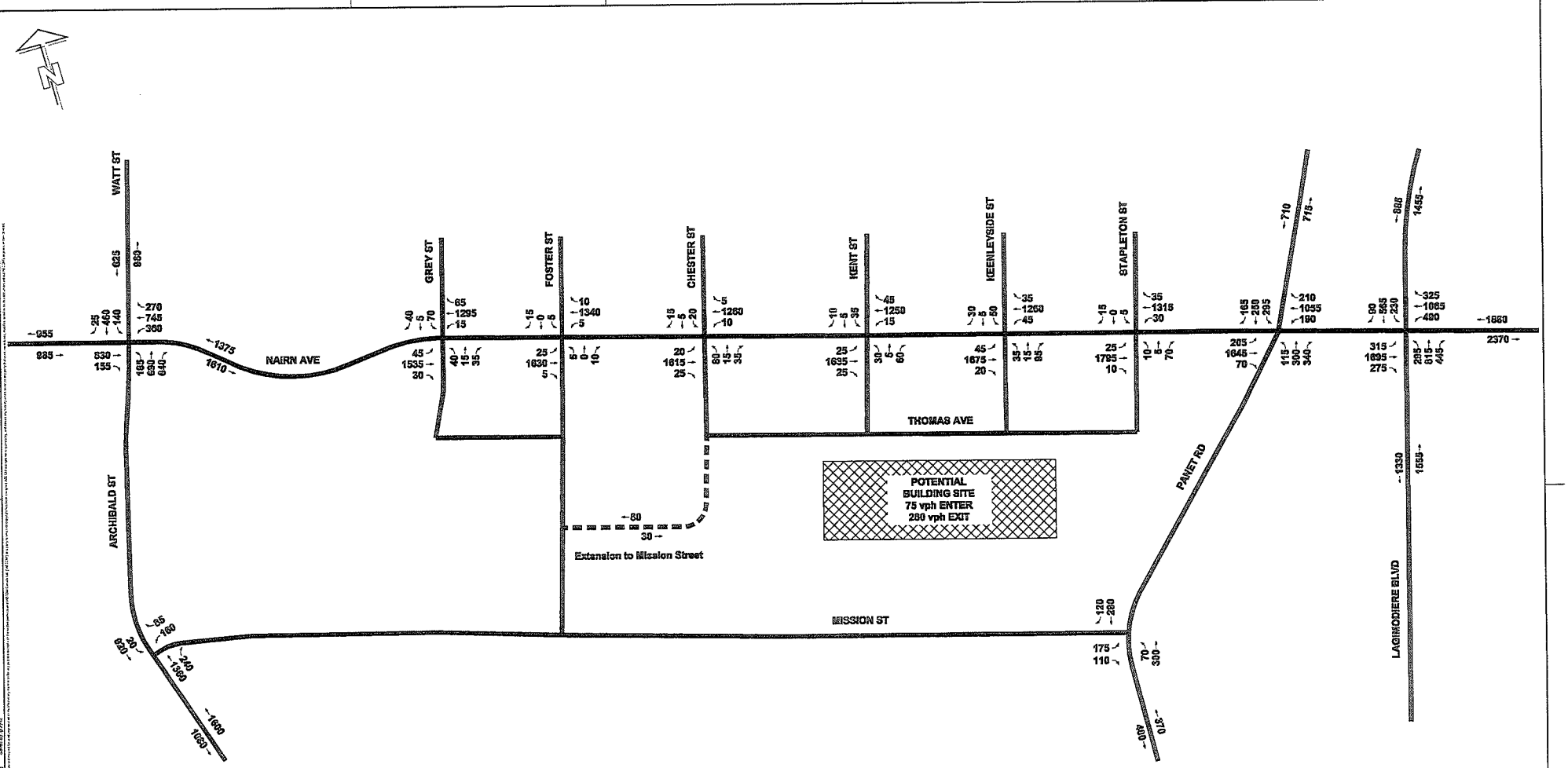
Five-Year Forecast Morning Peak Hour Traffic (Connection to Mission Street)

Figure - 8b



City of Winnipeg
Public Works East Yards-Traffic Impact Analysis

AECOM

Five-Year Forecast Afternoon Peak Hour Traffic (Connection to Mission Street)

Figure - 9b

Table 5. Forecast Morning Peak Hour Corridor Traffic Operations (REPEAT)

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	E	C	A	E	D	A	D	C	A	D	D	C
V/C	0.50	0.49	0.42	0.73	0.84	0.15	0.73	0.36	0.36	0.54	0.65	0.56
Intersection LOS / ICU	D / 73%											
Nairn Ave & Panet Rd												
Movement LOS	B		B	A	A	A	C	E	B	D	D	A
V/C	0.31		0.31	0.43	0.56	0.12	0.19	0.53	0.37	0.71	0.41	0.51
Intersection LOS / ICU	B / 65%											
Nairn Ave & Stapleton St												
Movement LOS	C	A	A	B	A	A	C		C	F		
V/C	0.06	0.37	0.19	0.15	0.74	0.37	0.13		0.13	0.96		
ICU LOS / ICU	C / 70%											
Nairn Ave & Keenleyside St												
Movement LOS	A		A	A		A	D		B	D		C
V/C	0.11		0.36	0.20		0.63	0.20		0.17	0.36		0.30
Intersection LOS / ICU	A / 97%											
Nairn Ave & Kent St												
Movement LOS	A		A	A		B	D		B	C		
V/C	0.03		0.31	0.17		0.62	0.27		0.11	0.26		
Intersection LOS / ICU	A / 79%											
Nairn Ave & Chester St												
Movement LOS	A		A	A		A	D			C		
V/C	0.03		0.31	0.08		0.60	0.30			0.15		
Intersection LOS / ICU	A / 63%											
Nairn Ave & Foster St												
Movement LOS	C	A	A	B	A	A	E		E	D		
V/C	0.03	0.40	0.20	0.04	0.75	0.38	0.15		0.15	0.24		
ICU LOS / ICU	B / 62%											
Nairn Ave & Grey St												
Movement LOS	A		A	A		A	C		B	D		
V/C	0.15		0.37	0.07		0.71	0.10		0.05	0.59		
Intersection LOS / ICU	A / 70%											
Nairn Ave & Watt St												
Movement LOS		D		F	E	A	C	C	A	C	D	
V/C		0.76		1.49	1.11	0.20	0.70	0.43	0.53	0.57	0.93	
Intersection LOS / ICU	E / 94%											
Archibald St & Mission St												
Movement LOS					D				A		B	
V/C					0.83				0.44		0.74	
Intersection LOS / ICU	B / 97%											
Mission St & Panet Rd												
Movement LOS		C					A	A			A	
V/C		0.30					0.14	0.14			0.27	
ICU LOS / ICU	B / 56%											

Table 7. Forecast Morning Peak Hour Corridor Traffic Operations – Mission St. Connection

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	E	C	A	E	D	A	D	C	A	D	D	C
V/C	0.49	0.49	0.40	0.69	0.83	0.15	0.68	0.37	0.36	0.54	0.63	0.54
Intersection LOS / ICU	D / 72%											
Nairn Ave & Panet Rd												
Movement LOS	B		B	A	A	A	C	E	B	D	D	A
V/C	0.30		0.31	0.42	0.54	0.12	0.19	0.53	0.37	0.71	0.41	0.51
Intersection LOS / ICU	B / 64%											
Nairn Ave & Stapleton St												
Movement LOS	C	A	A	B	A	A		C		F		
V/C	0.06	0.36	0.19	0.13	0.72	0.37		0.11		0.83		
ICU LOS / ICU	C / 69%											
Nairn Ave & Keenleyside St												
Movement LOS	A		A	A		A		D	B	D		C
V/C	0.11		0.35	0.16		0.63		0.14	0.13	0.35		0.29
Intersection LOS / ICU	A / 81%											
Nairn Ave & Kent St												
Movement LOS	A		A	A		A		D	B		C	
V/C	0.03		0.28	0.12		0.59		0.12	0.08		0.27	
Intersection LOS / ICU	A / 67%											
Nairn Ave & Chester St												
Movement LOS	A		A	A		A		D			C	
V/C	0.03		0.29	0.07		0.59		0.21			0.16	
Intersection LOS / ICU	A / 62%											
Nairn Ave & Foster St												
Movement LOS	C	A	A	B	A	A		E	E		D	
V/C	0.03	0.38	0.19	0.04	0.73	0.37		0.15	0.15		0.23	
ICU LOS / ICU	B / 61%											
Nairn Ave & Grey St												
Movement LOS	A		A	A		A		C	B		D	
V/C	0.14		0.35	0.07		0.69		0.10	0.05		0.58	
Intersection LOS / ICU	A / 69%											
Nairn Ave & Watt St												
Movement LOS		D		F	E	A	C	C	A	C	D	
V/C		0.76		1.37	1.10	0.20	0.70	0.43	0.49	0.57	0.93	
Intersection LOS / ICU	E / 94%											
Archibald St & Mission St												
Movement LOS					E				A		B	
V/C					0.90				0.45		0.74	
Intersection LOS / ICU	B / 98%											
Mission St & Panet Rd												
Movement LOS		C					A	A			A	
V/C		0.38					0.19	0.19			0.27	
ICU LOS / ICU	B / 60%											

Table 6. Forecast Afternoon Peak Hour Corridor Traffic Operations (REPEAT)

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	F	F	D	E	C	A	E	D	B	E	D	A
V/C	0.84	1.13	0.54	0.90	0.61	0.46	0.79	0.77	0.75	0.74	0.57	0.24
Intersection LOS / ICU	E / 88%											
Nairn Ave & Panet Rd												
Movement LOS	C	D		C	D	C	C	E	C	F	D	A
V/C	0.71	0.95		0.74	0.54	0.31	0.39	0.86	0.69	1.09	0.28	0.31
Intersection LOS / ICU	D / 93%											
Nairn Ave & Stapleton St												
Movement LOS	B	A	A	C	A	A	D		D	C		
V/C	0.05	0.78	0.40	0.12	0.56	0.30	0.31		0.31	0.09		
ICU LOS / ICU	C / 69%											
Nairn Ave & Keenleyside St												
Movement LOS	B	C		A	A		D		B	D		B
V/C	0.21	0.79		0.26	0.52		0.34		0.40	0.33		0.13
Intersection LOS / ICU	B / 79%											
Nairn Ave & Kent St												
Movement LOS	A	A		A	A		D		C	D		
V/C	0.10	0.62		0.10	0.48		0.31		0.39	0.32		
Intersection LOS / ICU	A / 74%											
Nairn Ave & Chester St												
Movement LOS	A	A		A	A		D			C		
V/C	0.10	0.67		0.09	0.52		0.59			0.16		
Intersection LOS / ICU	A / 64%											
Nairn Ave & Foster St												
Movement LOS	B	A	A	C	A	A	D		D	C		
V/C	0.06	0.70	0.35	0.01	0.59	0.30	0.10		0.10	0.10		
ICU LOS / ICU	B / 62%											
Nairn Ave & Grey St												
Movement LOS	A	A		A	A		D		B	D		
V/C	0.24	0.63		0.10	0.56		0.32		0.16	0.59		
Intersection LOS / ICU	A / 68%											
Nairn Ave & Watt St												
Movement LOS	F			F	B	A	C	D	D	C		C
V/C	1.23			1.53	0.84	0.34	0.55	0.77	0.98	0.55		0.56
Intersection LOS / ICU	E / 93%											
Archibald St & Mission St												
Movement LOS				D					A	A		
V/C				0.65					0.69	0.47		
Intersection LOS / ICU	B / 66%											
Mission St & Panet Rd												
Movement LOS	E						A	A				A
V/C	0.71						0.06	0.06				0.26
ICU LOS / ICU	C / 65%											

Table 8. Forecast Afternoon Peak Hour Corridor Traffic Operations – Mission St. Connection

	Eastbound			Westbound			Northbound			Southbound		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Regent Ave & Lagimodiere Blvd												
Movement LOS	F	F	D	E	C	A	E	D	B	E	D	A
V/C	0.84	1.13	0.48	0.90	0.61	0.46	0.77	0.77	0.76	0.74	0.57	0.24
Intersection LOS / ICU	E / 88%											
Nairn Ave & Panet Rd												
Movement LOS	C	D		C	D	C	C	E	C	F	D	A
V/C	0.71	0.92		0.74	0.53	0.31	0.39	0.86	0.69	1.09	0.28	0.31
Intersection LOS / ICU	D / 92%											
Nairn Ave & Stapleton St												
Movement LOS	B	A	A	C	A	A	D		D	C		
V/C	0.05	0.77	0.39	0.10	0.56	0.30	0.31		0.31	0.09		
ICU LOS / ICU	C / 68%											
Nairn Ave & Keenleyside St												
Movement LOS	B	B		A	A		D		B	D		B
V/C	0.19	0.70		0.23	0.49		0.28		0.34	0.33		0.13
Intersection LOS / ICU	B / 79%											
Nairn Ave & Kent St												
Movement LOS	A	A		A	A		D		C	D		
V/C	0.10	0.61		0.10	0.48		0.22		0.31	0.32		
Intersection LOS / ICU	A / 73%											
Nairn Ave & Chester St												
Movement LOS	A	A		A	A		D			C		
V/C	0.09	0.65		0.08	0.50		0.56			0.17		
Intersection LOS / ICU	A / 62%											
Nairn Ave & Foster St												
Movement LOS	B	A	A	B	A	A	E		E	C		
V/C	0.05	0.69	0.35	0.01	0.57	0.29	0.11		0.11	0.10		
ICU LOS / ICU	B / 62%											
Nairn Ave & Grey St												
Movement LOS	A	A		A	A		D		B	D		
V/C	0.23	0.62		0.10	0.54		0.32		0.16	0.59		
Intersection LOS / ICU	A / 68%											
Nairn Ave & Watt St												
Movement LOS	F			F	B	A	C	D	D	C		C
V/C	1.23			1.37	0.83	0.34	0.56	0.78	0.96	0.55		0.57
Intersection LOS / ICU	E / 92%											
Archibald St & Mission St												
Movement LOS				D					A	A		
V/C				0.72					0.70	0.46		
Intersection LOS / ICU	B / 68%											
Mission St & Panet Rd												
Movement LOS	E						A	A				A
V/C	0.80						0.07	0.07				0.26
ICU LOS / ICU	C / 69%											

5. Corridor Traffic Operations Analysis

5.1 Geometry

The existing Nairn Avenue cross-section does not appear to have sufficient median width to incorporate additional turning lanes (i.e. dual turning lanes for constrained left turn movements). An extension of storage length within the turning bays may be possible, but is not identified as necessary based on queue lengths within the analysis models and would not improve the v/c ratios, level of service or ICU results. This may be an additional measure that is integrated into the site approval process to ensure the through traffic on Nairn Avenue is given a high-level of priority.

The northbound approaches at intersections along Nairn Avenue that would be used by the proposed site traffic appear to have sufficient width to accommodate the forecast traffic volumes. Stapleton Street is currently the widest northbound approach, but will be limited in attracting northbound left turns since it is a stop-controlled intersection. Kent Street is also a wider street than Keenleyside Street and Chester Street and may be chose as a preferred exit point out of the site.

Roadway widening is not anticipated to be necessary on any of these mentioned roadways.

5.2 Traffic Control

The intersection of Nairn Avenue and Stapleton Street may require traffic signals in order to provide sufficient priority to northbound and southbound vehicles at the existing stop-controlled approaches. However, if this intersection does not provide adequate access to or from Nairn Avenue, site traffic will not utilize this intersection. There are three other intersections that are signalized and can be used to enter or exit the proposed site. It is recommended that the City of Winnipeg continue to monitor the traffic volumes and pedestrian counts at the Nairn Avenue and Stapleton Street intersection to determine if and where this intersection ranks on the City's list of locations requiring traffic signals.

The intersection of Lagimodiere Boulevard and Regent Avenue currently operates under significant congestion and has been identified as requiring a separate study to determine appropriate mitigation to provide additional capacity. The intersection appears to be completely built-out within the available right-of-way and it may not be possible to improve the intersection as an at-grade intersection.

The intersection of Nairn Avenue and Watt Street already prohibits eastbound left turn movements and it may not be possible to improve the level of control and signal timing at this location. It was noted during the site visit that westbound left turning vehicles in the shared left turn and through lane are continually trapped in this lane with rapidly approaching through traffic that often does not expect the left turn vehicle to stop. This is caused by two traffic signal lights controlling this single lane (i.e. there is a signal for the left turn movements in this lane and a separate signal head for the through movements in this lane). Further examination of this intersection may support this issue in terms of collision configurations, but is not within the scope of this study. Further review at this intersection is required.

All other intersections appear to have the appropriate level of traffic control, but are congested due to the magnitude of westbound and eastbound through traffic on Nairn Avenue or northbound and southbound through traffic on Watt Street, Archibald Street, Panet Road and Lagimodiere Boulevard.

5.3 Alternative Transportation

The proposed site has four transit routes that provide an alternative to automobile traffic for commuting to and from work. The available transit routes include:

1. Route 42 – Plessis Express
2. Route 46 – Transcona Express
3. Route 47 – Transcona
4. Route 48 – McMeans Express

The City of Winnipeg also identifies a future Bus Rapid Transit (BRT) route along the south property line that may impact the potential for a connection to the Foster Street railway underpass.

Appendix D illustrates the proximity of the potential BRT line, as well as a right-of-way for a future corridor that would have implications on the viability of the connection to the Foster Street railway underpass. However, the timing of this corridor is unknown and it is not part of the Plan Winnipeg 2020 Vision's road network plan for 2020 and beyond.

In addition, Mission Street to the south, Regent Avenue to the east and Talbot Avenue to the north are identified by the City of Winnipeg as proposed Active Transportation Network links. These connections would allow alternative modes of transportation for employees as well.

Stapleton Street currently has sidewalks on both sides between Nairn Avenue and Thomas Avenue. There is a sidewalk on the east side of Chester Street and Keenleyside Street between Nairn Avenue and Thomas Avenue. There is no sidewalk on Kent Street between Nairn Avenue and Thomas Avenue.

6. Recommendations

The existing Nairn Avenue corridor and adjacent study intersections examined through the completion of this study operated under congested conditions during the peak periods of the typical weekday. Most intersections have movements operating at a LOS C to LOS D, with severely constrained movements either operating at LOS E or failure.

The proposed site will generate a maximum of approximately 450 trips during the morning peak hour and 355 trips during the afternoon peak hour onto the City of Winnipeg road network, with the majority destined to and from Lagimodiere Boulevard. There are four intersections along Nairn Avenue that can be utilized by site traffic, which minimizes the impact of the additional traffic on the study intersections.

The results of the TIA indicate that the proposed site plan can be incorporated into the existing road network with negligible impacts above the normal background growth rates on Nairn Avenue. A potential south connection from Thomas Avenue to the adjacent Mission Street (via the Foster Street railway underpass) was examined as a secondary access point and would likely provide minimal benefit to the key intersections along Nairn Avenue, including at Watt Street and at Lagimodiere Boulevard.

It is recommended that the Public Yards East site be approved to develop at the proposed location based on the review of traffic impacts. Further, the following items are recommended for consideration by the City of Winnipeg in order to address concerns with existing conditions, and future operations as traffic continues to increase along the Nairn Avenue corridor with or without site development.

- *Further study to examine alternatives to provide additional capacity at Lagimodiere Boulevard and Regent Avenue.*
- *Safety review at the intersection of Nairn Avenue and Watt Street to examine the westbound approach.*
- *Traffic signal timing along Nairn Avenue be monitored to ensure sufficient green time is provided to side streets, where possible during the morning and afternoon peak hours*
- *The intersection of Nairn Avenue and Stapleton Street be periodically monitored by the City of Winnipeg to determine if and where the intersection ranks on the City's list of potential traffic signalization locations.*

Appendix A

Intersection Traffic Count Data

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Wednesday, March 11, 2009
N-S Road: Lagimodiere Blvd
E-W Road: Regent Ave
Weather:
Recorder:

MORNING

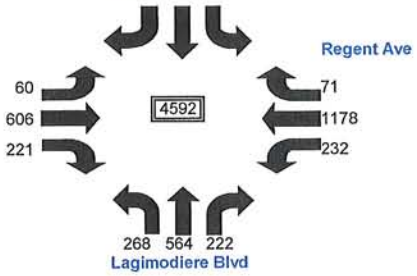
Time Finish	Lagimodiere Blvd NB			NB	Lagimodiere Blvd SB			SB	Regent Ave EB			EB	Regent Ave WB			WB	TOT	HOUR
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL	TOT
6:45	53	131	62	246	13	45	25	83	13	175	69	257	44	196	10	250	836	
7:00	49	130	75	254	39	102	25	166	11	135	53	199	46	232	22	300	919	
7:15	41	120	81	242	29	129	44	202	15	99	53	167	47	295	11	353	964	
7:30	60	129	67	256	30	190	43	263	12	131	51	194	56	321	17	394	1107	3826
7:45	73	136	50	259	37	214	52	303	15	155	43	213	57	292	17	366	1141	4131
8:00	64	152	53	269	42	227	48	317	16	168	65	249	60	294	10	364	1199	4411
8:15	71	147	52	270	44	184	59	287	17	152	62	231	59	271	27	357	1145	4592
8:30	52	160	79	291	34	162	36	232	31	132	37	200	51	228	18	297	1020	4505
8:45	57	149	64	270	36	174	49	259	18	172	60	250	56	235	23	314	1093	4457
9:00	70	122	80	272	44	133	36	213	15	173	48	236	43	229	30	302	1023	4281
Peak 7:15 to 8:15	268	564	222	1054	153	815	202	1170	60	606	221	887	232	1178	71	1481	4592	

AFTERNOON

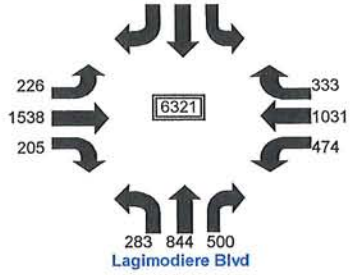
Time Finish (p.m.)	Lagimodiere Blvd NB			NB	Lagimodiere Blvd SB			SB	Regent Ave EB			EB	Regent Ave WB			WB	TOT	HOUR
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL	TOT
3:45	78	191	112	381	55	163	24	242	41	308	46	395	128	276	60	464	1482	
4:00	81	171	128	380	54	136	25	215	54	388	54	496	105	309	76	490	1581	
4:15	73	193	102	368	46	153	11	210	60	346	59	465	139	274	73	486	1529	
4:30	75	186	133	394	46	127	19	192	61	412	39	512	105	252	66	423	1521	6113
4:45	83	231	85	399	73	128	26	227	51	356	65	472	142	255	103	500	1598	6229
5:00	56	201	123	380	61	154	17	232	63	419	49	531	101	240	80	421	1564	6212
5:15	69	226	159	454	60	158	18	236	51	351	52	454	126	284	84	494	1638	6321
5:30	66	170	81	317	48	134	16	198	50	370	60	480	115	233	88	436	1431	6231
5:45	52	190	110	352	60	129	23	212	51	309	47	407	103	276	80	459	1430	6063
6:00	42	135	87	264	62	138	23	223	41	242	40	323	83	263	54	400	1210	5709
Peak : 4:15 to 5:15	283	844	500	1627	240	567	80	887	226	1538	205	1969	474	1031	333	1838	6321	

Summary:

AM Peak
7:15 to 8:15



PM Peak
4:15 to 5:15



Classification Data

MORNING 7:15 to 8:15

Time (a.m.)	Lagimodiere Blvd NB			NB	Lagimodiere Blvd SB			SB	Regent Ave EB			EB	Regent Ave WB			WB	TOT
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL
Auto	260	547	217	1024	148	792	197	1137	48	581	211	840	229	1146	65	1440	4441
Trucks	8	17	4	29	4	23	5	32	11	14	10	35	0	18	6	24	120
Buses	0	0	1	1	1	0	0	1	1	11	0	12	3	14	0	17	31
Peak Hour: 7:15 to 8:15	268	564	222	1054	153	815	202	1170	60	606	221	887	232	1178	71	1481	4592

AFTERNOON 4:15 to 5:15

Time (a.m.)	Lagimodiere Blvd NB			NB	Lagimodiere Blvd SB			SB	Regent Ave EB			EB	Regent Ave WB			WB	TOT
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL
Auto	277	844	496	1617	236	554	79	869	222	1516	203	1941	468	1011	331	1810	6237
Trucks	6	0	2	8	4	13	1	18	4	7	2	13	3	11	1	15	54
Buses	0	0	2	2	0	0	0	0	0	15	0	15	3	9	1	13	30
Peak Hour: 4:15 to 5:15	283	844	500	1627	240	567	80	887	226	1538	205	1969	474	1031	333	1838	6321

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Thursday, March 12, 2009
N-S Road: Panet Rd
E-W Road: Nairn Ave
Weather:
Recorder:

MORNING

Time Finish	Panet Rd NB LT	NB ST	NB RT	NB TOT	Panet Rd SB LT	SB ST	SB RT	SB TOT	Nairn Ave EB LT	EB ST	EB RT	EB TOT	Nairn Ave WB LT	WB ST	WB RT	WB TOT	TOT ALL	HOUR TOT
6:45	2	17	16	35	32	42	38	112	8	190	21	219	24	206	19	249	615	
7:00	6	16	15	37	53	31	37	121	17	151	24	192	14	276	19	309	659	
7:15	9	15	10	34	36	36	41	113	18	121	14	153	30	311	31	372	672	
7:30	10	21	19	50	38	51	53	142	14	174	23	211	39	369	19	427	830	2776
7:45	10	25	19	54	55	59	57	171	16	149	22	187	43	295	24	362	774	2935
8:00	8	24	26	58	65	75	41	181	9	139	26	174	38	330	27	395	808	3084
8:15	7	21	18	46	33	54	57	144	7	153	16	176	44	284	26	354	720	3132
8:30	8	30	22	60	39	55	47	141	20	154	17	191	66	276	20	362	754	3056
8:45	10	18	20	48	41	44	41	126	23	180	18	221	35	272	27	334	729	3011
9:00	10	14	39	63	46	38	40	124	22	163	20	205	47	224	30	301	693	2896
Peak 7:15 to 8:15	35	91	82	208	191	239	208	638	46	615	87	748	164	1278	96	1538	3132	

AFTERNOON

Time Finish (p.m.)	Panet Rd NB LT	NB ST	NB RT	NB TOT	Panet Rd SB LT	SB ST	SB RT	SB TOT	Nairn Ave EB LT	EB ST	EB RT	EB TOT	Nairn Ave WB LT	WB ST	WB RT	WB TOT	TOT ALL	HOUR TOT
3:45	19	67	82	168	53	35	52	140	42	303	23	368	57	259	35	351	1027	
4:00	13	50	64	127	78	61	49	188	44	265	20	329	60	320	52	432	1076	
4:15	31	64	72	167	85	75	36	196	56	344	20	420	46	247	46	339	1122	
4:30	27	47	68	142	69	48	48	165	47	375	12	434	41	263	54	358	1099	4324
4:45	26	105	103	234	59	62	40	161	38	325	21	384	38	228	57	323	1102	4399
5:00	28	82	94	204	78	59	29	166	44	397	12	453	61	258	47	366	1189	4512
5:15	20	82	89	191	70	59	36	165	55	354	20	429	46	235	58	339	1124	4514
5:30	17	60	76	153	73	57	35	165	57	298	18	373	49	266	42	357	1048	4463
5:45	22	47	57	126	58	45	28	131	44	342	16	402	49	184	52	285	944	4305
6:00	20	67	70	157	91	45	34	170	41	217	9	267	53	246	38	337	931	4047
Peak 4:15 to 5:15	101	316	354	771	276	228	153	657	184	1451	65	1700	186	984	216	1386	4514	

Summary:

AM Peak
7:15 to 8:15
Panet Rd
208 239 191
Nairn Ave
46 615 87
3132
96 1278 164
35 91 82
Panet Rd

PM Peak
4:15 to 5:15
Panet Rd
153 228 276
184 1451 65
4514
216 984 186
101 316 354
Panet Rd

Classification Data

MORNING 7:15 to 8:15

Time (a.m.)	Panet Rd NB LT	NB ST	NB RT	NB TOT	Panet Rd SB LT	SB ST	SB RT	SB TOT	Nairn Ave EB LT	EB ST	EB RT	EB TOT	Nairn Ave WB LT	WB ST	WB RT	WB TOT	TOT ALL
Auto	32	91	71	194	187	239	207	633	44	591	85	720	163	1243	89	1495	3042
Trucks	3	0	11	14	0	0	1	1	1	17	2	20	1	22	3	26	61
Buses	0	0	0	0	4	0	0	4	1	7	0	8	0	13	4	17	29
Peak Hour: 7:15 to 8:15	35	91	82	208	191	239	208	638	46	615	87	748	164	1278	96	1538	3132

AFTERNOON 4:15 to 5:15

Time (a.m.)	Panet Rd NB LT	NB ST	NB RT	NB TOT	Panet Rd SB LT	SB ST	SB RT	SB TOT	Nairn Ave EB LT	EB ST	EB RT	EB TOT	Nairn Ave WB LT	WB ST	WB RT	WB TOT	TOT ALL
Auto	100	316	347	763	272	228	151	651	184	1428	63	1675	185	963	212	1360	4449
Trucks	1	0	7	8	0	0	1	1	0	9	2	11	1	11	0	12	32
Buses	0	0	0	0	4	0	1	5	0	14	0	14	0	10	4	14	33
Peak Hour: 4:15 to 5:15	101	316	354	771	276	228	153	657	184	1451	65	1700	186	984	216	1386	4514

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Thursday, March 5, 2009
N-S Road: Stapleton St
E-W Road: Nairn Ave
Weather:
Recorder:

MORNING

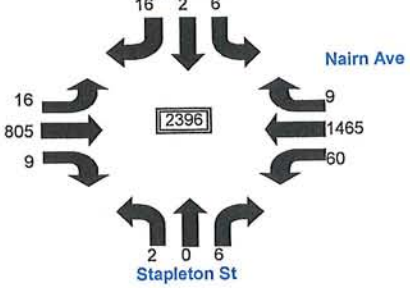
Time Finish	Stapleton St NB LT	ST	RT	NB TOT	Stapleton St SB LT	ST	RT	SB TOT	Nairn Ave EB LT	ST	RT	EB TOT	Nairn Ave WB LT	ST	RT	WB TOT	TOT ALL	HOUR TOT
6:45	0	0	3	3	3	0	5	8	2	233	0	235	6	298	1	305	551	
7:00	0	0	0	0	3	0	4	7	3	173	0	176	5	245	1	251	434	
7:15	0	0	0	0	1	1	4	6	5	195	1	201	5	369	0	374	581	
7:30	2	0	1	3	3	0	8	11	4	194	1	199	10	438	6	454	667	2233
7:45	0	0	4	4	2	0	0	2	2	216	1	219	17	324	1	342	567	2249
8:00	0	0	1	1	0	1	4	5	5	200	6	211	28	334	2	364	581	2396
8:15	0	0	4	4	1	1	4	6	3	193	1	197	14	345	1	360	567	2382
8:30	0	1	3	4	1	1	4	6	5	220	3	228	3	306	3	312	550	2265
8:45	0	0	3	3	2	0	4	6	2	209	2	213	10	308	2	320	542	2240
9:00	0	0	1	1	3	0	7	10	5	197	0	202	7	272	3	282	495	2154
Peak 7:00 to 8:00	2	0	6	8	6	2	16	24	16	805	9	830	60	1465	9	1534	2396	

AFTERNOON

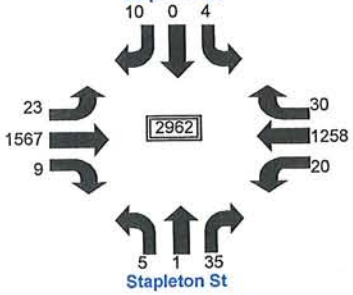
Time Finish (p.m.)	Stapleton St NB LT	ST	RT	NB TOT	Stapleton St SB LT	ST	RT	SB TOT	Nairn Ave EB LT	ST	RT	EB TOT	Nairn Ave WB LT	ST	RT	WB TOT	TOT ALL	HOUR TOT
3:45	0	0	6	6	3	0	4	7	2	352	1	355	2	340	7	349	717	
4:00	3	0	11	14	3	1	2	6	3	334	1	338	10	335	12	357	715	
4:15	4	0	4	8	0	0	2	2	6	396	0	402	5	329	12	346	758	
4:30	0	1	9	10	0	0	3	3	4	371	3	378	7	286	6	299	690	2880
4:45	1	0	13	14	2	0	4	6	7	416	5	428	3	333	5	341	789	2952
5:00	0	0	9	9	2	0	1	3	6	384	1	391	5	310	7	322	725	2962
5:15	2	0	5	7	1	0	0	1	7	375	0	382	7	269	5	281	671	2875
5:30	2	1	7	10	3	0	2	5	3	362	1	366	7	299	5	311	692	2877
5:45	0	0	5	5	1	0	3	4	9	308	2	319	5	205	8	218	546	2634
6:00	1	0	2	3	5	0	7	12	11	249	1	261	4	247	5	256	532	2441
Peak 4:00 to 5:00	5	1	35	41	4	0	10	14	23	1567	9	1599	20	1258	30	1308	2962	

Summary:

AM Peak
7:00 to 8:00



PM Peak
4:00 to 5:00



Classification Data

MORNING 7:00 to 8:00

Time (a.m.)	Stapleton St NB LT	ST	RT	NB TOT	Stapleton St SB LT	ST	RT	SB TOT	Nairn Ave EB LT	ST	RT	EB TOT	Nairn Ave WB LT	ST	RT	WB TOT	TOT ALL
Auto	2	0	6	8	5	2	16	23	15	779	9	803	60	1423	9	1492	2326
Trucks	0	0	0	0	1	0	0	1	1	15	0	16	0	30	0	30	47
Buses	0	0	0	0	0	0	0	0	0	11	0	11	0	12	0	12	23
Peak Hour: 7:00 to 8:00	2	0	6	8	6	2	16	24	16	805	9	830	60	1465	9	1534	2396

AFTERNOON 4:00 to 5:00

Time (a.m.)	Stapleton St NB LT	ST	RT	NB TOT	Stapleton St SB LT	ST	RT	SB TOT	Nairn Ave EB LT	ST	RT	EB TOT	Nairn Ave WB LT	ST	RT	WB TOT	TOT ALL
Auto	5	1	35	41	4	0	10	14	23	1532	9	1564	19	1239	30	1288	2907
Trucks	0	0	0	0	0	0	0	0	0	24	0	24	1	11	0	12	36
Buses	0	0	0	0	0	0	0	0	0	11	0	11	0	8	0	8	19
Peak Hour: 4:00 to 5:00	5	1	35	41	4	0	10	14	23	1567	9	1599	20	1258	30	1308	2962

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Thursday, March 5, 2009
N-S Road: Keenleyside St
E-W Road: Nairn Avenue
Weather:
Recorder:

MORNING

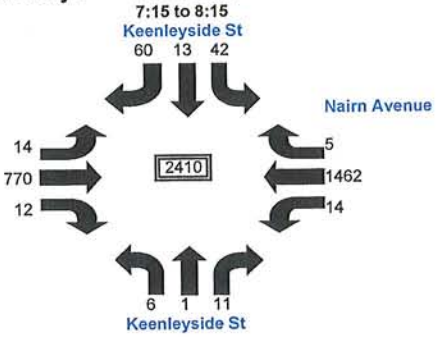
Time Finish	Keenleyside St NB			NB	Keenleyside St SB			SB	Nairn Avenue EB			EB	Nairn Avenue WB			WB	TOT	HOUR
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL	TOT
6:45	0	1	1	2	17	0	15	32	1	230	0	231	3	251	0	254	519	
7:00	0	1	0	1	9	3	14	26	3	181	4	188	6	290	1	297	512	
7:15	0	0	1	1	6	2	17	25	2	186	0	188	0	375	0	375	589	
7:30	0	0	2	2	7	2	16	25	6	180	3	189	4	383	1	388	604	2224
7:45	2	0	5	7	15	2	20	37	3	215	3	221	4	382	0	386	651	2356
8:00	3	1	1	5	13	6	12	31	1	176	4	181	3	334	2	339	556	2400
8:15	1	0	3	4	7	3	12	22	4	199	2	205	3	363	2	368	599	2410
8:30	1	1	1	3	17	0	13	30	0	201	0	201	4	296	1	301	535	2341
8:45	1	2	5	8	8	3	14	25	7	202	0	209	2	309	3	314	556	2246
9:00	1	2	4	7	3	2	9	14	2	207	2	211	4	254	1	259	491	2181
Peak 7:15 to 8:15	6	1	11	18	42	13	60	115	14	770	12	796	14	1462	5	1481	2410	

AFTERNOON

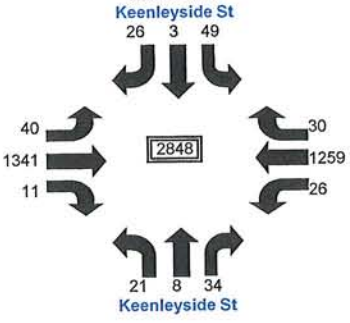
Time Finish (p.m.)	Keenleyside St NB			NB	Keenleyside St SB			SB	Nairn Avenue EB			EB	Nairn Avenue WB			WB	TOT	HOUR
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL	TOT
3:45	0	3	10	13	13	1	7	21	14	240	3	257	8	322	6	336	627	
4:00	5	1	6	12	11	2	6	19	12	308	3	323	6	357	7	370	724	
4:15	4	2	14	20	16	0	10	26	9	316	2	327	8	340	4	352	725	
4:30	6	2	5	13	11	1	5	17	7	358	4	369	8	256	6	270	669	2745
4:45	6	3	9	18	11	0	5	16	12	359	2	373	4	306	13	323	730	2848
5:00	3	2	6	11	6	0	11	17	7	325	1	333	11	289	5	305	666	2790
5:15	6	3	8	17	12	2	8	22	10	348	3	361	8	292	4	304	704	2769
5:30	5	1	6	12	10	1	10	21	11	327	3	341	1	260	5	266	640	2740
5:45	2	0	11	13	13	2	9	24	7	267	5	279	2	227	6	235	551	2561
6:00	3	0	4	7	13	1	11	25	6	227	4	237	3	229	6	238	507	2402
Peak 3:45 to 4:45	21	8	34	63	49	3	26	78	40	1341	11	1392	26	1259	30	1315	2848	

Summary:

AM Peak
7:15 to 8:15



PM Peak
3:45 to 4:45



Classification Data

MORNING 7:15 to 8:15

Time (a.m.)	Keenleyside St NB			NB	Keenleyside St SB			SB	Nairn Avenue EB			EB	Nairn Avenue WB			WB	TOT
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL
Auto	6	1	11	18	42	13	60	115	14	750	12	776	13	1422	5	1440	2349
Trucks	0	0	0	0	0	0	0	0	0	10	0	10	1	27	0	28	38
Buses	0	0	0	0	0	0	0	0	0	10	0	10	0	13	0	13	23
Peak Hour: 7:15 to 8:15	6	1	11	18	42	13	60	115	14	770	12	796	14	1462	5	1481	2410

AFTERNOON 3:45 to 4:45

Time (a.m.)	Keenleyside St NB			NB	Keenleyside St SB			SB	Nairn Avenue EB			EB	Nairn Avenue WB			WB	TOT
	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	ALL
Auto	21	8	34	63	49	3	26	78	35	1305	11	1351	26	1223	30	1279	2771
Trucks	0	0	0	0	0	0	0	0	5	23	0	28	0	26	0	26	54
Buses	0	0	0	0	0	0	0	0	0	13	0	13	0	10	0	10	23
Peak Hour: 3:45 to 4:45	21	8	34	63	49	3	26	78	40	1341	11	1392	26	1259	30	1315	2848

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Tuesday, March 3, 2009
N-S Road: Kent St
E-W Road: Nairn Avenue
Weather:
Recorder:

MORNING

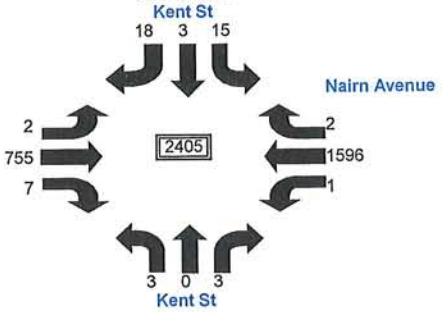
Time Finish	Kent St NB LT	Kent St NB ST	Kent St NB RT	NB TOT	Kent St SB LT	Kent St SB ST	Kent St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL	HOUR TOT
6:45	0	0	0	0	2	0	6	8	0	266	0	266	1	267	1	269	543	
7:00	0	0	0	0	2	3	3	8	0	162	2	164	0	294	3	297	469	
7:15	1	0	1	2	7	1	4	12	0	147	1	148	1	370	1	372	534	
7:30	0	0	0	0	4	0	3	7	1	195	2	198	0	461	0	461	666	2212
7:45	1	0	0	1	3	0	7	10	1	216	1	218	0	401	1	402	631	2300
8:00	1	0	2	3	1	2	4	7	0	197	3	200	0	364	0	364	574	2405
8:15	3	0	0	3	1	0	2	3	2	146	0	148	0	346	3	349	503	2374
8:30	0	0	1	1	5	0	5	10	3	188	1	192	2	300	3	305	508	2216
8:45	2	0	0	2	7	1	2	10	4	205	0	209	0	281	2	283	504	2089
9:00	0	0	3	3	8	1	4	13	2	212	1	215	2	278	1	281	512	2027
Peak 7:00 to 8:00	3	0	3	6	15	3	18	36	2	755	7	764	1	1596	2	1599	2405	

AFTERNOON

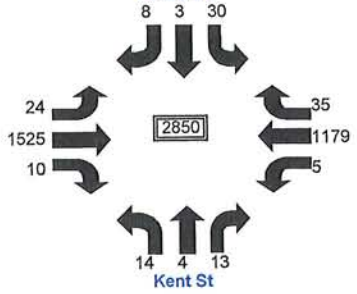
Time Finish (p.m.)	Kent St NB LT	Kent St NB ST	Kent St NB RT	NB TOT	Kent St SB LT	Kent St SB ST	Kent St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL	HOUR TOT
3:45	0	0	3	3	15	0	5	20	1	354	5	360	1	325	2	328	711	
4:00	4	1	8	13	7	0	2	9	8	420	4	432	1	326	16	343	797	
4:15	2	3	3	8	7	1	0	8	3	339	1	343	1	318	7	326	685	
4:30	5	0	2	7	8	1	2	11	8	354	3	365	2	256	5	263	646	2839
4:45	3	0	0	3	8	1	4	13	5	412	2	419	1	279	7	287	722	2850
5:00	2	0	2	4	6	0	2	8	4	343	5	352	3	211	4	218	582	2635
5:15	9	1	6	16	20	2	2	24	6	381	1	388	2	232	4	238	666	2616
5:30	2	2	3	7	3	2	5	10	7	373	3	383	2	232	7	241	641	2611
5:45	2	1	1	4	6	0	2	8	1	290	2	293	1	227	2	230	535	2424
6:00	1	1	3	5	5	0	3	8	4	295	2	301	3	254	4	261	575	2417
Peak 3:45 to 4:45	14	4	13	31	30	3	8	41	24	1525	10	1559	5	1179	35	1219	2850	

Summary:

AM Peak
7:00 to 8:00



PM Peak
3:45 to 4:45



Classification Data

MORNING 7:00 to 8:00

Time (a.m.)	Kent St NB LT	Kent St NB ST	Kent St NB RT	NB TOT	Kent St SB LT	Kent St SB ST	Kent St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL
Auto	3	0	2	5	15	3	18	36	2	727	7	736	1	1556	2	1559	2336
Trucks	0	0	1	1	0	0	0	0	0	17	0	17	0	28	0	28	46
Buses	0	0	0	0	0	0	0	0	0	11	0	11	0	12	0	12	23
Peak Hour: 7:00 to 8:00	3	0	3	6	15	3	18	36	2	755	7	764	1	1596	2	1599	2405

AFTERNOON 3:45 to 4:45

Time (a.m.)	Kent St NB LT	Kent St NB ST	Kent St NB RT	NB TOT	Kent St SB LT	Kent St SB ST	Kent St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL
Auto	14	4	13	31	30	3	8	41	24	1493	9	1526	4	1152	35	1191	2789
Trucks	0	0	0	0	0	0	0	0	0	17	1	18	1	18	0	19	37
Buses	0	0	0	0	0	0	0	0	0	15	0	15	0	9	0	9	24
Peak Hour: 3:45 to 4:45	14	4	13	31	30	3	8	41	24	1525	10	1559	5	1179	35	1219	2850

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Tuesday, March 3, 2009
N-S Road: Chester St
E-W Road: Nairn Avenue

Weather:
Recorder:

MORNING

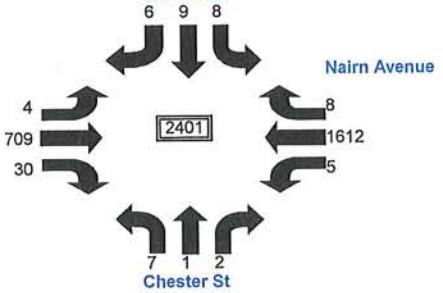
Time Finish	Chester St NB LT	NB ST	NB RT	NB TOT	Chester St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL	HOUR TOT
6:45	0	0	0	0	2	0	2	4	1	238	5	244	1	276	1	278	526	
7:00	0	1	0	1	2	2	4	8	0	177	12	189	1	283	0	284	482	
7:15	1	1	0	2	3	0	1	4	0	158	9	167	1	403	2	406	579	
7:30	1	0	1	2	2	3	2	7	1	170	8	179	0	476	1	477	665	2252
7:45	2	0	0	2	3	2	2	7	2	188	3	193	2	404	2	408	610	2336
8:00	3	0	1	4	0	4	1	5	1	193	10	204	2	329	3	334	547	2401
8:15	3	0	0	3	2	1	0	3	1	156	3	160	0	337	0	337	503	2325
8:30	7	0	0	7	7	0	5	12	2	178	2	182	1	345	2	348	549	2209
8:45	6	0	0	6	6	2	2	10	2	195	2	199	1	270	1	272	487	2086
9:00	6	1	1	8	5	1	0	6	5	219	4	228	4	252	2	258	500	2039
Peak : 7:00 - 8:00	7	1	2	10	8	9	6	23	4	709	30	743	5	1612	8	1625	2401	

AFTERNOON

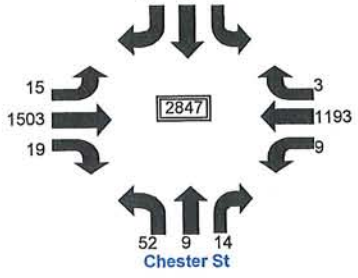
Time Finish (p.m.)	Chester St NB LT	NB ST	NB RT	NB TOT	Chester St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL	HOUR TOT
3:45	11	2	6	19	3	0	4	7	3	364	5	372	2	298	1	301	699	
4:00	6	1	5	12	5	1	3	9	1	418	8	427	4	303	2	309	757	
4:15	26	5	2	33	5	0	2	7	4	349	3	356	3	331	0	334	730	
4:30	9	1	1	11	4	1	2	7	7	372	3	382	0	261	0	261	661	2847
4:45	22	3	2	27	1	1	3	5	4	371	4	379	0	283	0	283	694	2842
5:00	10	2	7	19	3	0	2	5	5	354	3	362	0	186	1	187	573	2658
5:15	9	1	2	12	6	2	2	10	7	422	1	430	2	254	1	257	709	2637
5:30	6	1	1	8	2	0	2	4	6	356	2	364	0	239	3	242	618	2594
5:45	7	4	3	14	2	0	3	5	4	297	3	304	0	238	2	240	563	2463
6:00	4	2	2	8	0	0	0	0	3	274	1	278	1	255	1	257	543	2433
Peak : 3:30 to 4:30	52	9	14	75	17	2	11	30	15	1503	19	1537	9	1193	3	1205	2847	

Summary:

AM Peak
7:00 - 8:00



PM Peak
3:30 to 4:30



Classification Data

MORNING 7:00 - 8:00

Time (a.m.)	Chester St NB LT	NB ST	NB RT	NB TOT	Chester St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL
Auto	7	1	2	10	8	9	6	23	4	676	28	708	5	1560	8	1573	2314
Trucks	0	0	0	0	0	0	0	0	0	22	2	24	0	52	0	52	76
Buses	0	0	0	0	0	0	0	0	0	11	0	11	0	0	0	0	11
Peak Hour: 7:00 - 8:00	7	1	2	10	8	9	6	23	4	709	30	743	5	1612	8	1625	2401

AFTERNOON 3:30 to 4:30

Time (a.m.)	Chester St NB LT	NB ST	NB RT	NB TOT	Chester St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL
Auto	51	9	14	74	17	2	11	30	15	1448	18	1481	9	1169	3	1181	2766
Trucks	1	0	0	1	0	0	0	0	0	55	1	56	0	24	0	24	81
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peak Hour: 3:30 to 4:30	52	9	14	75	17	2	11	30	15	1503	19	1537	9	1193	3	1205	2847

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Wedensday, March 4, 2009
N-S Road: Foster St
E-W Road: Nairn Avenue
Weather:
Recorder:

MORNING

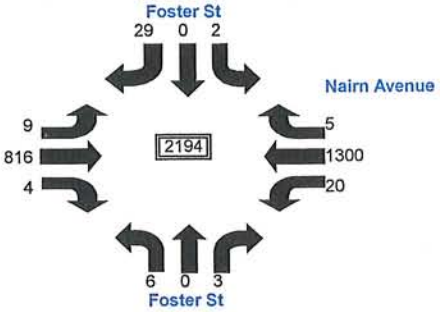
Time Finish	Foster St NB LT	NB ST	NB RT	NB TOT	Foster St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL	HOUR TOT
6:45	3	0	1	4	1	0	8	9	0	256	0	256	0	306	0	306	575	
7:00	1	0	0	1	2	0	2	4	2	188	0	190	0	259	2	261	456	
7:15	2	0	1	3	1	0	5	6	0	202	2	204	4	360	0	364	577	
7:30	2	0	1	3	0	0	3	3	1	181	1	183	3	311	0	314	503	2111
7:45	1	0	1	2	0	0	8	8	4	233	0	237	7	311	3	321	568	2104
8:00	1	0	0	1	1	0	13	14	4	200	1	205	6	318	2	326	546	2194
8:15	0	0	1	1	0	0	8	8	1	199	1	201	2	304	3	309	519	2136
8:30	2	0	2	4	1	0	4	5	3	176	0	179	2	321	3	326	514	2147
8:45	1	0	1	2	1	1	8	10	10	173	1	184	4	300	6	310	506	2085
9:00	2	0	5	7	1	0	5	6	1	235	3	239	3	278	1	282	534	2073
Peak : 7:00 - 8:00	6	0	3	9	2	0	29	31	9	816	4	829	20	1300	5	1325	2194	

AFTERNOON

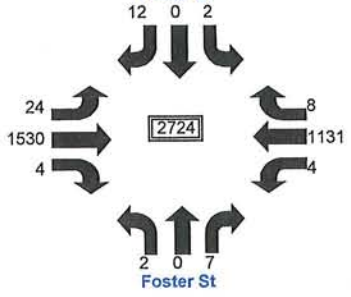
Time Finish (p.m.)	Foster St NB LT	NB ST	NB RT	NB TOT	Foster St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL	HOUR TOT
3:45	0	1	3	4	0	0	1	1	6	323	3	332	5	258	2	265	602	
4:00	0	0	4	4	0	0	1	1	4	378	0	382	1	360	4	365	752	
4:15	1	0	0	1	0	0	2	2	7	344	0	351	2	286	0	288	642	
4:30	1	0	1	2	2	0	6	8	7	382	1	390	0	219	3	222	622	2618
4:45	0	0	2	2	0	0	3	3	6	426	3	435	1	266	1	268	708	2724
5:00	0	0	5	5	0	0	2	2	5	362	0	367	0	237	5	242	616	2588
5:15	3	0	5	8	2	0	6	8	9	385	0	394	1	288	0	289	699	2645
5:30	1	0	2	3	2	0	7	9	3	362	1	366	1	252	2	255	633	2656
5:45	0	1	2	3	0	0	3	3	4	311	1	316	0	230	3	233	555	2503
6:00	0	0	0	0	1	0	1	2	3	276	1	280	0	217	0	217	499	2386
Peak : 3:45 - 4:45 p.m.	2	0	7	9	2	0	12	14	24	1530	4	1558	4	1131	8	1143	2724	

Summary:

AM Peak
7:00 - 8:00



PM Peak
3:45 - 4:45 p.m.



Classification Data

MORNING 7:00 - 8:00

Time (a.m.)	Foster St NB LT	NB ST	NB RT	NB TOT	Foster St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL
Auto	4	0	2	6	2	0	29	31	9	756	4	769	14	1261	5	1280	2086
Trucks	2	0	1	3	0	0	0	0	0	44	0	44	6	24	0	30	77
Buses	0	0	0	0	0	0	0	0	0	16	0	16	0	15	0	15	31
Peak Hour: 7:00 - 8:00	6	0	3	9	2	0	29	31	9	816	4	829	20	1300	5	1325	2194

AFTERNOON 3:45 - 4:45 p.m.

Time (a.m.)	Foster St NB LT	NB ST	NB RT	NB TOT	Foster St SB LT	SB ST	SB RT	SB TOT	Nairn Avenue EB LT	EB ST	EB RT	EB TOT	Nairn Avenue WB LT	WB ST	WB RT	WB TOT	TOT ALL
Auto	2	0	7	9	2	0	12	14	24	1486	4	1514	4	1084	8	1096	2633
Trucks	0	0	0	0	0	0	0	0	0	26	0	26	0	31	0	31	57
Buses	0	0	0	0	0	0	0	0	0	18	0	18	0	16	0	16	34
Peak Hour: 3:45 - 4:45 p.m.	2	0	7	9	2	0	12	14	24	1530	4	1558	4	1131	8	1143	2724

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Wedensday, March 4, 2009
N-S Road: Grey St
E-W Road: Nairn Avenue
Weather:
Recorder:

MORNING

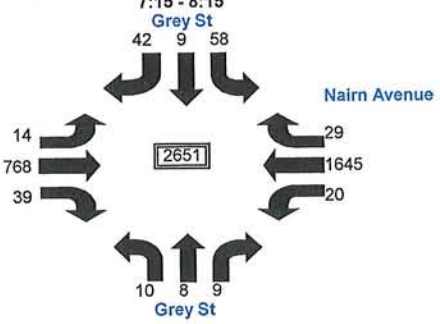
Time Finish	Grey St NB LT	Grey St NB ST	Grey St NB RT	NB TOT	Grey St SB LT	Grey St SB ST	Grey St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL	HOUR TOT
6:45	1	1	0	2	15	2	4	21	0	235	3	238	2	290	4	296	557	
7:00	0	0	0	0	8	3	13	24	2	209	5	216	1	300	4	305	545	
7:15	0	0	1	1	10	0	8	18	1	184	3	188	1	355	3	359	566	
7:30	3	1	0	4	12	0	14	26	1	188	8	197	2	426	6	434	661	2329
7:45	3	3	2	8	16	2	5	23	4	196	9	209	6	382	7	395	635	2407
8:00	3	2	4	9	16	6	11	33	4	202	12	218	5	328	10	343	603	2465
8:15	1	2	3	6	14	1	12	27	5	182	10	197	7	509	6	522	752	2651
8:30	7	3	4	14	19	1	15	35	5	165	7	177	6	294	10	310	536	2526
8:45	11	1	6	18	10	4	12	26	10	160	8	178	11	282	11	304	526	2417
9:00	10	2	8	20	28	1	20	49	4	216	12	232	10	256	10	276	577	2391
Peak : 7:15 - 8:15	10	8	9	27	58	9	42	109	14	768	39	821	20	1645	29	1694	2651	

AFTERNOON

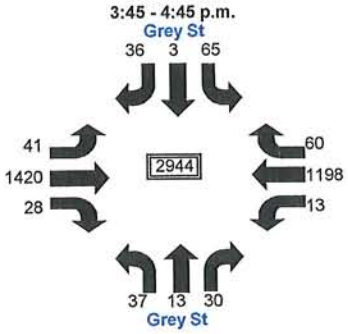
Time Finish (p.m.)	Grey St NB LT	Grey St NB ST	Grey St NB RT	NB TOT	Grey St SB LT	Grey St SB ST	Grey St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL	HOUR TOT
3:45	10	4	6	20	18	0	16	34	16	312	0	328	1	287	9	297	679	
4:00	8	3	6	17	19	0	8	27	13	349	1	363	4	333	19	356	763	
4:15	6	4	8	18	12	0	12	24	6	321	6	333	6	331	11	348	723	
4:30	6	1	2	9	16	0	5	21	10	370	11	391	0	242	15	257	678	2843
4:45	17	5	14	36	18	3	11	32	12	380	10	402	3	292	15	310	780	2944
5:00	7	5	6	18	13	5	8	26	18	340	3	361	2	231	17	250	655	2836
5:15	12	4	2	18	14	0	13	27	18	384	1	403	0	287	14	301	749	2862
5:30	6	6	4	16	23	2	9	34	5	325	4	334	2	272	19	293	677	2861
5:45	2	3	3	8	24	0	5	29	13	291	1	305	0	236	11	247	589	2670
6:00	4	1	1	6	16	0	6	22	8	256	0	264	0	235	14	249	541	2556
Peak : 3:45 - 4:45 p.m.	37	13	30	80	65	3	36	104	41	1420	28	1489	13	1198	60	1271	2944	

Summary:

AM Peak
7:15 - 8:15



PM Peak
3:45 - 4:45 p.m.



Classification Data

MORNING 7:15 - 8:15

Time (a.m.)	Grey St NB LT	Grey St NB ST	Grey St NB RT	NB TOT	Grey St SB LT	Grey St SB ST	Grey St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL
Auto	9	8	3	20	55	9	42	106	14	733	38	785	19	1608	29	1656	2567
Trucks	1	0	6	7	3	0	0	3	0	21	1	22	1	37	0	38	70
Buses	0	0	0	0	0	0	0	0	0	14	0	14	0	0	0	0	14
Peak Hour: 7:15 - 8:15	10	8	9	27	58	9	42	109	14	768	39	821	20	1645	29	1694	2651

AFTERNOON 3:45 - 4:45 p.m.

Time (a.m.)	Grey St NB LT	Grey St NB ST	Grey St NB RT	NB TOT	Grey St SB LT	Grey St SB ST	Grey St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL
Auto	34	13	26	73	65	3	36	104	41	1396	22	1459	9	1144	59	1212	2848
Trucks	3	0	4	7	0	0	0	0	0	24	6	30	4	36	1	41	78
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	18	18
Peak Hour: 3:45 - 4:45 p.m.	37	13	30	80	65	3	36	104	41	1420	28	1489	13	1198	60	1271	2944

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Tuesday, March 10, 2009
N-S Road: Watt St
E-W Road: Nairn Avenue
Weather:
Recorder:

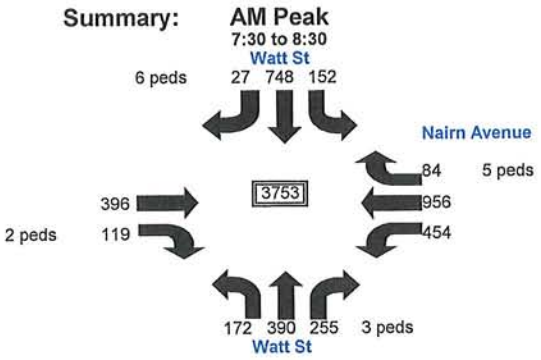
MORNING

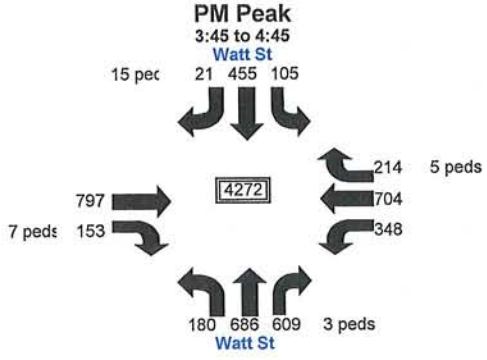
Time Finish	Watt St NB LT	Watt St NB ST	Watt St NB RT	NB TOT	Watt St SB LT	Watt St SB ST	Watt St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL	HOUR TOT
6:45	27	53	39	119	43	136	3	182	-	124	45	169	73	143	14	230	700	
7:00	30	52	45	127	30	96	3	129	-	102	31	133	116	199	21	336	725	
7:15	21	52	53	126	35	125	6	166	-	88	28	116	78	231	21	330	738	
7:30	43	66	36	145	26	143	4	173	-	79	30	109	120	280	17	417	844	3007
7:45	47	104	85	236	41	218	7	266	-	146	30	176	119	278	20	417	1095	3402
8:00	50	107	65	222	50	202	6	258	-	81	32	113	116	228	24	368	961	3638
8:15	36	81	42	159	30	195	8	233	-	57	25	82	99	221	24	344	818	3718
8:30	39	98	63	200	31	133	6	170	-	112	32	144	120	229	16	365	879	3753
8:45	41	91	66	198	18	150	6	174	-	86	38	124	106	186	18	310	806	3464
9:00	31	71	43	145	34	119	5	158	-	97	23	120	73	179	28	280	703	3206
Peak : 7:30 to 8:30	172	390	255	817	152	748	27	927	0	396	119	515	454	956	84	1494	3753	

AFTERNOON

Time Finish (p.m.)	Watt St NB LT	Watt St NB ST	Watt St NB RT	NB TOT	Watt St SB LT	Watt St SB ST	Watt St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL	HOUR TOT
3:45	51	145	152	348	13	126	3	142	-	147	45	192	63	174	41	278	960	
4:00	60	140	159	359	19	111	11	141	-	201	32	233	91	171	54	316	1049	
4:15	23	183	159	365	23	119	2	144	-	231	49	280	97	208	60	365	1154	
4:30	26	191	164	381	34	104	6	144	-	235	42	277	73	151	53	277	1079	4242
4:45	71	172	127	370	29	121	2	152	-	130	30	160	87	174	47	308	990	4272
5:00	38	156	126	320	24	103	3	130	-	218	42	260	76	158	28	262	972	4195
5:15	30	212	173	415	35	104	2	141	-	169	24	193	81	143	60	284	1033	4074
5:30	35	155	95	285	15	105	2	122	-	143	30	173	53	150	30	233	813	3808
5:45	30	135	125	290	25	91	3	119	-	178	23	201	47	107	37	191	801	3619
6:00	20	131	69	220	24	84	4	112	-	127	20	147	58	151	45	254	733	3380
Peak : 3:45 to 4:45	180	686	609	1475	105	455	21	581	0	797	153	950	348	704	214	1266	4272	

Summary:





Classification Data

MORNING 7:30 to 8:30

Time (a.m.)	Watt St NB LT	Watt St NB ST	Watt St NB RT	NB TOT	Watt St SB LT	Watt St SB ST	Watt St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL
Auto	167	374	249	790	142	738	26	906	0	375	111	486	444	920	78	1442	3624
Trucks	5	6	4	15	8	6	1	15		12	8	20	10	21	6	37	87
Buses	0	10	2	12	2	4	0	6		9	0	9	0	15	0	15	42
Peak Hour: 7:30 to 8:30	172	390	255	817	152	748	27	927	0	396	119	515	454	956	84	1494	3753

AFTERNOON 3:45 to 4:45

Time (a.m.)	Watt St NB LT	Watt St NB ST	Watt St NB RT	NB TOT	Watt St SB LT	Watt St SB ST	Watt St SB RT	SB TOT	Nairn Avenue EB LT	Nairn Avenue EB ST	Nairn Avenue EB RT	EB TOT	Nairn Avenue WB LT	Nairn Avenue WB ST	Nairn Avenue WB RT	WB TOT	TOT ALL
Auto	172	669	601	1442	105	446	21	572	0	774	142	916	339	672	208	1219	4149
Trucks	8	11	6	25	0	3	0	3		9	7	16	8	19	5	32	76
Buses	0	6	2	8	0	6	0	6		14	4	18	1	13	1	15	47
Peak Hour: 3:45 to 4:45	180	686	609	1475	105	455	21	581	0	797	153	950	348	704	214	1266	4272

City of Winnipeg East Public Works Yards Relocation
Traffic Count Summary

Date: Tuesday, March 10, 2009
N-S Road: Archibald St
E-W Road: Mission St
Weather:
Recorder:

MORNING

Time Finish	Archibald St NB ST	RT	NB TOT	Archibald St SB LT	ST	SB TOT			Mission St WB LT	RT	WB TOT	TOT ALL	HOUR TOT
6:45	121	29	150	59	200	259			12	12	24	433	
7:00	130	23	153	29	261	290			18	8	26	469	
7:15	119	13	132	14	218	232			51	9	60	424	
7:30	147	15	162	21	300	321			61	12	73	556	1882
7:45	203	21	224	18	331	349			91	8	99	672	2121
8:00	256	20	276	31	329	360			57	8	65	701	2353
8:15	186	16	202	10	310	320			67	8	75	597	2526
8:30	208	14	222	10	275	285			66	4	70	577	2547
8:45	204	20	224	7	268	275			47	6	53	552	2427
9:00	168	18	186	9	220	229			36	8	44	459	2185
Peak : 7:30 to 8:30	853	71	924	69	1245	1314			281	28	309	2547	

AFTERNOON

Time Finish (p.m.)	Archibald St NB ST	RT	NB TOT	Archibald St SB LT	ST	SB TOT			Mission St WB LT	RT	WB TOT	TOT ALL	HOUR TOT
3:45	297	34	331	5	261	266			43	27	70	667	
4:00	270	44	314	5	251	256			32	13	45	615	
4:15	275	46	321	8	252	260			28	15	43	624	
4:30	366	79	445	6	217	223			34	16	50	718	2624
4:45	297	37	334	4	243	247			41	30	71	652	2609
5:00	307	49	356	5	235	240			25	20	45	641	2635
5:15	357	53	410	2	209	211			24	11	35	656	2667
5:30	321	53	374	4	187	191			29	8	37	602	2551
5:45	255	45	300	3	176	179			23	11	34	513	2412
6:00	250	36	286	5	146	151			17	8	25	462	2233
Peak : 4:15 to 5:15	1327	218	1545	17	904	921			124	77	201	2667	

Summary:

AM Peak
7:30 to 8:30
Archibald St
1245 69
Mission St
28
2547
281
853 71
Archibald St

PM Peak
4:15 to 5:15
Archibald St
904 17
77
2667
124
1327 218
Archibald St

Classification Data

MORNING 7:30 to 8:30

Time (a.m.)	Archibald St NB ST	RT	NB TOT	Archibald St SB LT	ST	SB TOT		EB TOT	Mission St WB LT	RT	WB TOT	TOT ALL
Auto	822	71	893	69	1219	1288		0	269	24	293	2474
Trucks	15	0	15	0	20	20		0	10	4	14	49
Buses	16	0	16	0	6	6		0	2	0	2	24
Peak Hour: 7:30 to 8:30	853	71	924	69	1245	1314		0	281	28	309	2547

AFTERNOON 4:15 to 5:15

Time (a.m.)	Archibald St NB	ST	RT	NB TOT	Archibald St SB LT	ST		SB TOT				EB TOT	Mission St WB LT		RT	WB TOT	TOT ALL
Auto	0	1307	208	1515	16	881	0	897	0	0	0	0	121	0	76	197	2609
Trucks		15	5	20	1	10		11				0	1		1	2	33
Buses		5	5	10	0	13		13				0	2		0	2	25
Peak Hour: 4:15 to 5:15		1327	218	1545	17	904		921				0	124		77	201	2667

Appendix B

Detailed Level of Service Definitions

COMMONLY USED LEVEL OF SERVICE DEFINITIONS

Level of Service For Urban Arterial Road		Level of Service For Traffic Signal Controlled Intersection
Free flowing traffic with average overall travel speed in the upper range.	A	Minimal delay experienced by motorists and no traffic signal phase is fully utilized. Very seldom does a motorist wait longer than the duration of one red signal interval. The approaches appear open, turning movements are easily made and drivers have freedom of operation. The (Poisson) probability is that 95% of the time all vehicles arriving on one complete cycle will clear during the next green interval.
Delay is not unreasonable. Average overall speeds drop due to intersection delay and intervehicular conflicts.	B	Traffic signal phases are occasionally fully utilized and delays experienced by motorists are not unreasonable. Many drivers begin to feel somewhat restricted within groups of vehicles approaching the intersection. The (Poisson) probability is that 90% of the time all vehicles arriving on one cycle will clear during the next green interval.
Traffic flow still stable with acceptable delays. Average overall travel speeds in the middle range.	C	Traffic signal phases are more frequently fully utilized, but delays are still acceptable. Drivers feel more restricted, may have to wait more than the duration of one red signal interval and queues may develop behind turning vehicles. The (Poisson) probability is that 75% of the time all vehicles arriving on one complete cycle will clear during the next green interval.
Approaching unstable flow. Delays at intersections may become extensive. Average overall speeds in the lower range.	D	Drivers experience increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period but there are enough traffic signal cycles with lower demand to permit the occasional clearance of developing queues and prevent excessive back-ups. The (Poisson) probability is that 60% of the time all vehicles arriving on one complete cycle will clear during the next green interval.
Unstable flow. Continuous backup on approaches to intersections. Average over-all traffic speed variable but in the lower range.	E	Traffic flow demand equals the capacity. Continuous delays are experienced. There are long queues of vehicles waiting upstream of the intersection and delays to vehicles may extend to several traffic signal cycles. The (Poisson) probability is that 50% of the time all vehicles arriving on one complete cycle will clear during the next green interval.

Appendix C

Existing vs. Forecast Capacity Analysis

The following operational impacts were noted upon comparison of the existing and forecast morning peak hour corridor operations:

- *Lagimodiere Boulevard and Regent Avenue* – eastbound left-turn decreases from LOS D to LOS E and overall intersection operation decreases from LOS C to LOS D
- *Nairn Avenue and Panet Road* – none to report
- *Nairn Avenue and Stapleton Street* – northbound approach maintains LOS F, but v/c increases from 0.27 to 0.97. Overall operation decreases from LOS B to LOS C
- *Nairn Avenue and Keenleyside Street* – overall intersection ICU increasing from 73 to 97 percent with LOS A
- *Nairn Avenue and Kent Street* – overall intersection ICU increasing from 60 to 79 percent with LOS A
- *Nairn Avenue and Chester Street* – northbound approach decreases from LOS C to LOS D
- *Nairn Avenue and Foster Street* – southbound approach decreases from LOS C to LOS D
- *Nairn Avenue and Grey Street* – none to report
- *Nairn Avenue and Watt Street* – none to report
- *Archibald Street and Mission Street* – none to report
- *Mission Street and Panet Road* – none to report

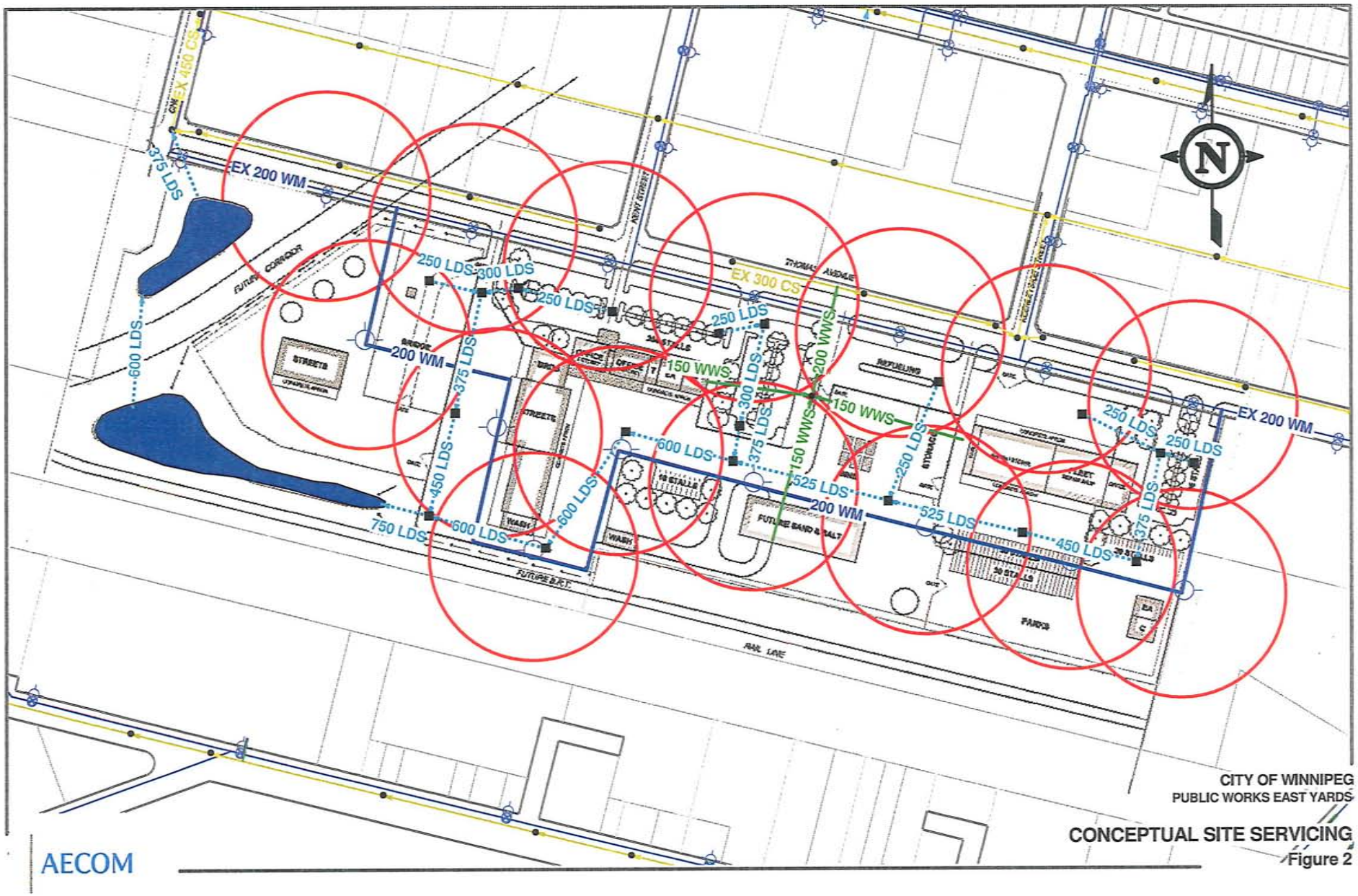
The reduced level of service and loss of capacity during the morning peak hour results from a combination of mildly increased northbound traffic demands as assumed site vehicles and equipment leaves the Public Works Yards for the day, as well as increased traffic volumes on Nairn Avenue from background traffic growth (not associated with the site) and site generated traffic entering the site (employees starting shift).

The operational impacts noted upon comparing the existing and forecast afternoon peak hour corridor operations include:

- *Lagimodiere Boulevard and Regent Avenue* – eastbound left-turn decreases from LOS E to LOS F and V/C ratio increases to 0.84 from 0.66
- *Nairn Avenue and Panet Road* – the eastbound shared through and right turn movement increases in V/C ratio from 0.80 to 0.95, while its southbound through decreases from LOS C to LOS D
- *Nairn Avenue and Stapleton Street* – northbound approach decreases from LOS C to LOS D

Appendix D

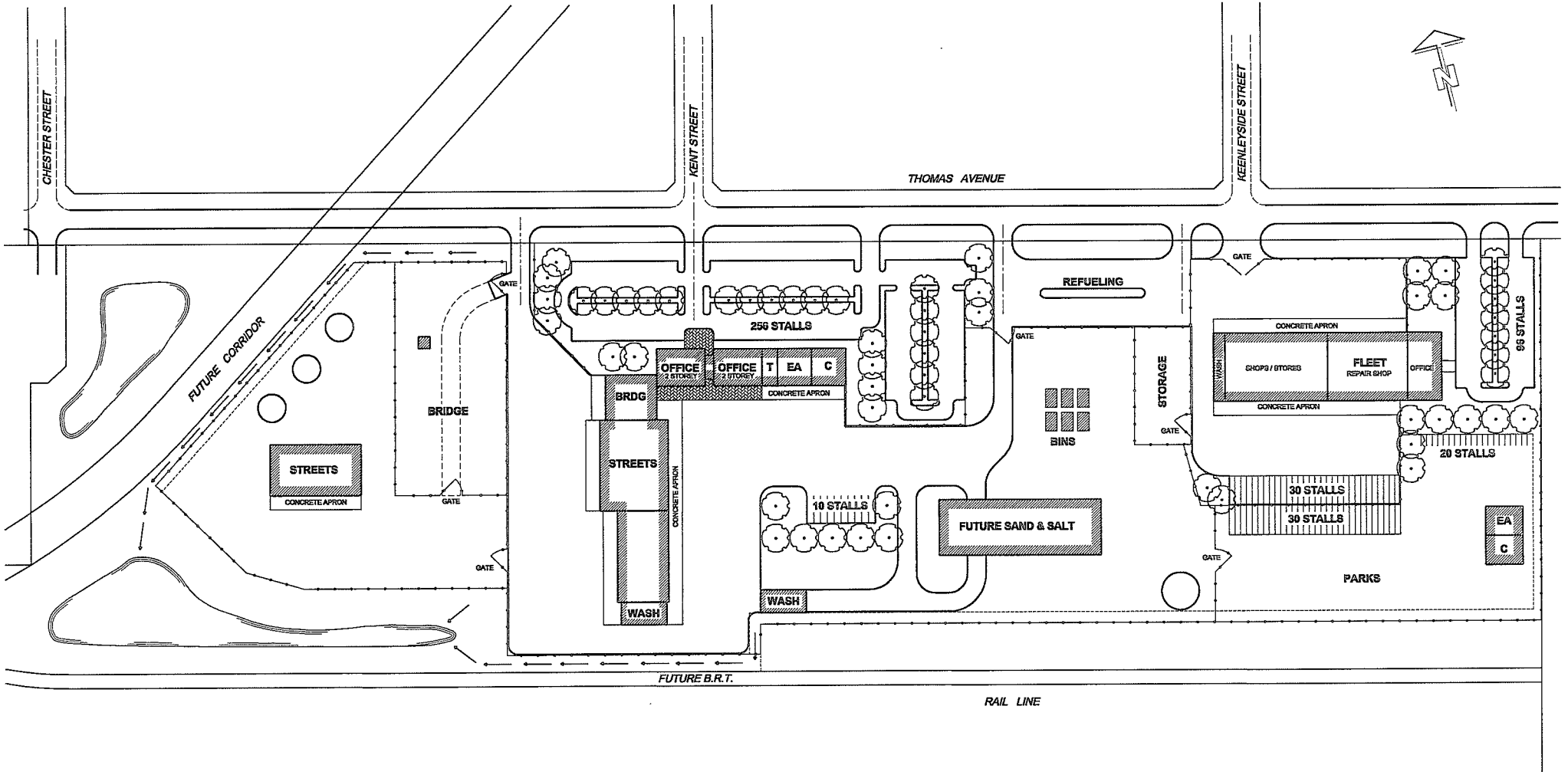
Schematics of Future Transportation Network Corridors

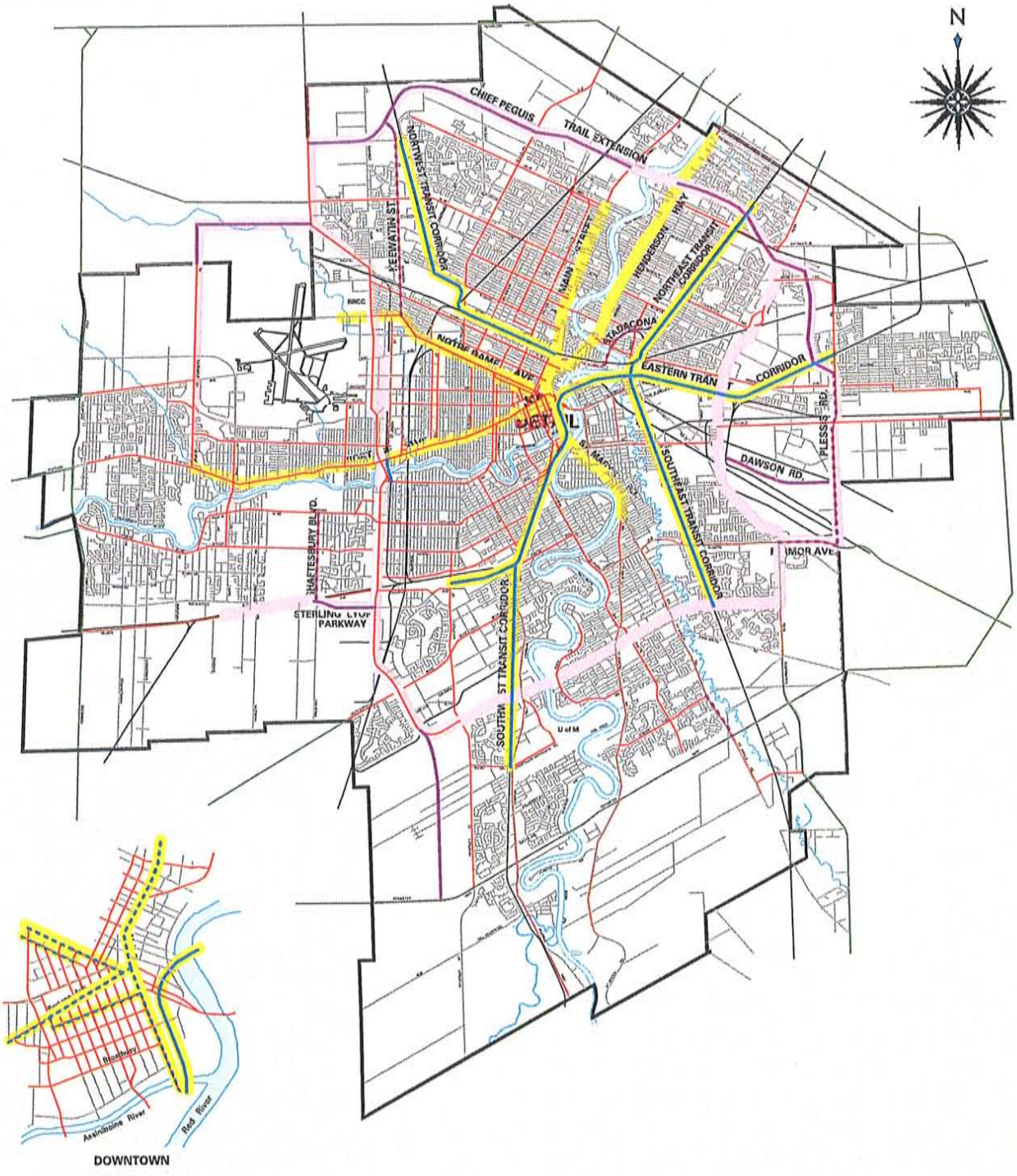


CITY OF WINNIPEG
PUBLIC WORKS EAST YARDS

CONCEPTUAL SITE SERVICING
Figure 2

AECOM


CHESTER STREET
KENT STREET
THOMAS AVENUE
KEENLEYSIDE STREET
FUTURE CORRIDOR
BRIDGE
GATE
STREETS
CONCRETE APRON
256 STALLS
OFFICE
2 STOREY
OFFICE
2 STOREY
T
EA
C
BRDG
STREETS
CONCRETE APRON
WASH
10 STALLS
REFUELING
BINS
STORAGE
FUTURE SAND & SALT
CONCRETE APRON
SHOPS / STORES
FLEET
REPAIR SHOP
OFFICE
WASH
99 STALLS
20 STALLS
30 STALLS
30 STALLS
EA
C
PARKS
FUTURE B.R.T.
RAIL LINE



Policy Plate C

TRANSPORTATION CONCEPT PLAN
TO 2020 AND BEYOND

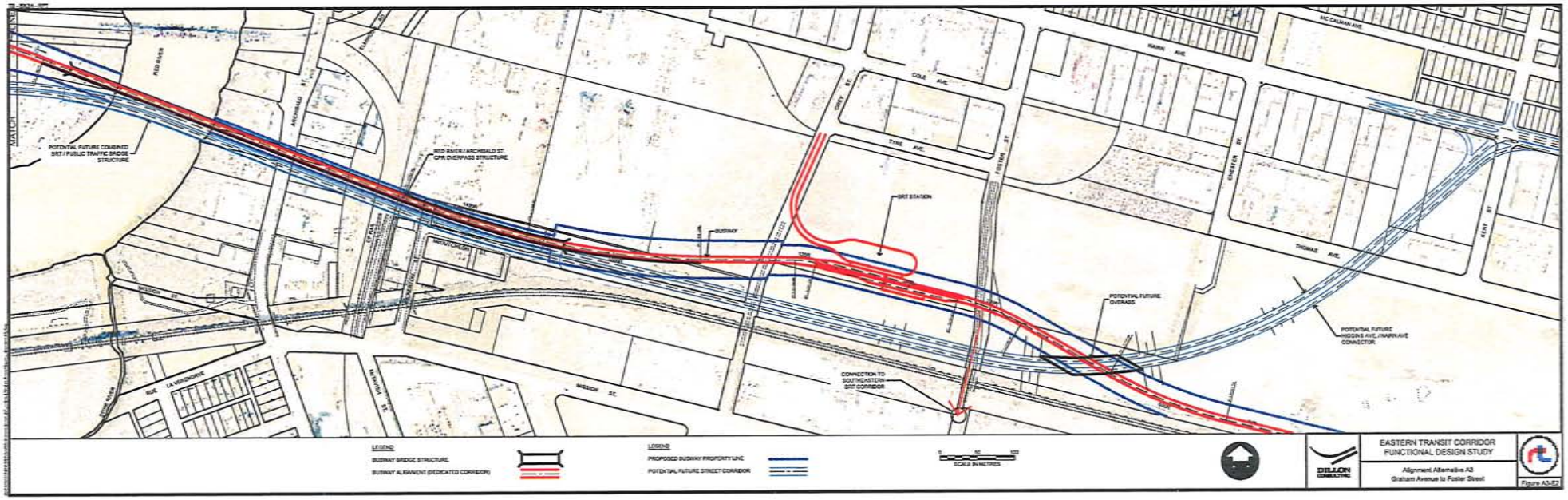
PLAN WINNIPEG 2020 VISION

Winnipeg

- REGIONAL STREET NETWORK (for information only, not designated by this Plan)
- HIGH SPEED TRANSIT NETWORK
- Busway (Bus-Only Roadway in a Dedicated Right-of-Way)
- On-Street Transit Priority Measures (e.g. Diamond Lanes, Transit Priority Signals)
- INNER RING / LOOP ROUTES (West & East)
- Major Street Additions For Consideration Beyond 2020
- Major Street Widenings For Consideration Beyond 2020
- HIGHWAY NETWORK (Under Provincial Jurisdiction)
- CITY OF WINNIPEG BOUNDARY

EFFECTIVE DATE: December 12, 2001

This map is intended for information only. Its interpretation should be confirmed by contacting The City of Winnipeg Planning, Property and Development Department at: (204) 986-7731.


POTENTIAL FUTURE COMBINED BRT / PUBLIC TRAFFIC BRIDGE STRUCTURE
RED RIVER / ARCHIBALD ST. CPR OVERPASS STRUCTURE
BUSWAY
BRT STATION
POTENTIAL FUTURE OVERASS
POTENTIAL FUTURE HIGGINS AVE. / MAIN AVE CONNECTOR
CONNECTION TO SOUTHEASTERN BRT CORRIDOR
RED RIVER
ARCHIBALD ST.
MISSION ST.
TYNE AVE.
FOSTER ST.
MAIN AVE.
DRAYTON ST.
THOMAS AVE.
KENT ST.
COLE AVE.
MC CALMAN AVE.
LEGEND
BUSWAY BRIDGE STRUCTURE
BUSWAY ALIGNMENT (DEDICATED CORRIDOR)
LEGEND
PROPOSED BUSWAY FIGIFORTY LINE
POTENTIAL FUTURE STREET CORRIDOR
SCALE IN METRES
DILLON CONSULTING
EASTERN TRANSIT CORRIDOR FUNCTIONAL DESIGN STUDY
Alignment Alternative A3
Graham Avenue to Foster Street
Figure A3-E2

Appendix D4

Former Elmwood / Narin Landfill Site Final Preliminary

Site Condition Assessment Report [KGS Group]

CITY OF WINNIPEG

FORMER ELMWOOD / NAIRN LANDFILL SITE
FINAL PRELIMINARY SITE CONDITION ASSESSMENT REPORT

December 2008

KGS GROUP

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

08-0107-15_COVERPAGE.CRD

Winnipeg

CITY OF WINNIPEG
FORMER ELMWOOD / NAIRN AVENUE LANDFILL SITE
PRELIMINARY SITE CONDITIONS ASSESSMENT
FINAL REPORT

December 2008
KGS Group Project No. 08-0107-15

Privileged and Confidential

Prepared for:
City of Winnipeg
Planning Property and Development Department
Civic Accommodation Division
3rd Floor, 65 Garry Street
Winnipeg, Manitoba R3C 4K4

KGS Group
Prepared by:

Bob Long, P.Eng.
Senior Structural Engineer

KGS Group
Prepared by:

Mark Wilcox, C.E.T., B. Sc.
Environmental Scientist/Geomatics Specialist

KGS Group
Prepared by:

Brian Bodnaruk, P.Eng.
Senior Hydraulic/Hydrological Engineer

KGS Group
Reviewed by:

Robert D. Sinclair, P. Eng.
Manager, Environmental Services

KGS GROUP

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

December 23, 2008 File No. 08-0107-15

City of Winnipeg
Planning Property and Development Department
Civic Accommodation Division
3rd Floor, 65 Garry Street
Winnipeg, Manitoba
R3C 4K4

ATTENTION: Ms. Bonnie Konzelman, P. Eng.
Contract Coordinator

RE: Former Elmwood / Nairn Avenue Landfill Site
Preliminary Site Conditions Assessment Report
City Of Winnipeg

Dear Ms. Konzelman:

Please find a copy of the Former Elmwood / Nairn Avenue Landfill Site Final Preliminary Site Conditions Assessment Report.

We trust the above final report is adequate for the City of Winnipeg to complete their review of the site condition and proposed recommendations, however, please do not hesitate to contact the undersigned should you have any questions.

Yours truly,

Robert D. Sinclair, P. Eng.
Manager, Environmental Services

RDS/jr
Enclosed

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
SUITE 301A, 1001 WILLIAM ST., THUNDER BAY, ONTARIO, P7B 6M1 PH:(807)623-2195 FAX:(807)473-5671

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1.0 INTRODUCTION

KGS Group has been contracted by the City of Winnipeg to conduct a preliminary site condition assessment on the former Elmwood/Nairn Avenue Landfill Site (See Figure 1). The City of Winnipeg is evaluating the cost-effectiveness and practicality of developing a Works and Operation Yard and possibly a Fleet Maintenance Building on the landfill site.

The facilities components are currently defined to require in the order of 12 hectares (30 acres) with the Works and Operation Building having an area of approximately 9,000 m^2 (100,000 ft^2) composed mainly of garage area, a Fleet Maintenance Facility of approximate 4,500 m^2 (50,000 ft^2), a salt storage facilty with road access for heavy equipment, both granular and paved parking areas and yard storage areas as well as a small, 0.6 hectare (1.5 acre) stormwater management pond within approximately 12 hectares (30 acres). A possible refueling station may also be situated on site. The following study components are presented in the report.

- Review of Background Data
- Geophysical Screening Survey
- Test Pit and Groundwater Quality Survey (77 test pit logs in Appendix A)
- Foundation Options and Cost Evaluation (Appendix B)
- Stormwater Management Pond Evaluation (Appendix C)
- Leadership in Energy and Environmental Design (LEED) Components

The study components are presented in this final report with appendices.

2.0 BACKGROUND DATA

The site was formally part of an east-west trending depression that was made up of east-west elongated swampy areas. Remnants of these wet depressions are visible to the east of Highway 59/Lagimodiere. These low, wet pond areas were systematically in filled using mainly waste asphalt, concrete and soil from City of Winnipeg road renewal projects from back into the 1950's to about the 1990's. Current employees of local asphalt/concrete recycling companies worked on this site in the past.

KGS Group conducted a Landfill Site Disposition Study for the City of Winnipeg in 1992 to 1993, however, there was limited information on the Elmwood/Nairn Avenue Site likely because it was known to be essentially construction wastes (asphalt, concrete and soil) mainly from City of Winnipeg street road renewals and this previous 1993 study was focused on landfill leachate and gas concerns.

Four existing piezometers were located on site, two near Thomas Avenue, one at the back near the CN Rail line, and one located in the snow dump area. These were sampled for groundwater quality and landfill gas (methane) levels, water quality data is presented in Table 2.

A general geologic profile for the site is 1 m of soil cover, 2 to 3 m of asphalt, concrete and soil underlain by reeds and bulrushes with about 0.3 m of bog/peat deposit overlying brown, undisturbed silty clay.

3.0 GEOPHYSICAL SCREENING SURVEY

The Elmwood Landfill geophysical survey was completed on November 4th and November 13th, 2008 by KGS Staff Personnel. The geophysical survey consisted of using an electromagnetic conductivity (EM) device on an approximate 10-metre grid within the landfill site. A local EM benchmark site was established to insure quality control of the EM Survey.

3.1 EQUIPMENT AND METHODS

EM 31 Mk 2

The geophysical electromagnetic conductivity survey utilized the Geonics EM 31 Mk 2 electromagnetic induction instrument to measure in-situ conductivity. The EM 31 has a fixed coil spacing of 3.66 meters and operates on a 9.8 kHz frequency. The EM 31 instrument was completed in the Vertical Dipole Position. This allows for the Quadrature Phase (conductivity) and in-phase readings to a depth of 6 m. The units of measure used for conductivity is millimho/metre (also known as millisiemens/metre) and the In-phase unit of measure is parts per thousand (PPT).

The instrument was properly calibrated to the manufacturer specifications. This included the procedure of instrument zeroing every day and checking onto the same location at the start and end of every day to ensure that instrument drift did not occur. During the course of the survey no drift above +/- 0.2 millimhos/m was detected and the zero check value was 0.0 on each day. The benchmark site was located on the northern location of the site.

Global Positioning System (GPS)

EM 31 surveys were conducted by coupling the EM 31 Mk2 to a Trimble GeoXT real time sub-meter differential grade GPS (DGPS) unit with Post Processing capabilities. This method allowed for the in the field coupling of all EM31 readings to have an accurate GPS position. The GPS/EM final positions were corrected to a KGS Survey Grade Base located on site for the survey. This procedure insured that all positions for the survey were corrected and has an absolute accuracy of no more than 0.5 metres.

3.2 GEOPHYSICAL RESULTS AND DATA ANALYSIS

The geophysical electromagnetic Vertical Dipole conductivity survey completed on the Elmwood property utilized the Geonics EM 31 Mk 2 electromagnetic induction instrument to measure in-situ conductivity. The EM 31 has a fixed coil spacing of 3.66 meters and operates on a 9.8 kHz frequency. This allows for the Quadrature Phase (conductivity) and in-phase readings to a depth of 6 m. The units of measure used for conductivity is millimho/metre (also known as millisiemens/metre). The conductivity is a measure of the resisteivty of the soil and is an indicator of the soil mass below the ground. The In-phase unit of measure is parts per thousand (PPT) and is very sensitive to large metallic objects that may be located below the ground surface.

The instrument was properly calibrated to the manufacturer specifications. This included the procedure of instrument zeroing every day and checking onto the same location at the start and end of every day to ensure that instrument drift did not occur. During the course of the survey no drift above +/- 0.2 millimhos/m was detected and the zero check value was 0.0 on each day. The benchmark site was located on the northern location of the site.

The EM conductivity survey readings were mapped and analyzed in a Geographical Information System (GIS) and overlaid with other known features. The EM 31 conductivity values were then interpolated by an Inverse Distance Weighting (IDW) GRID method to facilitate a conductivity surface. The GRID surface allows for better analysis when comparing the conductivity and in-phase readings and identifying trends across the project site. Figure 2 shows the vertical Di-pole conductivity for the Elmwood Landfill. The conductivity results are classified into EM ranges to assist in the interpretation and display of the conductivity results. The in-phase results are shown on Figure 3 and the blue indicates the locations of areas where the presence of higher levels of metallic material is located on the landfill site.

The EM conductivity results are consistent with the soil material found during the test pitting and demonstrate normal conductivity for these soil types and type of fill found during the investigation. The expected typical conductivity for the site was 50-125 mS/m. The In-phase component of the EM survey indicates that no large metal objects are buried in the landfill site up to a depth of 6 metres, but significant amounts of small metal and rebar are scattered

throughout the site, specifically in the areas south of the main access gate. The EM31 results indicate that the north end of site shows elevated conductivity (conductivity values 125-200 mS/m) that may be a result of road salting and the proximity of the water main and valves, but does not appear to be a result of leachate impacted soils. The area to the west show very high values of conductivity (150 to 600 mS/m and red in colour) that are higher than normal for the soils on site and is an indication of the presence of leachate to some extent. The test pitting in this area found garbage materiel and backfill in the western holes. The green areas show the lowest conductivity and define soil and rubble with lowly impacted groundwater.

4.0 TEST PIT AND GROUNDWATER QUALITY SURVEY

Following the above EM geophysical survey, KGS Group conducted a program of 77 test pits over the site between November 3 and 13, 2008 and this subsurface information is presented in Appendix A and the test pit locations are shown on Figure 4. A backhoe and operator was supplied by J. D. Penner Ltd of Winnipeg. The EM geophysical survey provided information as to areas of concern but it was still important to provide a broad coverage of the site. As noted in the EM survey figures, the main area of concern in terms of actual municipal waste with leachate is on the north side of the snow dump area between Foster and Chester Avenue adjacent to the car parts recycling facility. Concrete with rebar is exposed in many areas throughout the area west of Chester Avenue. Other than this area there are no significant environmental limitation to development over the remaining area to the east.

The partial groundwater quality data base as presented in Table 1, is quite variable but presents no significant concerns. Conductivity is a general parameter that reflects overall groundwater quality. The results from the site demonstrate measurable, but relatively low leachate impact levels based on a measure of dissolved minerals or leachate in the groundwater. Levels in the 2000 mS/m range demonstrated no real leachate impacts, below 10,000 mS/m low leachate impacts and over 25,000 mS/m medium to higher leachate impacts and values near 100,000 very high leachate impacts. This quality data, coupled with the fact that not all holes encountered groundwater, also suggests that groundwater quality or quantity will not present significant concerns during construction. Groundwater quality shows pH values in the 8 to 10 range and this is expected for long-term leaching of the basic pH levels from concrete cements. Groundwater may flow into the excavation but will slow within several days and could be readily pumped back to the ponds along the south side of the property or to the storm ponds with good construction schedule planning. Dilution with on-site ponds or storm pond would be expected to lower pH values into the 8 to 9 range with no real concerns. These small ponds may fill and overflow, but overland discharge through the current thick, natural grasses would mitigate most quality concerns.

5.0 FOUNDATION OPTIONS AND COST EVALUATION

As noted previously, this work component is presented in Appendix B. Also, in overall terms, the City of Winnipeg can locate the facility anywhere east of Chester Avenue with no real preference relative to environmental or geotechnical foundations design concepts.

6.0 STORMWATER MANAGEMENT POND EVALUATION

A small stormwater management pond will be required to dampen out peak flows from the proposed development as well as settle suspended solids from overall site but with a focus on granular parking and roadway areas. The stormwater management pond sizing evaluation is presented in Appendix C. An area of approximately 0.4 hectare (1 acre) will be required within a fenced area with approximate 2 m of operating depth.

The drainage district for this site is the Mission District which is about to be studied for relief. There is a 1500 mm sewer on Mission south of the railway tracks. The existing snow dump, site for pond, has a drain system with a valve and a pipe to the 450 mm storm sewer on Chester, with drainage then into the Roland District.

The conservative approach would be to limit the drainage of the entire site prior to development. Therefore a connection using the existing pit and valve system at Chester is recommended. The existing system should be inspected during the next phase of this work. Scheduling the storm pond and site drainage early in the process and possibly oversizing the required storm water pond would mitigate run-off concerns during, as well as after, construction.

7.0 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED)

The proposed construction on a former landfill site would present LEED components as would the recycling of wastes where cost-effective. Furthermore, KGS Group has completed geothermal HVAC evaluation for the casino on Regent Avenue and has ongoing groundwater work at the Freshwater Fish Marketing Corporation further east in Transcona. There would be options to consider groundwater based geothermal systems, horizontally bored, closed loop system below the rubble wastes or a combination of the two options, all of which are significant LEED components.

The City of Winnipeg Streets Maintenance group currently has a standing offer with Rocky Roads located just to the west of the study site. Rocky Roads can supply crushed recycled waste material that meets City of Winnipeg specifications for various uses. All of the waste asphalt and concrete recyclers would take the landfill rubble that must be excavated at no cost with some reimbursement from Rocky Roads possible. All recyclers require that the material not include significant dirt levels and such material would require storage to allow rainfall to clean the material if practical. It would not be practical or cost-effective to recycle any of the wastes that do not need to be removed for construction.

8.0 CONCLUSIONS

- The historic Elmwood / Nairn Avenue Landfill was developed within low lying wet depression areas that were infilled by mainly asphalt, concrete and soil wastes from the 1950's to about the 1990's with snow and street sweepings still disposed of at the site.

- The City of Winnipeg used the site for street renewal wastes for many years in the past.

- The geophysical and test pit survey demonstrated that the site east of Chester is essential all street renewal / similar wastes, however, some municipal waste was defined west of Chester along the north side of the open and relatively flat, snow dump area.

- The geophysical survey defined elevated conductivity in the snow dump area likely related to "old" leachate making development in this area generally less desireable.

- There are no significant environmentally related limitation in the area east of Foster but the rubble must be managed for foundation systems as presented in Appendix B.

- Groundwater does demonstrate elevated pH's and Total Dissolved Solids (TDS) related to mainly concrete and soil dissolution but groundwater can be managed with no significant cost implication.

- Storm water management will be required but the system area is quite small and in the order of 0.4 hectares (1 acre) within a fenced area.

- The snow dump area away from the leachate would be a potential storm water management location and would be constructed from the deep, native silty clay deposits to produce a water tight structure.

- There are opportunities for "green" development of the site with LEED components for the re-use of the landfill site, re-use/recycle of wastes as well as potential for both open loop (groundwater) and closed loop (horizontally drilled loops) at the site.

9.0 RECOMMENDATIONS

It is recommended that the City of Winnipeg consider the following regarding the potential development of the Elmwood / Nairn Avenue Landfill Site:

- Focus the main development into the area east of Chester Avenue.
- Limit the development in the snow dump area to the possible construction of storm water management pond or possibly material or equipment storage.
- Consider LEED development of the site where practical and cost effective.
- Utilize the foundation concepts as an initial basis to defining the cost / benefits of building design and conceptual layout.
- Discuss the general stormwater management plans for the area with Water and Waste staff as the development concept moves forward.
- Consider retaining the services of a specialized cost estimator to better define overall project costs relative to the use of the historic Elmwood/Nairn Landfill site.

10.0 STATEMENT OF LIMITATIONS

KGS Group prepared this report in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent environmental consultants. The information contained in this report, including its conclusions, is based on the information that was made available to KGS Group during the investigation and upon the services described which were performed within the time and budgetary requirements of the City of Winnipeg. As the report is based on available information, some of its conclusions could be different if the information upon which it is based is determined to be false, inaccurate or contradicted by additional information.

In evaluating the property, KGS Group has relied in good faith on information provided by individuals noted in this report. KGS Group assumes that the information provided is factual and accurate. KGS Group accepts no responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omissions, misinterpretations or fraudulent acts of the persons interviewed.

KGS Group makes no representation concerning the legal significance of its findings or the value of the property investigated. KGS Group has no contractual liability to third parties for the information or opinions contained in this report.

TABLES

TABLE 1
GENERAL WATER QUALITY
ELMWOOD LANDFILL
WINNIPEG, MANITOBA

Parameter [1]	EQL	TP1	TP4	TP6	TP7	TP19	TP49	TP69
		3-Nov-08	3-Nov-08	3-Nov-08	3-Nov-08	4-Nov-08	7-Nov-08	12-Nov-08
pH (units)	*0.01*	7.81	9.61	10.42	10.81	9.60	8.04	7.98
E.C. (µS/cm)	*0.4*	3880	1210	2850	2110	2740	3080	14900
Alkalinity as $CaCO_3$	*1*	1500	124	190	278	49	1020	427
Bicarbonate as $CaCO_3$	*2*	1830	58	20	35	5	1240	521
Carbonate as $CaCO_3$	*0.6*	<0.6	46.1	104	149	26.8	<0.6	<0.6
Hydroxide as $CaCO_3$	*0.4*	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Hardness as $CaCO_3$	*0.2*	1440	172	377	300	770	1470	2500
Chloride	*9*	611	196	833	510	478	121	5110
Sulphate	*9*	<9	159	17	24	685	853	409
Nitrate & Nitrite (as N)	*0.005*	0.01	1.54	0.01	0.04	0.035	0.125	0.011
Calcium	*0.05*	167	43	151	120	307	216	114
Magnesium	*0.01*	249	15.6	0.36	0.32	1.01	226	539
Potassium	*0.05*	41	25.6	40	34.5	31	21.8	311
Sodium	*0.02*	330	178	398	300	254	279	1630
Iron	*0.01*	1.08	5.79	0.17	0.26	0.25	0.91	<0.01
Manganese	*0.0002*	1.21	0.14	0.0068	0.0093	0.0199	0.815	0.305
T.D.S.	*5*	2300	698	1550	1160	1780	2330	8370

Notes:

"-" = No Data

EQL = Estimated Quantitation Limit = The lowest level of the parameter that can be quantified with confidence

E.C. = Electrical Conductivity

T.D.S. = Total Dissolved Solids

1. All values are expressed in milligrams per litre (mg/L) unless indicated otherwise.

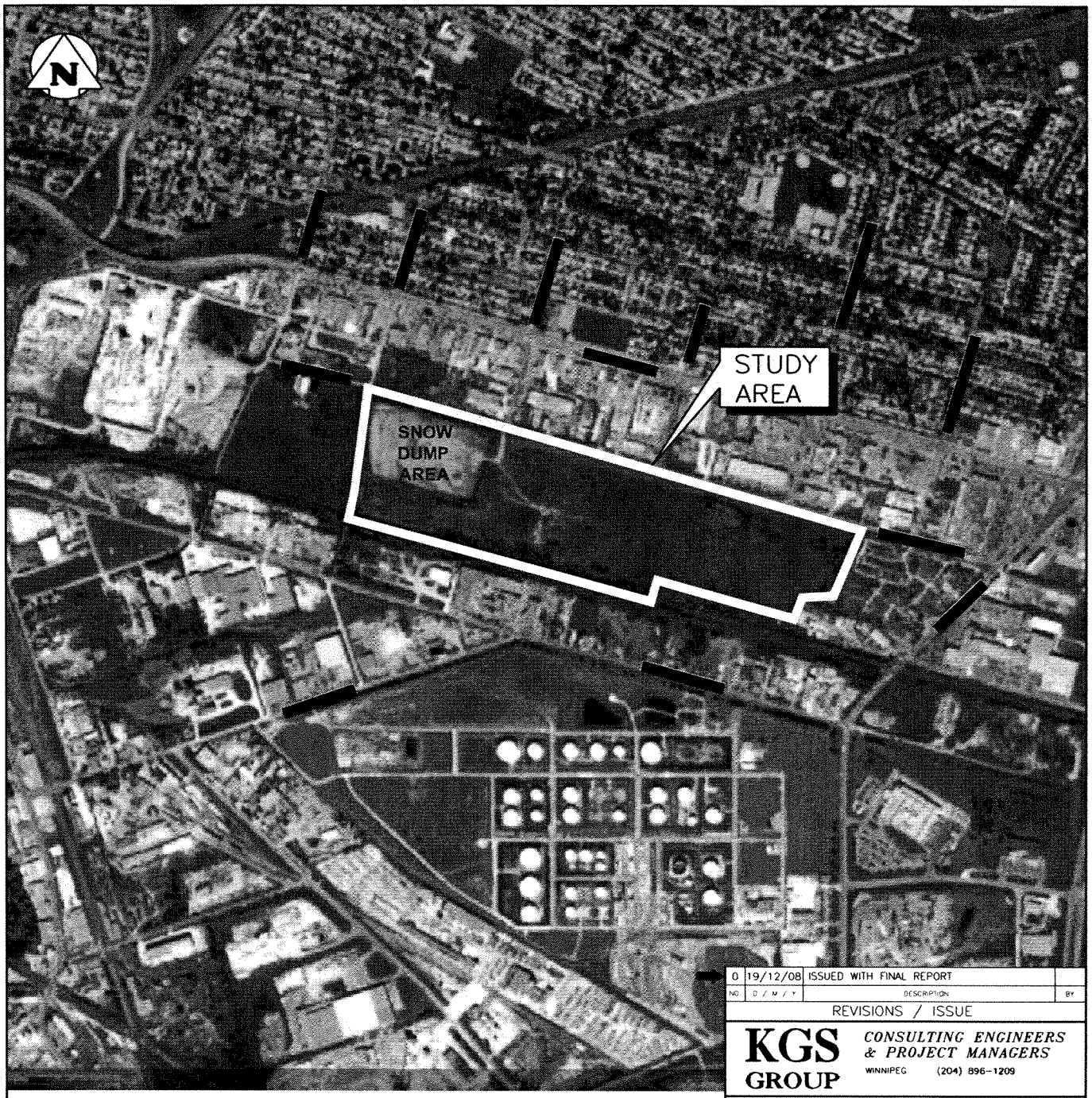
TABLE 2
PIEZOMETER DATA
ELMWOOD LANDFILL
WINNIPEG, MANITOBA

Sample No.	Date	Parameter [1]														
		pH (units)	E.C. (µS/cm)	Turbidity (ntu)	Alkalinity as $CaCO_3$	Hardness as $CaCO_3$	Ammonia	Nitrate	Calcium	Chloride	Sulphate	Magnesium	Potassium	Total Phosphorous	Sodium	Iron
EQL		*0.01*	*0.4*	-	*1*	*0.2*	-	*0.005*	*0.05*	*9*	*9*	*0.01*	*0.05*	*0.3*	*0.02*	*0.01*
GWQ 26 P36L	14-Nov-08	7.81	5640	183	1320	1380	5.013	0.18	84	570	1150	240	222	2.8	702	27.50
GWQ 26 P37L	14-Nov-08	7.52	5340	320	1180	1710	7.618	0.13	134	815	190	284	32.4	0.4	537	4.52
GWQ 27 P19E	14-Nov-08	7.21	7310	752	1610	4670	0.019	0.04	540	400	3430	698	22	1.2	475	4.33
GWQ 27 P27L	14-Nov-08	7.17	3690	458	1270	1370	0.933	0.02	218	610	18	210	8.7	<0.3	359	13.60

Sample No.	Date	Parameter [1]													
		Manganese	T.D.S.	T.S.S.	T.K.N.	T.O.C.	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Zinc	Total Coliform (Col./100 mL)	E.Coli (CFU/100 mL)
EQL		*0.0002*	*5*	-	-	-	-	*0.001*	-	-	-	-	-	*3*	*3*
GWQ 26 P36L	14-Nov-08	0.28	4030	168	8	39	0.016	<0.001	0.016	0.013	0.009	0.093	0.159	23	<3
GWQ 26 P37L	14-Nov-08	0.09	2830	164	11	36	0.009	<0.001	0.027	0.021	0.022	0.022	0.049	430	<3
GWQ 27 P19E	14-Nov-08	0.43	7540	121	4	39	0.010	<0.001	0.020	0.045	0.034	0.163	1.250	93	<3
GWQ 27 P27L	14-Nov-08	0.97	2150	1360	2	28	0.018	<0.001	0.018	0.010	0.022	0.029	0.041	150	7

Notes:
"-" = No Data
EQL = Estimated Quantitation Limit = The lowest level of the parameter that can be quantified with confidence
E.C. = Electrical Conductivity
T.D.S. = Total Dissolved Solids
T.S.S. = Total Suspended Solids
T.O.C. = Total Organic Carbon
T.K.N. = Total Kjeldahl Nitrogen
1. All values are expressed in milligrams per litre (mg/L) unless indicated otherwise.

FIGURES



NO.	D / M / Y	DESCRIPTION	BY
0	19/12/08	ISSUED WITH FINAL REPORT	

REVISIONS / ISSUE

KGS GROUP
CONSULTING ENGINEERS & PROJECT MANAGERS
WINNIPEG (204) 896-1209

CLIENT
THE CITY OF WINNIPEG

PROJECT
FORMER ELMWOOD LANDFILL SITE
ASSESSMENT REPORT
WINNIPEG, MB

DWG. DESCRIPTION
SITE LOCATION MAP

ENG. STAMP

DESIGNED BY: RS	DRAWN BY: EC
CHECKED: RS	CHECKED:
APPROVED:	
SCALE: AS NOTED	DATE: NOVEMBER 2008
KGS DWG. NO: 08-0107-15 01	
CLIENT DWG. NO:	REV: 0

0 250 500 750m
SCALE: 1:12,500 METRIC

FIGURE 1

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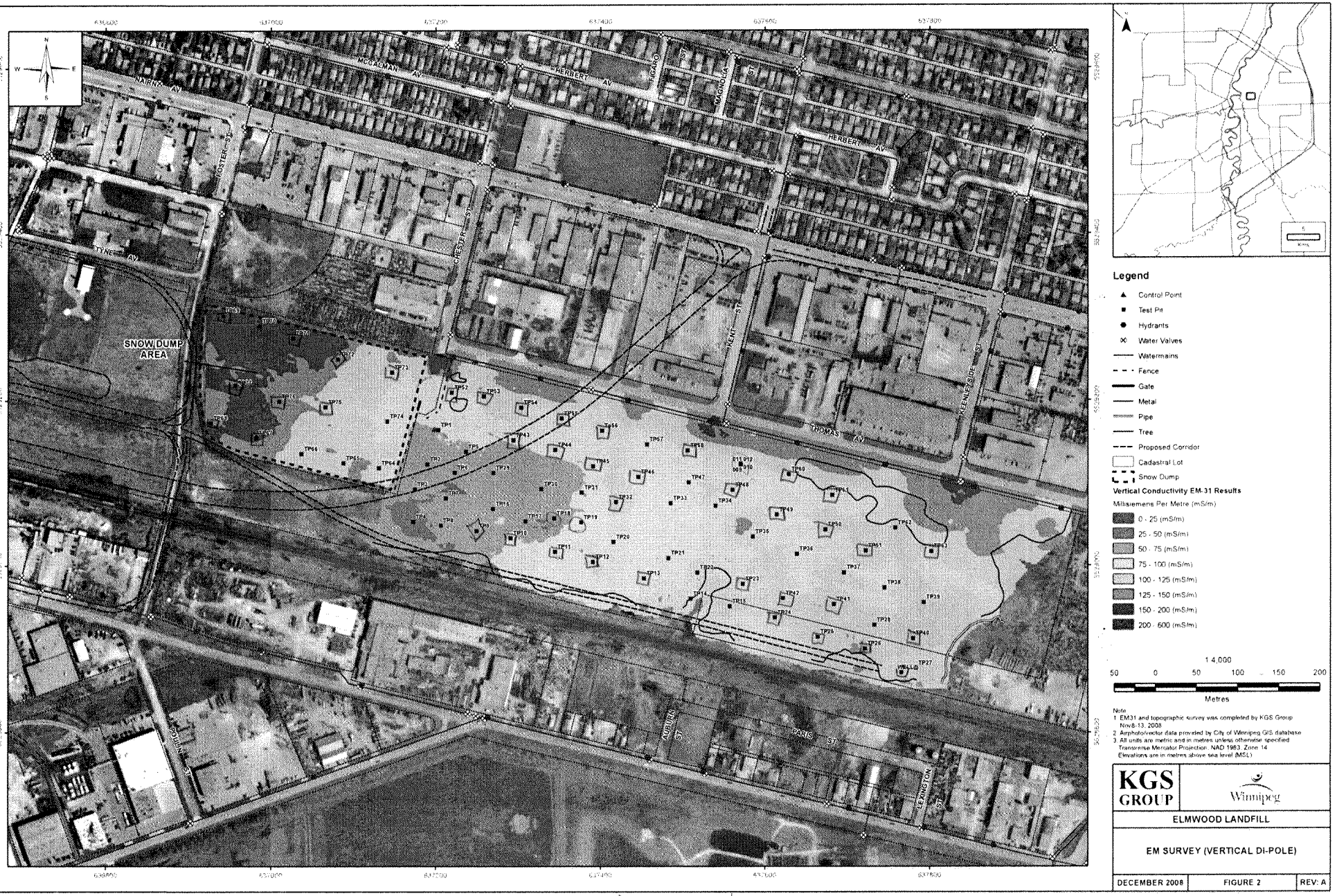

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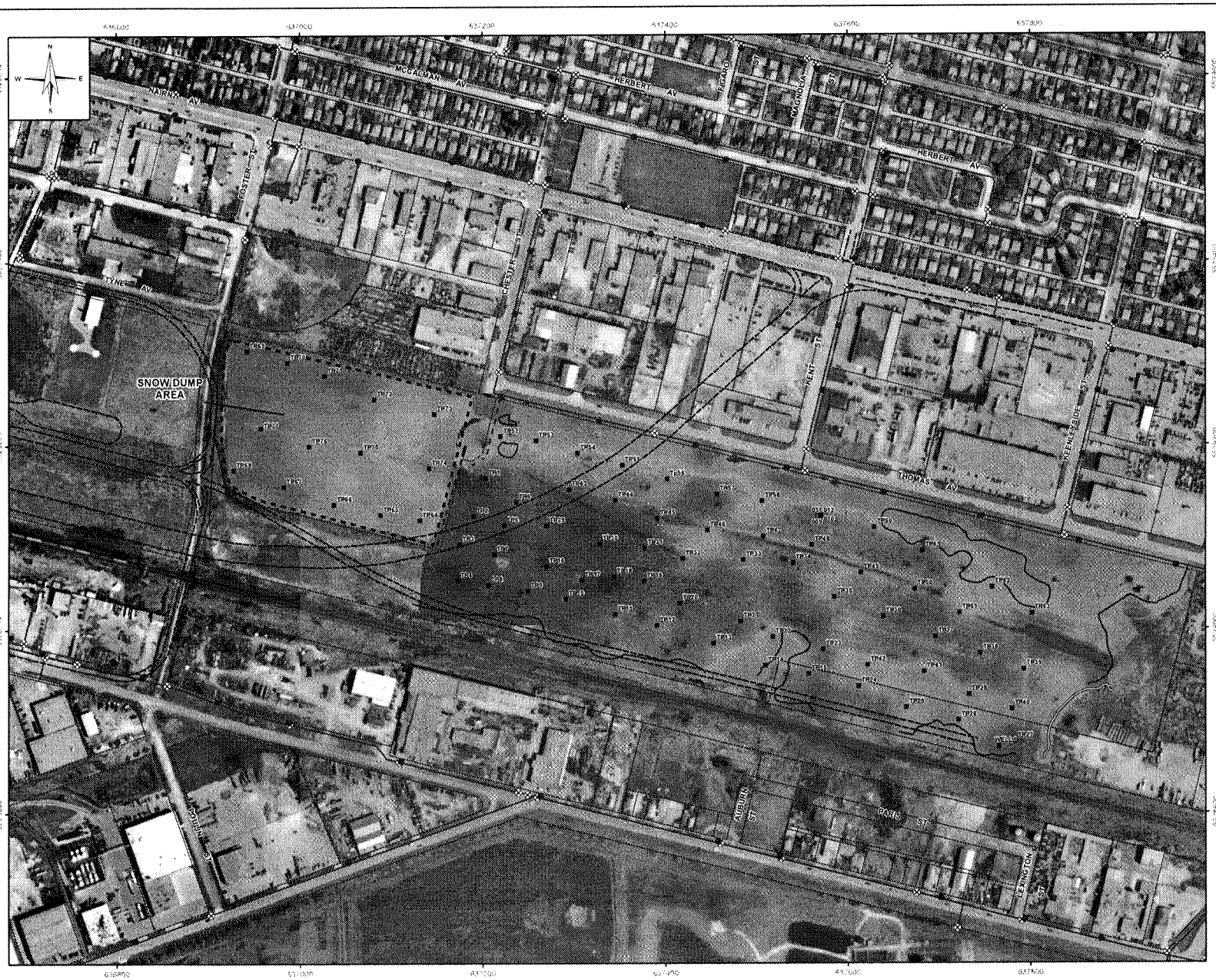
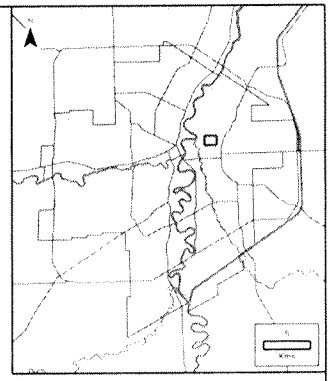
◇ garbage odour

○ large concrete slabs

▭ organic matter





Legend

- Control Point
- Test Pit
- Hydrants
- Water Valves
- Watermains
- Fence
- Gate
- Metal
- Pipe
- Tree
- Proposed Corridor
- Cadastral Lot
- Snow Dump

Vertical Inphase EM-31 Results

Parts Per Thousand (PPT)

High 19.6 (PPT)

Low -20.5 (PPT)

1:4,000

50 0 50 100 150 200

Metres

Note:
1. EM31 and topographic survey was completed by KGS Group Nov8-13, 2008
2. Airphoto/vector data provided by City of Winnipeg GIS database
3. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

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ELMWOOD LANDFILL

EM SURVEY (IN-PHASE)

DECEMBER 2008	FIGURE 3	REV: A

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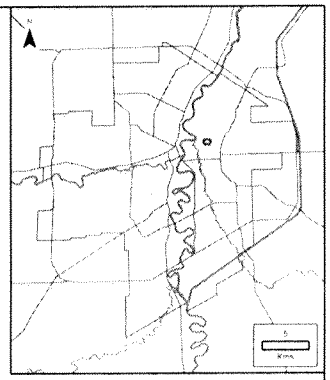

Legend

- Control Point
- Test Pit
- Hydrants
- Water Valves
- Watermains
- Fence
- Gate
- Metal
- Pipe
- Tree
- Proposed Corridor
- 1 m Index Contour
- 0.25 m Contour
- Cadastral Lot
- Snow Dump

1:2,000

25 0 25 50 75 100

Metres

Note:
1. EM31 and topographic survey was completed by KGS Group Nov8-13, 2008.
2. Airphoto/vector data provided by City of Winnipeg GIS database.
3. All units are metric and in metres unless otherwise specified.
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL).

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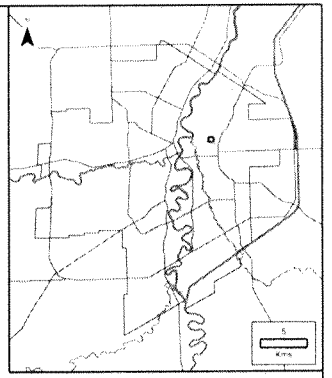
ELMWOOD LANDFILL

TOPOGRAPHICAL PLAN

Sheet 1 of 2

DECEMBER 2008	FIGURE 4	REV: A

P:\Projects\2008\08-0107-1SD\wg\GIS\MXDs\Elmwood.mxd



Legend

- Control Point
- Test Pit
- Hydrants
- Water Valves
- Watermains
- Fence
- Gate
- Metal
- Pipe
- Tree
- Proposed Corridor
- 1 m Index Contour
- 0.25 m Contour
- Cadastral Lot

1:2,000

25 0 25 50 75 100

Metres

Notes:
1. EM31 and topographic survey was completed by KGS Group Nov.8-13, 2008
2. Airphoto/vector data provided by City of Winnipeg GIS database
3. All units are metric and in metres unless otherwise specified
   Transverse Mercator Projection, NAD 1983, Zone 14
   Elevations are in metres above sea level (MSL)

KGS GROUP	Winnipeg
ELMWOOD LANDFILL	
TOPOGRAPHICAL PLAN Sheet 2 of 2	
DECEMBER 2008	FIGURE 4	REV: A

P:\Projects\2008\08-0107-1SD\wg\GIS\MXDs\Elmwood.mxd

APPENDICES

APPENDIX A

TEST PIT LOGS

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-01**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

JOB NO. 08-107-15

PROJECT

SITE Elmwood Landfill

DATE DRILLED 11/3/2008

LOCATION 45.7 m southwest of Thomas Avenue

UTMs (NAD83) N 5,529,165 E 637,203

DRILLING METHOD Rubber Tire Excavator Daewoo 180WV

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.0		ORGANIC MATERIAL		
	0.5		FILL - Asphalt, concrete, clay, brown, slightly moist, firm, low plasticity.		
	1.0				
	1.5				
	2.0				
	2.5				
	2.74		END OF TEST PIT AT 2.74 m.		
	3.0		Note: 1. Water bubbles visible, water flowed in at high volumes at 2.13 m.		
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-02**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m southwest of TP-01	UTMs (NAD83)	N 5,529,123 E 637,190
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**COVER** - Loose coarse grained gravel and cobbles.	
	1.0		**FILL** - Concrete (reinforced with rebar), asphalt, silty sand clay, brown, slightly moist, low plasticity.	
	1.5			
	2.0			
	2.5		**CLAY** - Grey, slightly moist, high plasticity. - Small silt seam, grey. - Railway tie visible at 2.59 m.	
	3.0			
	3.5		**END OF TEST PIT AT 3.66 m.**	
	4.0		Note: 1. Small trickles of water visible at 2.44 m.	
	4.5			
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-03**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	Approximately 30.5 m southwest of TP-02	UTMs (NAD83)	N 5,529,093 E 637,175
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			COVER - Loose coarse grained gravel and cobbles		
	0.5		**FILL** - Concrete (rebar visible), asphalt, sand and coarse grained gravel.		
	1.0		- Concrete, coarse grained gravel, silty clay.		
	1.5				
	2.0				
	2.5				
	3.0				
	3.5		**CLAY** - Grey, slightly moist, high plasticity.		
			CONCRETE AND GRAVEL FILL - Coarse grained gravel.		
	4.0				
			SANDY CLAY - Brown, slightly moist, intermediate plasticity.		
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0		Note: 1. Small trickles of water visible at 4.57 m.		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-04**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m south of TP-03	UTMs (NAD83)	N 5,529,053 E 637,173
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		ORGANIC MATERIAL COVER - Light brown		
	1.0		FILL - Concrete with rebar, coarse grained gravel, sandy clay, grey, moist.		
	1.5				
	2.0				
	2.5				
	3.0		END OF TEST PIT AT 3.05 m.		
	3.5		Note: 1. Water seeped into hole at high volumes at 2.44 m, no bubbles visible. 2. High volumes of concrete with rebar where uncovered.		
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-05**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	Approximately 30.5 m east of TP-01	UTMs (NAD83)	N 5,529,139 E 637,236
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.0		ORGANIC MATERIAL			
			COVER			
	0.5		FILL - Coarse grained gravel, concrete rebar, clay, grey, slightly moist.			
	1.0		- Railway tie uncovered at 1.22 m.			
	1.5					
	2.0					
	2.5					
	3.0		SANDY CLAY - Grey, moist, low plasticity.			
	3.5		- Black organic matter, roots visible.			
			CLAY - Grey, moderately moist, high plasticity.			
	4.0					
	4.5					
	5.0		END OF TEST PIT AT 4.88 m.			
			Note: 1. Water began to trickle into test pit at 4.88 m.			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

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DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-06**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m southwest of TP-05	UTMs (NAD83)	N 5,529,113 E 637,223
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) O 1000 2000 3000 4000
			COVER		
	0.5		**FILL** - Clay, grey, dry, low plasticity, mixed with coarse grained gravel, concrete with rebar, railway tie, piece of hydro pole, and asphalt visible.		
	1.0				
	1.5				
	2.0				
	2.5		**END OF TEST PIT AT 2.44 m.**		
	3.0		Notes: 1. Water entering into test pit at high volumes at 2.44 m, no bubbles visible. 2. Obtained water sample.		
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-07**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-03	UTMs (NAD83)	N 5,529,082 E 637,212
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.0		COVER			
			FILL - Concrete, cobbles mixed with clay, grey, slightly moist, low plasticity. Plant roots visible.			
	0.5					
	1.0					
	1.5					
	2.0					
	2.5		SILTY CLAY - Grey and brown, slightly moist, high plasticity, mixed with cobbles and concrete.			
	3.0		END OF TEST PIT AT 3.05 m.			
	3.5		Notes. 1. Water entering into test pit at high volumes at 3.05 m, no bubbles visible . 2. Obtained water sample.			
	4.0					
	4.5					
	5.0					
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-08**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-04	UTMs (NAD83)	N 5,529,049 E 637,206
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.0		**COVER**	
			FILL - Concrete with rebar, mixed with brown clay and coarse grained sand, moist, low plasticity.	
	0.5			
	1.0			
	1.5			
	2.0			
	2.5		- Clay, grey, moderately moist, intermediate plasticity, mixed with coarse grained sand at 2.44 m.	
	3.0		**END OF TEST PIT AT 3.05.**	
	3.5		Note: 1. Sloughing in of sides at 3.05.	
	4.0			
	4.5			
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-09**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-08	UTMs (NAD83)	N 5,529,042 E 637,249
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**COVER** **FILL** - Concrete and rebar mixed with clay, grey, moist, low plasticity, with coarse grained sand and gravel.			
	1.0					
	1.5					
	2.0					
	2.5					
	3.0		- Very moist, high plasticity, loose coarse grained gravel. Very strong garbage odour, no garbage visible at 3.05 m.			
	3.5					
	4.0					
	4.5		**CLAY** - Grey, very moist, high plasticity, with coarse grained gravel.			
	5.0		- Silt seam, beige/brown, slightly moist, intermediate plasticity at 5.49 m.			
	5.5		**END OF TEST PIT AT 5.49 m.**			
	6.0		Note: 1. Water visible entering test pit at 1.5 m.			
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-10**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-09	UTMs (NAD83)	N 5,529,033 E 637,291
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		FILL - Coarse grained gravel and cobbles.		
	1.0		SILTY CLAY - Grey, dry, low plasticity. - Black, low plasticity mixed with coarse grained sand between 0.91 m and 1.22 m		
	1.5		FILL - Concrete.		
	2.0		CLAY - Black, slightly moist, low plasticity, with coarse grained gravel.		
	2.5		SILT SEAM - Beige/brown, slightly moist, low plasticity.		
	3.0		CLAY - Grey, moist, high plasticity.		
	3.5				
	4.0		- Encountered grasses and black organic soil, fibers visible at 3.96 m.		
	4.5		CLAY - Dark grey, slightly moist, low plasticity, crumbling. Silt seam present, beige, moderately moist, intermediate plasticity.		
			END OF TEST PIT AT 4.57 m.		
	5.0				
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-11**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-10	UTMs (NAD83)	N 5,529,016 E 637,344
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			COVER		
	0.5		**SILT SEAM** - Beige, dry, low plasticity. Concrete slabs were visible at 0.61 m.		
			CLAY - Slightly moist, intermediate plasticity, with coarse grained sand.		
	1.0				
			- Dark grey, moist, intermediate plasticity. - Concrete slabs visible at 1.22 m.		
	1.5				
	2.0				
	2.5				
			ORGANIC MATTER - Black, with fibers, deposits of decomposing wood.		
	3.0				
			SILT SEAM - Beige, moist, intermediate plasticity.		
	3.5				
			CLAY - Grey, slightly moist, high plasticity.		
	4.0				
	4.5				
	5.0				
	5.5		**END OF TEST PIT AT 5.49 m.**		
			Note: 1. Small amount of water visible at 3.66 m.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-12**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-11	UTMs (NAD83)	N 5,529,004 E 637,391
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			ORGANIC MATTER - With fibers.		
	0.5		**SILTY CLAY** - Brown, slightly moist, intermediately plasticity, trace of coarse grained sand.		
	1.0				
	1.5				
	2.0		**SILT SEAM** - Grey, dry, crumbles.		
	2.5		**CLAY** - Dark grey, slightly moist, high plasticity, trace of coarse grained sand. Concrete and rebar visible at 2.13 m.		
	3.0		- Silty clay seam, brown with grey pockets, crumbles. Tree branches and fibers visible at 3.05 m.		SS1
	3.5				
	4.0		**CLAY** - Brown, slightly moist, intermediate plasticity.		
	4.5				
	5.0				
			END OF TEST PIT AT 15.19 m.		
	5.5		Notes: 1. Water trickling in at 3.66 m. 2. Soil sampled obtained at 3.1 m.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SS1 ● 2.2

SAMPLE TYPE ⧓ Grab from Bucket

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-13**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

JOB NO. **08-107-15**

PROJECT

SITE Elmwood Landfill

DATE DRILLED **11/3/2008**

LOCATION 30.5 m east of TP-12

UTMs (NAD83) N 5,528,985 E 637,453

DRILLING METHOD Rubber Tire Excavator Daewoo 180WV

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	SAMPLE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) 250 500 750 1000	FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) 1000 2000 3000 4000
			ORGANIC MATERIAL				
	0.5		SILTY CLAY - Beige, slightly moist, crumbles, with coarse grained gravel.				
	1.0		CLAY - Grey, very moist, wood visible.				
	1.5		- Water visible at 1.52 m.				
	2.0						
	2.5		SILTY CLAY - Dark grey, dry, low plasticity.		SS2	4.2	
	3.0		CLAY - Brown, slightly moist, high plasticity.				
	3.5						
	4.0						
	4.5		END OF TEST PIT AT 4.57 m.				
	5.0		Notes: 1. Encountered water at 1.52 m. 2. Soil sampled obtained at 2.44 m.				
	5.5						
	6.0						
	6.5						

SAMPLE TYPE Grab from Bucket

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2006\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-14**

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-13	UTMs (NAD83)	N 5,528,960 E 637,509
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.0		ORGANIC MATTER - Fibers visible.	
	0.5		SILTY CLAY - Beige, slightly moist, low plasticity.	
	1.0		CLAY - Grey, moist, high plasticity.	
	1.5			
	2.0			
	2.2		ORGANIC MATTER - Black, branches visible.	
	2.5		CLAY - Brown, slightly moist, high plasticity.	
	3.0			
	3.5			
	4.0			
	4.5		END OF TEST PIT AT 4.57 m.	
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVI\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-15**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/3/2008
LOCATION	30.5 m east of TP-14	UTMs (NAD83)	N 5,528,951 E 637,557
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			ORGANIC MATTER - Roots visible.		
	0.5		**FILL** - Coarse grained gravel and large slabs of concrete.		
	1.0		**SILTY CLAY** - Grey, slightly moist, low plasticity. Encountered wood at 0.91 m.		
	1.5				
	2.0		**CLAY** - Dark grey, slightly moist, firm, low plasticity.		
	2.5		**CLAY** - Grey, slightly moist, firm, intermediate plasticity.		
	3.0				
	3.5				
	4.0		**SILTY CLAY** - Brown, moist, soft, low plasticity.		
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-16**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-07	UTMs (NAD83)	N 5,529,069 E 637,269
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**ORGANIC MATERIAL** - Fibers visible.			
	1.0		**CRUSHED CONCRETE FILL**			
	1.5		**SILTY CLAY** - Grey, slightly moist, firm, low plasticity, with fine grained gravel.			
	2.0					
	2.5		**CLAY** - Grey, moist, firm, low plasticity. Encountered wooden debris.		SS3	● 0.4
	3.0					
	3.5		**SILTY CLAY** - Moist, firm, intermediate plasticity, coarse grained gravel, fill such as asphalt and crushed concrete visible.			
	4.0					
	4.5					
	5.0					
	5.5		**CLAY** - Grey, moist, slightly firm, high plasticity.			
	6.0		**END OF TEST PIT AT 6.10 m.**			
	6.5		Notes: 1. Soil sample obtained at 2.44 m.			

SAMPLE TYPE ⋈ Grab from Bucket

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-17**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-16	UTMs (NAD83)	N 5,529,054 E 637,309
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.0		**ORGANIC MATERIAL**		
			COVER		
	0.5		**CRUSHED CONCRETE FILL**		
	1.0				
	1.5				
	2.0		**CLAY** - Dark grey, very moist, with coarse grained gravel.		
			SILTY CLAY - Grey, moist, soft, low plasticity.		
	2.5		**CLAY** - Dark grey, moist, low plasticity, with fine grained gravel and coarse grained sand.		
	3.0		- Mixed with coarse grained gravel and cobbles at 3.05 m.		
	3.5		- Brown below 3.35 m.		
	4.0				
	4.5		**CLAY** - Dark grey, moist, firm, intermediate plasticity, with coarse grained sand.		
	5.0				
	5.5		**END OF TEST PIT AT 5.49 m.**		
	6.0		Note: 1. Water entering into test pit at 1.83 m.		
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-18**

SHEET 1 of 1

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

JOB NO. 08-107-15

PROJECT

SITE Elmwood Landfill

DATE DRILLED 11/4/2008

LOCATION 30.5 m east of TP-17

UTMs (NAD83) N 5,529,057 E 637,344

DRILLING METHOD Rubber Tire Excavator Daewoo 180WV

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.0		ORGANIC COVER		
	0.5		SANDY CLAY - Brown, slightly moist, firm, low plasticity. Wooden debris uncovered.		
	1.0		CRUSHED CONCRETE AND ASPHALT FILL		
	1.5		CLAY - Dark grey, moist, firm, low plasticity, with coarse grained gravel.		
	2.0		SILTY CLAY - Beige, dry, firm, crumbles.		
	2.5		CLAY - Grey, moist, firm, intermediate plasticity.		
	3.0		LARGE SLABS OF CONCRETE AND REBAR FILL - Mixed with clay, grey, very moist, firm, high plasticity.		
	3.5				
	4.0				
	4.5				
	5.0		END OF TEST PIT AT 5.18 m.		
	5.5		Note: 1. Encountered water at 3.66 m.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-19**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-18	UTMs (NAD83)	N 5,529,052 E 637,377
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			ORGANIC COVER		
	0.5		**SILTY CLAY** - Dark grey, slightly moist, firm, low plasticity, with coarse grained gravel.		
	1.0		**FILL** - Concrete slabs and cobbles, mixed with clay, grey, slightly moist, firm, low plasticity.		
	1.5		**SILTY CLAY** - Dark grey, moist, firm, low plasticity, mixed with coarse grained gravel.		
	2.0				
	2.5		**SILTY CLAY** - Brown, firm, moist, high plasticity.		
	3.0		**LARGE SLABS OF CONCRETE AND REBAR FILL** - Mixed with silty clay, grey, very moist, firm, high plasticity.		
	3.5				
	4.0				
	4.5		**SILTY CLAY** - Light grey, moist, soft.		
	5.0		**SILTY CLAY** - Grey, slightly moist, firm, high plasticity.		
	5.5		**END OF TEST PIT AT 5.49 m.**		
	6.0		Note: 1. Encountered water at 1.52 m.		
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-20**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-19	UTMs (NAD83)	N 5,529,028 E 637,416
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			ORGANIC COVER - Roots visible.		
	0.5		**FILL** - Concrete pieces mixed with coarse grained gravel mixed with silty clay, brown, slighty dry, firm, intermediate plasticity with coarse grained sand.		
	1.0				
	1.5				
	2.0				
	2.5				
	3.0		**SILTY SAND** - Grey, very moist, coarse grained sand, fine grained gravel mixed with concrete slabs/pieces.		
	3.5				
	4.0		**SILTY CLAY** - Grey, moist, firm, high plasticity.		
	4.5				
	5.0		**END OF TEST PIT AT 4.88 m.**		
	5.5		Note: 1. Water entered into hole at 2.74 m.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-21**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-20	UTMs (NAD83)	N 5,529,009 E 637,482
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.0		**ORGANIC COVER**		
	0.5		**SILTY CLAY** - Brown, slightly moist, firm, low plasticity, silt pockets and roots visible.		
	1.0		- Mixed with concrete slabs/pieces. No silt pockets and no visible roots below 0.91 m.		
	1.5				
	2.0		**SILTY CLAY** - Brown, moist, firm, intermediate plasticity, some medium grained sand.		
	2.5		- Dark grey, soft below 2.74 m.		
	3.0				
	3.5		**SILTY CLAY** - Light brown, moist, soft, high plasticity.		
	4.0				
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0		Note: 1. Water entered into test pit at 4 27 m.		
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR	INSPECTOR		
J & D PENNER	K. SINCLAIR	APPROVED _____	DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-22**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-21	UTMs (NAD83)	N 5,528,991 E 637,518
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		ORGANIC COVER - Roots visible.			
	1.0		SILTY CLAY - Dark grey, dry, firm, low plasticity, with coarse grained sand.			
	1.5		SANDY SILTY CLAY - Beige, dry, firm, low plasticity, with coarse grained gravel, trace concrete slabs/pieces.			
	2.0					
	2.5		SILTY CLAY - Grey, slightly moist, medium soft, high plasticity.			
	3.0		- Brown, firm below 3.05 m.			
	3.5					
	4.0					
	4.5		END OF TEST PIT AT 4.57 m.			
	5.0		Note: 1. Water seeping in at 2.13 m.			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-23**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-22	UTMs (NAD83)	N 5,528,978 E 637,573
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.0		**ORGANIC COVER** - Fibers/roots visible.		
			SILTY CLAY - Grey, slightly moist, firm, high plasticity.		
	0.5				
	1.0		- Light brown, soft below 0.91 m.		
			- Dark brown, with light brown silt pockets below 1.22 m.		
	1.5				
	2.0				
	2.5				
			ORGANIC MATTER - Black, moist, low plasticity, crumbly. Fibrous roots visible.		
	3.0		**SILTY CLAY** - Light brown, slightly moist, soft, high plasticity.		
	3.5				
	4.0				
	4.5		**SILTY CLAY** - Light brown, slightly moist, soft, low plasticity, crumbly.		
	5.0				
	5.5		**SILTY CLAY** - Brown, slightly moist, soft, high plasticity.		
	6.0		**END OF TEST PIT AT 6.10 m.**		
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-24**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-15	UTMs (NAD83)	N 5,528,937 E 637,612
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
			ORGANIC MATTER - Roots visible.	
	0.5		**FILL** - Concrete pieces/slabs mixed with silty clay, light brown, moist, moderately firm, intermediate plasticity, with black organic matter pockets with visible fibrous roots.	
	1.0		**SILTY CLAY** - Brown, slightly moist, firm, high plasticity.	
	1.5		**SILTY CLAY** - Dark grey, sightly moist, firm, low plasticity, with coarse grained sand and fine grained gravel.	
	2.0			
	2.5		**ORGANIC MATTER** - Black, slightly moist, moderately firm, intermediate plasticity, crumbly. Fibrous roots visible.	
			SILTY CLAY - Grey, moist, soft, high plasticity.	
	3.0			
	3.5			
	4.0		- Light brown, slightly moist, firm below 3.96 m.	
	4.5			
	5.0		**END OF TEST PIT AT 4.88 m.**	
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-25**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 m east of TP-24	UTMs (NAD83)	N 5,528,914 E 637,664
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			ORGANIC MATTER - Roots visible.		
	0.5		**FILL** - Coarse grained gravel, concrete slabs/pieces with silty clay, brown, slightly moist, moderately firm, high plasticity.		
	1.0				
	1.5		- Wooden debris visible at 1.52 m.		
	2.0		**ORGANIC MATTER** - Black, slightly moist, soft, low plasticity. Roots visible.		
	2.5		**SILTY CLAY** - Grey, slightly moist, firm, high plasticity.		
	3.0				
	3.5		- Brown below 3.66 m.		
	4.0				
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-26**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 east of TP-25	UTMs (NAD83)	N 5,528,900 E 637,721
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.0		**ORGANIC COVER** - Fibers visible.			
	0.2		**SILTY CLAY** - Beige/tan, slightly moist, soft, intermediate plasticity.			
	0.5		**FILL** - Concrete with rebar, mixed with silty clay, grey, moist, firm, high plasticity.			
	1.0					
	1.5					
	2.0					
	2.2		**ORGANIC MATTER** - Black, slightly moist, soft, low plasticity. Roots visible.			
	2.5		**SILTY CLAY** - Grey, firm, moist high plasticity.			
	3.0					
	3.5		- Brown below 3.66 m.			
	4.0					
	4.5		**END OF TEST PIT AT 4.57 m.**			
	5.0		Note: 1. Water seeping into test pit at 2.13 m.			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-27**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 east of TP-26	UTMs (NAD83)	N 5,528,877 E 637,783
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			ORGANIC COVER - Fibers visible.		
	0.5		**FILL** - Coarse grained gravel, pebbles and concrete.		
	1.0				
	1.5				
	2.0				
	2.5		**ORGANIC MATTER** - Black, slightly moist, soft, spongy, mosses and fibers visible.		
	3.0		**SILTY CLAY** - Grey, wet, firm, high plasticity.		
	3.5		- Rail ties uncovered at 3.66 m.		SS4
	4.0		- Brown below 3.96 m.		
	4.5				
	5.0		**END OF TEST PIT AT 4.88 m.**		
	5.5		Note: 1. Soil sampled obtained at 3.66 m.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SS4 ● 2.8

SAMPLE TYPE ⋈ Grab from Bucket

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-28**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/4/2008
LOCATION	30.5 north of TP-26	UTMs (NAD83)	N 5,528,928 E 637,733
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			ORGANIC MATTER - Fibers visible.		
			- Black, moist, soft, high plasticity below 0.28 m.		
	0.5		**FILL** - Coarse grained gravel mixed with silty clay, light grey, firm, dry, low plasticity.		
	1.0		**SILTY CLAY** - Grey, slightly moist, firm, intermediate plasticity.		
	1.5				
	2.0				
	2.5		**END OF TEST PIT AT 2.44 m.**		
	3.0		Note: 1. Encountered water at 2.13 m.		
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. SINCLAIR

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-29**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION	North of TP-16	UTMs (NAD83)	N 5,529,113 E 637,270
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SAND AND GRAVEL FILL** - Grey to brown, damp, compact, well graded, fine grained sand to coarse grained gravel, trace organics.			
	1.0					
	1.5					
	2.0		- Trace concrete below 1.83 m.			
	2.5		**SILTY CLAY FILL** - Grey to brown, damp, firm, high plasticity.			
	3.0		- Hard below 2.90 m.			
	3.5		**CLAY** - Grey, damp, firm, high plasticity.			
	4.0		**END OF TEST PIT AT 3.96 m.**			
	4.5					
	5.0					
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-30**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION	North of TP-17	UTMs (NAD83)	N 5,529,093 E 637,328
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SAND AND GRAVEL FILL** - Brown, damp, compact, well graded, fine grained sand to coarse grained gravel. - Trace wood, PVC pipe at 0.61 m.		
	1.0		**SILTY CLAY FILL** - Grey to black, damp, soft, intermediate plasticity, trace organic matter.		
	1.5				
	2.0				
	2.5				
	3.0		- Asphalt chunks, trace wood, trace concrete below 3.05 m.		
	3.5				
	4.0				
	4.5		**END OF TEST PIT AT 4.27 m.** Note: 1. Water seeping into test pit at 0.61 m.		
	5.0				
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-31**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

JOB NO. **08-107-15**

PROJECT

SITE Elmwood Landfill

DATE DRILLED **11/5/2008**

LOCATION North of TP-19

UTMs (NAD83) N **5,529,089** E **637,377**

DRILLING METHOD Rubber Tire Excavator Daewoo 180WV

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SAND AND GRAVEL FILL** - Brown, damp, compact, well graded, fine grained sand to coarse grained gravel, organics.		
	1.0		**SILTY CLAY FILL** - Grey, damp, firm, high plasticity, concrete rebar, bricks below 0.61 m.		
	1.5				
	2.0				
	2.5				
	3.0				
	3.5				
	4.0		**SILTY CLAY** - Brown, damp, stiff, high plasticity.		
	4.5		**SILTY CLAY** - Light brown, damp, soft, intermediate plasticity.		
	5.0		**SILTY CLAY** - Brown, damp, stiff, high plasticity.		
	5.5		**END OF TEST PIT AT 4.88 m.**		
	6.0		Note: 1. Water seeping into test pit at 1.83 m.		
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-32**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION	North of TP-20	UTMs (NAD83)	N 5,529,077 E 637,419
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY CLAY FILL** - Brown to grey, damp, firm, high plasticity, trace brick, concrete.		
	1.0				
	1.5				
	2.0				
	2.5		- Some wood and other organics below 2.44 m.		
	3.0				
	3.5		**SILTY CLAY** - Brown, damp, stiff, friable, intermediate plasticity.		
	4.0				
	4.5		**SILTY CLAY** - Brown, damp, firm, high plasticity, silt inclusions, trace oxidation.		
	5.0		- Dark brown, stiff, massive below 4.88 m.		
			END OF TEST PIT AT 5.03 m.		
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED _____ DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-33**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION		UTMs (NAD83)	N 5,529,075 E 637,485
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY CLAY FILL** - Brown to grey, damp, soft to firm, intermediate plasticity, trace brick, concrete, organics.			
	1.0					
	1.5		- Large chunk of concrete and rebar below 1.52 m.			
	2.0					
	2.5		- Wood below 2.74 m.			
	3.0		**SILTY CLAY** - Grey, damp, firm, high plasticity.			
	3.5					
	4.0		**SILT** - Grey, moist, soft, intermediate plasticity, oxidation.			
	4.5		**SILTY CLAY** - Brown, damp, stiff, high plasticity, trace silt inclusions, trace oxidation.			
	5.0		**END OF TEST PIT AT 5.18 m.**			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-34**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION	North of TP-22	UTMs (NAD83)	N 5,529,072 E 637,540
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.0		**TOPSOIL**		
			SILTY CLAY FILL - Brown, damp, firm, intermediate plasticity, wood bricks.		
	0.5				
	1.0				
	1.5				
	2.0				
	2.5				
	3.0		- Concrete at 2.74 m.		
	3.5				
	4.0		**SILTY CLAY** - Brown, damp, firm, high plasticity, trace silt inclusions, slight oxidation.		
	4.5		- Stiff below 4.27 m.		
			END OF TEST PIT AT 4.57 m.		
	5.0		Note: 1. Water entering into test pit at 2.74 m.		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-35**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION	Norh of TP-23	UTMs (NAD83)	N 5,529,035 E 637,585
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown to grey, damp, soft, intermediate plasticity, trace organics, concrete and rebar.		
	1.0				
	1.5				
	2.0				
	2.5				
	3.0				
	3.5		**SILT** - Brown, moist, soft, intermediate plasticity.		
	4.0		**SILTY CLAY** - Brown, damp, firm, high plasticity, trace silt inclusions.		
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0		Note: 1. Water entering test pit at 0.61 m.		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-36**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

JOB NO. 08-107-15

PROJECT

SITE Elmwood Landfill

DATE DRILLED 11/5/2008

LOCATION North of TP-24

UTMs (NAD83) N 5,529,014 E 637,639

DRILLING METHOD Rubber Tire Excavator Daewoo 180WV

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown to grey, damp, firm, intermediate plasticity, trace organics, concrete and rebar, brick.		
	1.0				
	1.5				
	2.0				
	2.5				
	3.0		- Wood at 3.20 m.		
	3.5		**SILTY CLAY** - Brown, damp, stiff, blocky, intermediate plasticity.		
	4.0				
	4.5		**SILTY CLAY** - Brown, damp, firm, high plasticity, trace silt inclusions.		
	5.0		**END OF TEST PIT AT 4.88 m.**		
	5.5		Note: 1. Water entering test pit at 0.61 m.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-37**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION	North of TP-25	UTMs (NAD83)	N 5,528,991 E 637,696
DRILLING METHOD	Rubber Tire Excavator Daewoo 180WV		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.0		**SILTY CLAY FILL** - Black, damp, firm, intermediate plasticity, high organic content.		
	0.5		- Brown below 0.30 m.		
	1.0		- Grey below 0.61 m.		
	1.5				
	2.0				
	2.5				
	3.0		- Wood at 2.74 m.		
	3.5		**SILTY CLAY** - Dark brown, damp, stiff, high plasticity.		
	4.0				
	4.5				
	5.0		**END OF TEST PIT AT 4.88 m.**		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\200808-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-38**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/5/2008
LOCATION		UTMs (NAD83)	N 5,528,973 E 637,745
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown to grey, damp, firm, intermediate plasticity, trace organics, concrete bricks.		
	1.0		**SILT** - Light brown, wet, soft, intermediate plasticity.		
	1.5		**SILTY CLAY** - Brown, damp, firm, intermediate plasticity, organics.		
	2.0				
	2.5				
	3.0		**SILTY CLAY** - Grey to black, damp, soft, high plasticity, high organic content.		
	3.5				
	4.0		- Dark brown, firm below 3.96 m.		
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-39**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/6/2008
LOCATION	North of TP-27	UTMs (NAD83)	N 5,528,956 E 637,793
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown, dry, firm, intermediate plasticity, trace organics.		
	1.0		- Grey below 1.22 m.		
	1.5				
	2.0		**SILTY CLAY** - Grey, damp, soft, low plasticity.		
	2.5				
	3.0		**SILT** - Brown, damp, soft, low plasticity.		
	3.5				
	4.0		**SILTY CLAY** - Grey, damp, firm, high plasticity.		
	4.5		**END OF TEST PIT AT 4.27 m.**		
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-40**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/6/2008
LOCATION	North of TP-27	UTMs (NAD83)	N 5,528,912 E 637,780
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY CLAY FILL** - Grey, damp, soft, high plasticity.		
	1.0		- Brown, dry, firm, intermediate plasticity, concrete chunks below 1.22 m.		
	1.5				
	2.0				
	2.5		**SILTY CLAY** - Grey to black, moist, soft, high plasticity, very high organic content (old roots and bull rushes).		
	3.0				
	3.5		- Grey, damp, firm below 3.66 m.		
	4.0				
			END OF TEST PIT AT 4.27 m.		
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-41**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/6/2008
LOCATION	North of TP-25	UTMs (NAD83)	N 5,528,953 E 637,684
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace organics.		
	1.0		- Grey below 0.61 m.		
	1.5				
	2.0		**SILTY CLAY** - Grey to black, damp, soft, high plasticity, very high organic content.		
	2.5		**SILTY CLAY** - Light brown, damp, soft, intermediate plasticity.		
	3.0				
	3.5		**SILTY CLAY** - Dark brown, moist, soft, high plasticity, very high organic content.		
	4.0		- Laminated silt layers below 3.96 m.		
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR S & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-42**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/6/2008
LOCATION	North of TP-24	UTMs (NAD83)	N 5,528,961 E 637,622
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, concrete chunks, brick.	
	1.0		- Grey below 1.22 m.	
	1.5			
	2.0			
	2.5		**SILTY CLAY** - Grey to black, damp, soft, high plasticity, very high organic content.	
	3.0		- Dark brown, firm below 3.05 m.	
	3.5		- Brown, stiff, massive, trace silt inclusions below 3.66 m.	
	4.0			
			END OF TEST PIT AT 4.27 m.	
	4.5		Note: 1. Water entering into test pit at 3.35 m.	
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-43**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

PROJECT

SITE Elmwood Landfill

LOCATION Northeast of TP-29

DRILLING METHOD Excavator - Komatsu WB146

JOB NO. 08-107-15

DATE DRILLED 11/6/2008

UTMs (NAD83) N 5,529,152 E 637,294

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.0		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, concrete chunks, brick.		
	0.5		- Light brown below 0.61 m.		
	1.0				
	1.5		- Grey, soft, trace organic matter below 1.52 m.		
	2.0		- Grey to black, firm, very high organic content below 2.13 m.		
	2.5		**SILTY CLAY** - Grey, damp, soft, high plasticity.		
	3.0				
	3.5				
	4.0		- Brown below 4.27 m.		
	4.5				
	5.0		- Firm below 5.18 m.		
	5.5		END OF TEST PIT AT 5.49 m.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-44**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/6/2008
LOCATION	North of TP-30	UTMs (NAD83)	N 5,529,140 E 637,345
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		SILTY CLAY FILL - Grey, damp, firm, high plasticity, trace organic matter, trace brick.		
	1.0		- Brown below 0.61 m.		
	1.5		SILTY CLAY - Grey, damp, firm, high plasticity.		
	2.0				
	2.5		- Black, soft, very high organic content below 2.44 m.		
	3.0		- Grey, moist below 3.05 m.		
	3.5				
	4.0		- Brown, damp, firm, trace silt inclusions, trace oxidation below 3.96 m.		
	4.5		END OF TEST PIT AT 4.57 m.		
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-45**

SHEET 1 of 1

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

JOB NO. 08-107-15

PROJECT

SITE Elmwood Landfill

DATE DRILLED 11/6/2008

LOCATION North of TP-31

UTMs (NAD83) N 5,529,120 E 637,391

DRILLING METHOD Excavator - Komatsu WB146

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		CLAY FILL - Brown, damp, firm, high plasticity, trace organic matter, brick, concrete.		
	1.0				
	1.5		SILTY CLAY - Dark grey to black, damp, soft, high plasticity, organic matter present.		
	2.0				
	2.5				
	3.0				
	3.5				
	4.0		- Brown, damp, stiff, trace silt inclusions below 3.96 m.		
	4.5		END OF TEST PIT AT 4.57 m.		
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-46**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/6/2008
LOCATION	Northeast of TP-32	UTMs (NAD83)	N 5,529,108 E 637,446
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**TOPSOIL** -	
	1.0		**SILTY CLAY** - Brown, damp, firm, high plasticity, trace oxidation, trace organics, rebar.	
	1.5		- Concrete and bricks at 1.22 m.	
	2.0		- Dark brown below 1.52 m.	
	2.5		- Some coarse gravel at 1.83 m. Water trickling through gravel.	
	3.0		- Grey to black, soft, very high organic content below 3.05 m.	
	3.5		**SILT** - Brown, moist, soft, low plasticity.	
	4.0		**SILTY CLAY** - Brown, damp, stiff, high plasticity.	
	4.5		**END OF TEST PIT AT 4.57 m.**	
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-47**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/6/2008
LOCATION	North of TP-33	UTMs (NAD83)	N 5,529,101 E 637,507
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**TOPSOIL**	
	1.0		**SILTY CLAY** - Light brown, damp, firm, high plasticity, trace organics.	
	1.5			
	2.0		- Grey, trace wood, wire, concrete, brick, trace coarse grained gravel below 1.83 m.	
	2.5			
	3.0			
	3.5		**SILTY CLAY** - Light brown, damp, firm, intermediate plasticity, trace oxidation.	
	4.0			
	4.5		**SILTY CLAY** - Dark brown, damp, stiff, high plasticity, trace silt inclusions.	
	5.0		**END OF TEST PIT AT 4.88 m.**	
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR S & D PENNER

INSPECTOR A. OLEKSYN

APPROVED _____ DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-48**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/7/2008
LOCATION		UTMs (NAD83)	N 5,529,092 E 637,560
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace brick, concrete and wire.	
	1.0			
	1.5		- Trace fine to coarse grained gravel below 1.22 m.	
	2.0		- Grey below 1.83 m.	
	2.5			
	3.0			
	3.5		**SILTY CLAY** - Black, moist, soft, high plasticity, very high organic content.	
	4.0		- Light brown, damp, firm, oxidized below 3.66 m.	
	4.5		- Brown below 4.27 m.	
			END OF TEST PIT AT 4.57 m.	
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DES\GN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-49**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/7/2008
LOCATION	Northeast of TP-35	UTMs (NAD83)	N 5,529,062 E 637,614
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY CLAY FILL** - Brown, moist, firm, intermediate plasticity, concrete, rebar, some sand and gravel. Water trickled through sand and gravel.			
	1.0		- Light brown, damp, soft, high plasticity, trace organic matter below 0.61 m.			
	1.5		**SILTY CLAY** - Grey, damp, firm, high plasticity, trace organic matter.			
	2.0					
	2.5					
	3.0					
	3.5					
	4.0					
	4.5		- Black, moist, soft, very high organic content/peat below 4.27 m.			
			- Brown, damp, firm, oxidation below 4.57 m.			
	5.0		**END OF TEST PIT AT 4.88 m.**			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-50**

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/7/2008
LOCATION	Northeast of TP-36	UTMs (NAD83)	N 5,529,043 E 637,673
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION
	0.0		**SILTY CLAY FILL** - Grey, damp, firm, high plasticity, concrete.
	0.3		**SAND AND GRAVEL FILL** - Brown, damp, compact, well graded, fine grained sand to coarse grained gravel.
	0.5		**SILTY CLAY FILL** - Grey, damp, firm, high plasticity, concrete, plastic.
	1.0		
	1.5		
	2.0		
	2.5		
	3.0		- Grey to black, soft, very high organic content, reeds, peats below 2.74 m.
	3.5		**SILTY CLAY** - Brown, damp, firm, high plasticity, oxidation.
	4.0		
	4.5		**END OF TEST PIT AT 4.57 m.**
	5.0		
	5.5		
	6.0		
	6.5		

SAMPLE TYPE / NUMBER

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-51**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/7/2008
LOCATION	Northeast of TP-37	UTMs (NAD83)	N 5,529,017 E 637,722
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		SILTY CLAY - Brown, damp, firm, high plasticity, concrete, organic matter.			
	1.0		- Light brown, trace organic matter, brick below 0.61 m.			
	1.5		- Grey, organic matter below 1.22 m.			
	2.0					
	2.5					
	3.0					
	3.5		- Black, moist, soft, very high organic content, reeds, peat, wood below 3.35 m.			
	4.0		- Light brown, damp, moist, oxidation below 3.66 m.			
	4.5		- Dark brown, stiff below 4.27 m.			
	5.0		END OF TEST PIT AT 4.88 m.			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-52**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-01	UTMs (NAD83)	N 5,529,210 E 637,219
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		SILTY CLAY FILL - Brown, damp, firm, high plasticity, concrete/rebar, brick, wood, organic matter.	
	1.0		SILTY CLAY - Grey, damp, firm, high plasticity, organic matter.	
	1.5			
	2.0			
	2.5		- Grey to black, soft, very high organic content, reeds, roots, wood below 2.74 m.	
	3.0			
	3.5		- Brown, firm, oxidation below 3.66 m.	
	4.0			
	4.5		- Dark brown, stiff below 4.57 m.	
	5.0		END OF TEST PIT AT 4.88 m.	
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR A. OLEKSYN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-53**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

JOB NO. 08-107-15

PROJECT

SITE Elmwood Landfill

DATE DRILLED 11/10/2008

LOCATION North of TP-05

UTMs (NAD83) N 5,529,205 E 637,258

DRILLING METHOD Excavator - Komatsu WB146

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		SILTY CLAY FILL - Grey, damp, firm, high plasticity, trace concrete/rebar, trace brick, trace organic matter.	
	1.0		- Light brown, trace concrete below 0.61 m.	
	1.5		SILTY CLAY TO SILTY CLAY FILL - Grey to black, damp, firm, high plasticity, trace brick, concrete, tires.	
	2.0			
	2.5		SILTY CLAY - Grey to black, moist, soft, high plasticity, very high organic content.	
	3.0		- Brown, damp, firm, trace oxidation below 3.05 m.	
	3.5			
	4.0			
			END OF TEST PIT AT 4.27 m.	
	4.5			
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-54**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-43, east of TP-53	UTMs (NAD83)	N 5,529,192 E 637,304
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown, damp, soft, high plasticity, plastics, metal, trace organic matter, trace granular material, trace sand and gravel.		
	1.0		- Light brown, firm, trace concrete below 0.61 m.		
	1.5				
	2.0		**SILTY CLAY** - Grey to black, damp, firm, high plasticity.		
	2.5				
	3.0		**SILTY CLAY** - Grey to black, damp, soft, intermediate plasticity, high organic content (grass and reeds).		
	3.5		**SILTY CLAY** - Light brown, damp, stiff, high plasticity.		
	4.0		**END OF TEST PIT AT 3.96 m.**		
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-55**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-44	UTMs (NAD83)	N 5,529,178 E 637,353
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace organic matter, trace granular material (sand)		
	1.0		- Light brown below 0.61 m.		
	1.5		**SILTY CLAY** - Grey to black, damp, firm, high plasticity.		
	2.0		**SILTY CLAY** - Grey to black, damp, soft, intermediate plasticity, high organic content.		
	2.5		**SILTY CLAY** - Grey, damp, stiff, high plasticity.		
	3.0		**END OF TEST PIT AT 3.05 m.**		
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-56**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-45	UTMs (NAD83)	N 5,529,164 E 637,402
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		SILTY CLAY FILL - Grey, damp, firm, high plasticity, trace organic matter, trace concrete.			
	1.0		- Brown, saturated below 0.61 m.			
	1.5		SILTY CLAY - Grey to black, saturated, high plasticity, high organic content.			
	2.0		- Grey, damp, stiff, high plasticity below 2.13 m.			
	2.5					
			END OF TEST PIT AT 2.74 m.			
	3.0		Note: 1. Water began to fill test pit during excavation at 0.61 m.			
	3.5					
	4.0					
	4.5					
	5.0					
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-57**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

PROJECT

SITE Elmwood Landfill

LOCATION North of TP-46

DRILLING METHOD Excavator - Komatsu WB146

JOB NO. 08-107-15

DATE DRILLED 11/10/2008

UTMs (NAD83) N 5,529,147 E 637,456

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		SILTY CLAY FILL - Brown, damp, firm, high plasticity, trace organic matter, trace granular material (sand)		
	1.0		- Light brown, trace metal, concrete and rubber below 1.22 m.		
	1.5				
	2.0		SILTY CLAY - Grey to black, damp, firm, high plasticity, trace organic.		
	2.5		SILTY CLAY - Light brown, damp, soft, intermediate plasticity.		
	3.0		SILTY CLAY - Brown, damp, stiff, high plasticity.		
	3.5		END OF TEST PIT AT 3.66 m.		
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-58**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-47, east of TP-57	UTMs (NAD83)	N 5,529,140 E 637,506
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace organic matter, trace concrete and metal.			
	1.0		- Light brown below 0.61 m.			
	1.5					
	2.0		**SILTY CLAY** - Grey to black, damp, firm, high plasticity, trace concrete.			
	2.5		- Soft, high organic matters (wood and reeds) below 2.74 m.			
	3.0		- Brown, stiff, trace oxidation below 3.05 m.			
	3.5					
	4.0		**END OF TEST PIT AT 3.96 m.**			
	4.5					
	5.0					
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-59**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-48, east of TP-58	UTMs (NAD83)	N 5,529,123 E 637,570
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		SILTY CLAY FILL - Dark brown, damp, firm, high plasticity, trace organic matter.		
	1.0		- Light brown, trace concrete below 0.61 m.		
	1.5				
	2.0		SILTY CLAY - Grey to black, damp, firm, high plasticity, trace concrete.		
	2.5				
	3.0		- High organic matters (wood and reeds) below 3.05 m.		
	3.5		- Stiff, trace oxidation below 3.35 m.		
			END OF TEST PIT AT 3.66 m.		
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-60**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-49, east of TP-59	UTMs (NAD83)	N 5,529,111 E 637,629
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Dark brown, damp, firm, high plasticity, trace organic matter.		
	1.0		- Light brown, trace concrete below 0.91 m.		
	1.5				
	2.0		**SILTY CLAY** - Grey to black, damp, firm, high plasticity, trace concrete.		
	2.5		- Soft, high organic content below 2.44 m.		
	3.0		**SILTY CLAY** - Light brown, damp, soft, intermediate plasticity.		
	3.5		**SILTY CLAY** - Grey, damp, stiff, high plasticity.		
	4.0		**END OF TEST PIT AT 3.96 m.**		
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

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DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-61**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/10/2008
LOCATION	North of TP-50, east of TP-60	UTMs (NAD83)	N 5,529,085 E 637,682
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace organic matter.		
	1.0		- Light brown, trace concrete below 0.61 m.		
	1.5		**SILTY CLAY** - Grey to black, damp, firm, high plasticity, trace concrete.		
	2.0				
	2.5				
	3.0		**SILTY CLAY** - Grey to black, damp, soft, intermediate plasticity, high organic content.		
	3.5		**SILTY CLAY** - Grey, damp, stiff, high plasticity.		
	4.0				
			END OF TEST PIT AT 4.27 m.		
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-62**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	Northeast of TP-51	UTMs (NAD83)	N 5,529,045 E 637,758
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace organic matter, trace concrete.	
	1.0			
	1.5		**SILTY CLAY** - Grey to black, damp, firm, high plasticity, trace concrete, timber.	
	2.0			
	2.5			
	3.0		- Black, soft, trace timber, odour below 3.05 m.	
	3.5		**SILTY CLAY** - Light brown, damp, soft, intermediate plasticity.	
	4.0			
	4.5		**SILTY CLAY** - Brown, damp, stiff, high plasticity, trace oxidation.	
			END OF TEST PIT AT 4.57 m.	
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

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VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-63**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	North of TP-39	UTMs (NAD83)	N 5,529,017 E 637,802
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace organic matter, trace concrete.			
	1.0					
	1.5		**SILTY CLAY** - Grey to black, damp, firm, high plasticity, trace concrete, trace organic.			
	2.0					
	2.5					
	3.0		- Black, high organic content below 3.05 m.			
	3.5		- Light brown below 3.35 m.			
	4.0					
	4.5		- Stiff below 4.27 m.			
	5.0		**END OF TEST PIT AT 4.88 m.**			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

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KGS GROUP

SUMMARY LOG

HOLE NO. **TP-64**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	West landfill area, west of TP-03	UTMs (NAD83)	N 5,529,119 E 637,131
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		SILTY CLAY FILL - Wet, firm, intermediate plasticity, trace granular.		
	1.0		- Concrete blocks and rebar, hole filling with water at 0.91 m.		
			END OF TEST PIT AT 1.22 m.		
	1.5				
	2.0				
	2.5				
	3.0				
	3.5				
	4.0				
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

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DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-65**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

PROJECT

SITE Elmwood Landfill

LOCATION West of TP-64

DRILLING METHOD Excavator - Komatsu WB146

JOB NO. 08-107-15

DATE DRILLED 11/12/2008

UTMs (NAD83) N 5,529,125 E 637,088

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY SAND FILL** - Brown, damp, compact, medium grained sand with silt and trace gravel.		
	1.0		**SILTY CLAY FILL** - Grey, damp, firm, high plasticity, trace organic matter.		
	1.5		- Light brown below 1.52 m.		
	2.0		**SILTY CLAY** - Grey to black, damp, firm, high plasticity.		
	2.5				
	3.0				
	3.5		- Grey, some concrete below 3.35 m.		
	4.0				
	4.5		**END OF TEST PIT AT 4.27 m.**		
	5.0		Note: 1. Could not dig deeper than 4.27 m due to concrete.		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

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DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-66**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	West of TP-65	UTMs (NAD83)	N 5,529,136 E 637,037
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY SAND F FILL** - Brown, damp, compact, medium grained sand and silt, trace gravel, trace organic.			
	1.0		**SILTY CLAY FILL** - Light grey, damp, firm, high plasticity, trace organic matter, trace concrete.			
	1.5					
	2.0		**SILTY CLAY** - Grey, damp, firm, high plasticity, trace concrete, trace coarse grained gravel.			
	2.5					
	3.0					
	3.5		- Grey to black, wet, soft below 3.35 m.			
	4.0					
	4.5		- Damp, firm below 4.27 m.			
	5.0					
			END OF TEST PIT AT 5.18 m.			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

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DATE 11/20/08

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KGS GROUP

SUMMARY LOG

HOLE NO. **TP-67**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	West of TP-66	UTMs (NAD83)	N 5,529,155 E 636,982
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
			SILTY SAND FILL - Brown, damp, compact, medium grained sand and silt, trace gravel, trace organic matter.		
	0.5		SILTY CLAY FILL - Light brown, damp, firm, high plasticity, trace granular (sand).		
	1.0				
	1.5		SILTY CLAY - Brown, damp, firm, high plasticity, trace concrete.		
	2.0				
	2.5				
	3.0				
	3.5		- Black, soft, high organic content, odour below 3.35 m.		
	4.0				
	4.5		- Grey, stiff below 4.27 m.		
	5.0		END OF TEST PIT AT 5.18 m.		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) O
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

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VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-68**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	West of TP-67	UTMs (NAD83)	N 5,529,173 E 636,927
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY SAND** - Brown, damp, compact, medium grained sand and silt, trace gravel, trace organic matter.		
	1.0		**SILTY CLAY FILL** - Grey, damp, firm, high plasticity, trace concrete, trace organic matter.		
	1.5				
	2.0		**SILTY CLAY** - Grey to black, firm, high plasticity.		
	2.5				
	3.0		- Black, soft, high organic content (wood) below 3.05 m.		
	3.5		**SILTY CLAY** - Light brown, damp, soft, intermediate plasticity, some silt.		
	4.0		**SILTY CLAY** - Grey, damp, stiff, high plasticity.		
	4.5		**END OF TEST PIT AT 4.57 m.**		
	5.0		Note: 1. Water seeped into test pit at 2.44 m.		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-69**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	Northwest corner of fenced area, North of TP-68	UTMs (NAD83)	N 5,529,302 E 636,942
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY SAND FILL** - Brown, damp, compact, medium grained sand and silt, trace organic matter.		
	1.0		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace organic matter.		
	1.5				
	2.0				
	2.5		**SILTY CLAY** - Light brown, damp, firm, high plasticity.		
	3.0		**SILTY CLAY** - Grey to black, wet, firm, intermediate plasticity, high organic content.		
	3.5		- Black, soft, trace metal waste below 3.66 m.		
	4.0				
	4.5		**SILTY CLAY** - Grey, damp, stiff, high plasticity.		
	5.0		**END OF TEST PIT AT 5.18 m.**		
	5.5		Note: 1. Water entering test pit at 3.05 m. Water sample taken.		
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-70**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/12/2008
LOCATION	West of TP-69	UTMs (NAD83)	N 5,529,290 E 636,986
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		SILTY SAND - Brown, damp, compact, trace organic matter.			
	1.0		SILTY CLAY - Brown, damp, stiff, high plasticity, trace organic matter, trace concrete, trace metal.			
	1.5					
	2.0		- Grey to black, firm below 1.83 m.			
	2.5					
	3.0					
	3.5		- Grey, stiff below 3.35.			
	4.0		END OF TEST PIT AT 3.96 m.			
	4.5		Note: 1. Water seeped into test pit at 3.05 m.			
	5.0					
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVI\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-71**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/13/2008
LOCATION	East of TP-70	UTMs (NAD83)	N 5,529,275 E 637,027
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY SAND FILL** - Brown, damp, compact, medium grained sand and silt, trace organic matter, trace concrete/rebar.			
	1.0		**SILTY CLAY** - Light brown, damp, firm, high plasticity, trace bricks, trace concrete, trace metal.			
	1.5		- Grey to black below 1.52 m.			
	2.0					
	2.5					
	3.0					
	3.5					
	4.0		- Black, soft, high organic content below 3.96 m.			
	4.5		- Grey, stiff below 4.27 m.			
	5.0		**END OF TEST PIT AT 4.88 m.**			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-72**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/13/2008
LOCATION	East of TP-71	UTMs (NAD83)	N 5,529,250 E 637,081
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY SAND FILL** - Brown, damp, compact, medium grained sand and silt, trace organic matter, trace concrete/rebar.		
	1.0		**SILTY CLAY FILL** - Light brown, damp, firm, high plasticity, trace organic matter, trace concrete.		
	1.5				
	2.0		**SILTY CLAY** - Grey to black, damp, firm, high plasticity.		
	2.5				
	3.0				
	3.5				
	4.0		- Black, moist, soft, high organic content, with garbage below 3.96 m.		
	4.5				
	5.0		- Brown, damp, stiff below 4.88 m.		
			END OF TEST PIT AT 5.18 m.		
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR	INSPECTOR		
J & D PENNER	K. THIESSEN	APPROVED	DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-73**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/13/2008
LOCATION	East of TP-72	UTMs (NAD83)	N 5,529,234 E 637,147
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER
	0.5		**SILTY SAND FILL** - Brown, damp, compact, medium grained sand with silt, trace organic matter, trace concrete.		
	1.0		**SILTY CLAY FILL** - Light brown, damp, firm, high plasticity, trace organic matter, trace concrete.		
	1.5				
	2.0		**SILTY CLAY** - Grey, moist, firm, high plasticity.		
	2.5				
	3.0				
			SILTY CLAY - Black, damp, soft, intermediate plasticity, high organic matter.		
	3.5		**SILTY CLAY** - Brown, damp, stiff, high plasticity.		
			END OF TEST PIT AT 3.66 m.		
	4.0		Note: 1. Water seeped through at 3.35 m.		
	4.5				
	5.0				
	5.5				
	6.0				
	6.5				

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVLOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-74**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/13/2008
LOCATION	South of TP-73	UTMs (NAD83)	N 5,529,175 E 637,141
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**SAND AND GRAVEL FILL** - Damp, compact, medium grained sand and silt.	
	1.0		**SILTY CLAY FILL** - Brown, damp, firm, high plasticity, trace granular (sand and gravel), trace concrete.	
	1.5			
	2.0		**SILTY CLAY** - Grey, saturated, soft, high plasticity, trace garbage, trace concrete.	
	2.5			
	3.0			
	3.5		**CONCRETE**	
	4.0		**END OF TEST PIT AT 3.96 m.**	
	4.5			
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-75**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/13/2008
LOCATION	West of TP-74	UTMs (NAD83)	N 5,529,192 E 637,066
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	SAMPLE NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		SILTY SAND FILL - Brown, damp, compact, trace timber.			
	1.0		SILTY CLAY FILL - Brown, damp, firm, high plasticity, trace organic matter.			
	1.5					
	2.0		SILTY CLAY - Grey to black, damp, firm, high plasticity, trace garbage (clothing, metal, bricks, etc.).			
	2.5					
	3.0					
	3.5					
	4.0		SILTY CLAY - Black, damp, soft, intermediate plasticity, high organic content (wood and reeds).			
	4.5		- Light brown below 4.27 m.			
			SILTY CLAY - Brown, damp, stiff, high plasticity, trace oxidation			
	5.0		END OF TEST PIT AT 4.88 m.			
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-76**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/13/2008
LOCATION	West of TP-75	UTMs (NAD83)	N 5,529,199 E 637,010
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER
	0.5		**SILTY SAND FILL** - Brown, damp, compact, trace organic matter.	
	1.0		**SILTY CLAY** - Light brown, damp, firm, high plasticity, trace garbage (clothing, metal etc.).	
	1.5			
	2.0		- Grey to black, trace organic matter below 1.83 m.	
	2.5		- Black seam below 2.44 m.	
	3.0			
	3.5		**CONCRETE**	
			SILTY CLAY - Black, damp, soft, intermediate plasticity, high organic content.	
	4.0		**SILTY CLAY** - Grey, damp, stiff, high plasticity.	
			END OF TEST PIT AT 4.27 m.	
	4.5		Note: 1. Water seeped into test pit at 3.66 m.	
	5.0			
	5.5			
	6.0			
	6.5			

FIELD HEADSPACE TEST
Photoionizable Vapours (ppm) ●
250 500 750 1000

FIELD SOIL TEST (PETROFLAG)
Diesel Fuel (ppm) ○
1000 2000 3000 4000

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENVI\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TP-77**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	JOB NO.	08-107-15
PROJECT			
SITE	Elmwood Landfill	DATE DRILLED	11/13/2008
LOCATION	West of TP-76	UTMs (NAD83)	N 5,529,219 E 636,957
DRILLING METHOD	Excavator - Komatsu WB146		

ELEV. (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	FIELD HEADSPACE TEST Photoionizable Vapours (ppm) ● 250 500 750 1000 / FIELD SOIL TEST (PETROFLAG) Diesel Fuel (ppm) ○ 1000 2000 3000 4000
	0.5		**SILTY SAND FILL** - Brown, damp, compact, trace organic matter.			
	1.0		**SILTY CLAY** - Brown, damp, firm, high plasticity, trace organic matter.			
	1.5		- Grey, trace garbage (cloth), trace concrete below 1.52 m.			
	2.0					
	2.5					
	3.0					
			SILTY CLAY - Black, damp, soft, intermediate plasticity, high organic content.			
	3.5		**SILTY CLAY** - Grey, damp, stiff, high plasticity.			
			END OF TEST PIT AT 3.66 m.			
	4.0		Note: 1. Water seeped into test pit at 3.35 m.			
	4.5					
	5.0					
	5.5					
	6.0					
	6.5					

SAMPLE TYPE

CONTRACTOR J & D PENNER

INSPECTOR K. THIESSEN

APPROVED

DATE 11/20/08

VAPOURS (FOR TP) NO GW ELEV P:\PROJECTS\2008\08-0107-15\DESIGN\ENV\LOGS\ELMWOOD LANDFILL (NOV 3 TO NOV 13, 2008).GPJ

APPENDIX B

FOUNDATION OPTIONS AND COST EVALUATION

FORMER ELMWOOD / NAIRN LANDFILL SITE

FOUNDATION OPTIONS AND COST EVALUATION

1.0 INTRODUCTION

Site specific structural systems will be required to address landfill related issues at the Elmwood site. The following commentary outlines structural design options; the advantages and disadvantages of these options; the relative costs of each option; and the cost premium relative to more typical Winnipeg site conditions.

2.0 SITE DEVELOPMENT

Functional requirements for the proposed drainage building will include: offices, cold and heated storage, heated storage and a repair/maintenance shop. The total building area will be approximately 100,000 sq. ft (9,300 m^2) with up to 50,000 sq. ft. (4,650 m^2) of additional building area for fleet storage. Site development will also include: salt/gravel storage domes, yard storage, and parking areas for vehicles and heavy equipment.

3.0 SITE CONDITIONS

Test pits varying in depth from 3 to 5 meters have been excavated over the entire site. The depth of fill varies from 2.5 to 3.5 meters. Fill consists of concrete rubble, reinforcing steel and wood debris mixed with clay. At this time no deep test holes have been drilled. Based on prior experience in this area, it is anticipated that below the landfill there will be approximately 15 m to 16 m of clay and silty clay deposits overlaying glacial till and limestone bedrock.

The landfill material presents structural concerns with respect to potential settlement of floors which are constructed on grade and problems with pile installation i.e. augering through the fill and keeping holes open prior to casting piles and/or driving precast piles. In areas where concrete/reinforcing steel conflict with pile locations, installation options will be to core through the debri or excavate and backfill. Cost estimates for piling assume an average cost premium of 30% to account for pile installation complications.

4.0 BUILDING CONSTRUCTION

4.1 BUILDING OPTIONS

Structural options for the building foundations and main floor framing; the associated site preparation requirements; and the relative advantages and costs of each option are as follows:

SITE PREPARATION	STRUCTURAL OPTION	COMMENTS
1) Remove 900 mm to 1200 mm of fill; regraded with compacted crushed limestone and granular fill.	Concrete slab on grade with under slab membrane and ventilation piping; cast-in-place concrete or precast driven concrete piles	• Floor susceptible to settlement. Settlement could be minimized by preloading • Potential problems with augering and / or driving piles through the fill • A portion of the contaminate fill remains in place • Lowest relative cost. The estimate cost for building site preparation, piling and floor slab is $320/m^2. The estimated cost for a typical site which would require only 300 mm of excavation and fill is $210/m^2.
2) Regrade leaving fill in place	Concrete structural slab on void form; under slab membrane and ventilation system; cast-in-place concrete or precast driven piles	• Stable floor • Potential problems with pile installation • Contaminated fill remains in place • Higher cost relative to option 1). The estimated cost is $490/m^2. The estimated cost for this options on a typical site is $430/m^2.
3) Remove approx. 900 mm of fill	Steel framed with precast concrete structural floor or steel joists, metal decking and C-I-P concrete slab; vented crawlspace with membrane; cast-in-place concrete or precast driven piles.	• Stable floor • Potential problems with pile installation • Portion of contaminated fill left in place but a better ventilation system than option 1) or 2) • Higher cost than options 1) or 2). The estimated cost is $500/m^2. The estimated cost for a typical site is $465.00

SITE PREPARATION	STRUCTURAL OPTION	COMMENTS
4) Remove all the fill and backfill with compacted limestone and granular fill.	Concrete slab on grade; cast-in-place concrete piles	• Minimal slab settlement if fill adequately compacted • All contaminates removed, no membrane or ventilation system required • Piles must be installed prior to placing limestone fill which will make it difficult to achieve adequate compaction. • Similar cost to option 1, with membrance and vent pipes excluded. Estimated cost is $\$350/m^2$.
5) Remove all fill and replace with clay fill	Concrete structural slab on void form; cast-in-place concrete piles	• Stable floor • All contaminates removed, no membrane or ventilation required • Piles easiest to install; negative skin friction must be accounted for. • Similar cost to option 2 and 3 without membrance & ventilation cost. Estimated cost is $\$510/m^2$.

4.2 ADDITIONAL COMMENTS

The above options provide a range of possible structural systems. The choice of which system is most appropriate should be made with consideration given to functional requirements and the above grade framing system. A consideration will be to provide an option 1) substructure for the storage and shop area and either option 2 or 3 substructure for the office area. The office area could be 2 or 3 stories in height to minimize the building footprint. The storage/shop area will potentially have longer spans with "preengineered" steel framing components. Precast driven piles will be most appropriate for this superstructure which has fewer columns with higher column loads. Precast piles will also be most appropriate for a 2 or 3 story office building which has higher column loads.

5.0 PARKING AREAS

Base preparation for a typical site would include 600 mm excavation, geotextile, geogrid, limestone and granular fill. The unit cost for a typical site is \$55 to $\$60/m^2$. Assuming 1200 mm average excavation and backfill for the landfill site, the unit cost will be \$95 to $\$105/m^2$.

APPENDIX C

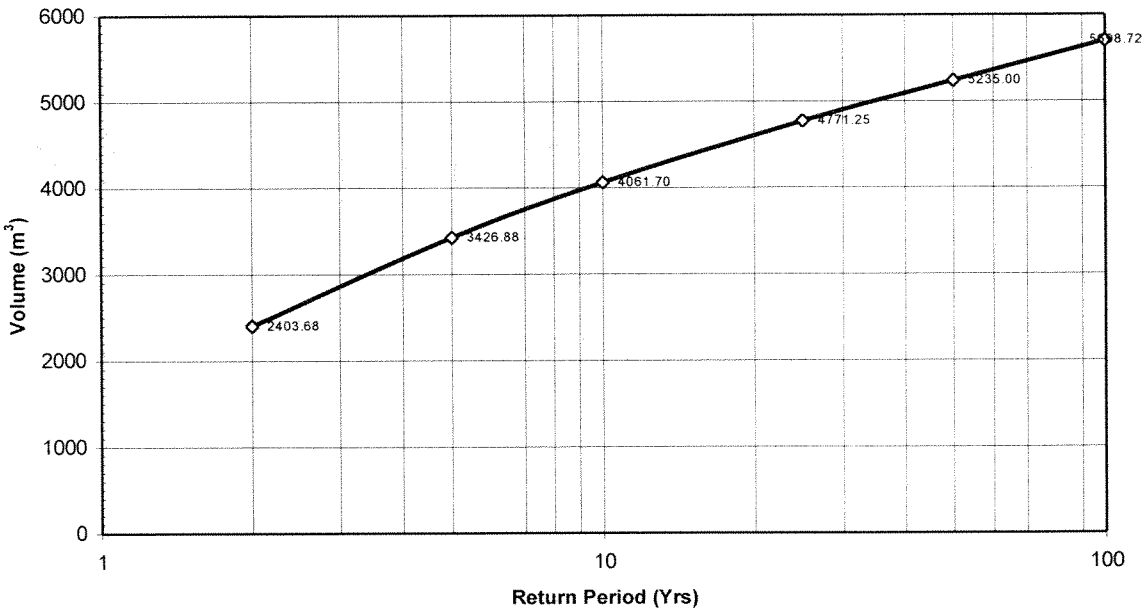
STORMWATER MANAGEMENT POND EVALUATION

STORMWATER POND SIZING ASSESSMENT

Runoff from the proposed development will require management at the site. Runoff from the landfill site will be collected in a wet pond located at the west end of the site. The surface area for the development has been assumed as 200 m x 400 m or 8.0 ha. It has been assumed that the majority of the site, when fully developed will be mostly impervious, with only about 5 percent pervious.

The surface runoff from the site has been determined for rainstorms having return periods from 2 years to 100 years. The computed runoff volumes have been plotted in the figure below as a frequency curve. The 1:25 year runoff volume of 4,700 m^3 has been selected for the sizing of the pond.

At this time there is no information on drainage features (surface drains or buried sewers) to convey the runoff from the site to the pond or downstream sewers or drains to drain water from the pond to the downstream sewer. As a result the pond has been sized to contain the design runoff volume with a pond depth of approximately 2 metres. Assuming equal width and length with 4:1 side slopes for sizing the pond, the approximate dimensions are 40 m x 40 m at the base and approximately 56 m x 56 m at the ground surface.



Appendix D5

Guidelines for the Mitigation of Methane Gas at Buildings and Utilities

and for Construction on Landfill Sites

Water and Waste Department • Service des eaux des déchets

STANDARDS AND GUIDELINES FOR THE MITIGATION OF METHANE GAS AT BUILDINGS AND UTILITIES

- AND -

GUIDELINES FOR CONSTRUCTION ON LANDFILL SITES

December, 2006

CONTACTS:

Trevor Sims, P. Eng.
Acting Planning & Environmental Engineer
Water and Waste Department
Solid Waste Services Division
2nd Floor, 1539 Waverley Street
Winnipeg, Manitoba
R3T 4V7
Telephone: (204) 986-5351
Fax: (204) 774-6729

Martin Grady
Administrator of Zoning and Permits
Planning, Property & Development
Department and Inspections Division
31 - 30 Fort Street
Winnipeg, Manitoba
R3C 4X7
Telephone: (204) 986-5147
Fax: (204) 986-6347

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SECTION I:

1. STANDARDS FOR MITIGATION OF METHANE GAS IN EXISTING BUILDINGS

Methane gas is a colourless, odourless, lighter than air gas. **Methane gas is explosive in a concentration range of 5% to 15% by volume in air in the presence of a source of ignition**. The lower explosive limit (L.E.L.) for methane gas is therefore 5% by volume concentration in air. A methane gas concentration described as 50% L.E.L. (50% of the lower explosive limit) is therefore a concentration of 2.5% methane gas by volume in air.

The current standard of when measures are required to mitigate methane gas infiltration into a building is when a concentration of 1% methane gas (20% L.E.L.) is encountered consistently at any point source within a building. This is generally referred to as a **"take action level"**. A point source is a measurement obtained at a floor crack, floor joint, floor drain, column base, utility access penetration, base grade crack or pile base.

"Consistently", for this purpose is determined to be a majority of monthly methane gas measurements over a period of one year being at or greater than 20% of the lower explosive limit (20% L.E.L., or 1% methane gas in air by volume).

The "take action level" set at a maximum concentration of 1% methane gas in air by volume (20% L.E.L.) (20% of the lower explosive limit for methane) allows a safety factor of 5.

A mid-air measurement of any concentration of methane gas is cause for immediate concern and assessment. A mid-air measurement is a measurement obtained in the mid-air usually at a height of 1.5 metres (4 to 5 feet) above the floor. The response to a mid-air measurement of methane gas is detailed in the "Procedures Regarding Explosive Gas Conditions in Buildings", which follows. It outlines the responsibilities of City departments and the personnel involved in the resolution and mitigation of methane gas concentrations within the building. The policy allows for individual interpretation of site specific conditions related to the building, but still establishes an action level that has a safety factor with respect to explosive concentrations. **As indicated, the detection in mid-air of a concentration of methane gas at or greater than 0.25% methane in air by volume (5% of the lower explosive limit) will be considered as an "alarm" situation.**

The "alarm" situation set at a maximum concentration of methane gas in mid-air of 0.25% methane gas in air by volume (5% L.E.L.) (5% of the lower explosive limit for methane) allows a safety factor of 20.

2. PROCEDURES REGARDING EXPLOSIVE GAS CONDITIONS IN BUILDINGS

If during monitoring of existing buildings on or adjacent to landfills an inspector designated by the Solid Waste Services Division, Water and Waste Department, of the City of Winnipeg encounters dangerous gas conditions, (as later defined herein), the following steps will be followed:

1) The inspector will advise the occupant of the building to vacate the premises until safe conditions are restored. If there are any obvious measures that can be quickly employed to lessen the hazard such as shutting off sources of ignition and providing extra ventilation by opening doors and windows, the occupant will be advised accordingly.

2) The inspector will telephone in an alarm (dial 911), identifying himself as an inspector for the Solid Waste Services Division monitoring for methane gas in buildings, and provide description and location of the subject building. Note that on receipt of a call, the alarm operator will transmit a “telephone alarm” and dispatch a full complement of Fire Apparatus.

3) The inspector will remain at the site until arrival of the Fire Department and will remain with the dispatched unit as required or until the situation has been rectified. The Fire Department will assist in the possible evacuation and ventilation of the dangerous area and remain on the scene until the emergency situation is over and conditions are stabilized.

4) If the situation warrants such action, Fire Communications personnel will attempt to contact the Manager of Development & Inspections, currently Mr. Deepak Joshi (986-5104), or other members of the Development and Inspections Division. During an emergency situation, Development and Inspections Division staff will be available to provide whatever advise or assistance that may be needed. In any event, the Fire Prevention Branch will notify the Development and Inspections Division of the incident upon receipt of the normal Fire Alarm reports. The Solid Waste Services Division will report their findings to the Development and Inspections Division as soon as possible.

5) If the condition cannot be alleviated, the building will remain vacated. If the situation is stabilized, the Solid Waste Services Division will test the premises on a daily basis or as required thereafter until long term protection is provided. Once the Development and Inspections Division is made aware of a hazardous situation they will likely issue an order to the owner to carry out whatever measures are necessary to safeguard the building. The Development and Inspections Division will also do the follow up to ensure that any remedial works were properly designed and installed.

DANGEROUS GAS CONDITIONS

Although 20% of the lower explosive limit (or 1% methane by volume in air) is the maximum acceptable standard currently employed for action to be taken, the alarm level will be at the discretion of the inspector in that there may be other pertinent considerations. In general, a maximum concentration of 5% of the lower explosive limit for methane (or 0.25% by volume in air) will be considered as an alarm situation if this concentration is encountered at mid-air level (in ambient air) within a portion of a building.

3. GUIDELINES FOR MITIGATION OF METHANE GAS IN EXISTING BUILDINGS

When methane gas mitigation measures are required as per previous standards, the approach would be to evaluate the situation on a site specific basis. The site specific approach allows for the consideration of site conditions & features, building construction & foundation, and methane generation or migration potential.

Any mitigation measures to be incorporated into the site or building will be to the satisfaction of the City of Winnipeg; Planning, Property & Development Department; Development and Inspections Division.

Mitigation measures may be in the form of the following techniques:

1) Sealing of floor cracks, breaks and joints.

   The floor cracks, breaks, and joints can be sealed with a variety of elastomeric compounds that prevent the infiltration of methane gas into the building.

2) Under slab venting

   Under slab venting may be a suitable mitigation measure and may be in the form of the following:

   a) a passive venting system, or
   b) an active venting system with or without a methane gas detection system.

3) Perimeter cut-off trench

   A number of design options are available for the installation of a perimeter cut-off trench around a building or site. The trench may include membrane technologies, collection systems, and either passive or active ventilation systems.

4) Under slab membranes

Described as modified slab-on-grade foundation design, the methane mitigation method employs the use of specially engineered membranes and collection systems under the floor slab to preclude methane gas from infiltrating the building. This technique can also be used to mitigate infiltration of methane gas into a crawl space.

All the mitigation measures above require monitoring and maintenance programs to ensure the integrity of the design and installation. The program is to be to the satisfaction of the Development and Inspections Division.

SECTION II:

A. POLICIES:

1. CITY OF WINNIPEG POLICY FOR BUILDING ON LANDFILL SITES

Buildings on landfills are allowed subject to compliance with the following conditions:

1. The elevation of the lowest part of the floor structure shall be a minimum of 750 mm above finished grade level.

2. The underside of the structural floor slab shall be free of obstructions to allow free air movement under the building. Vertical piles and shear walls shall be permitted provided they do not substantially obstruct air movement. The underside of the floor slab shall be free from pockets which may accumulate methane gas.

3. A minimum unpaved clear space of 100 percent of the building area shall be maintained equally around all sides of the building to allow for free venting and air movement around the building. Where paving is necessary for access to the building only, the clear space shall be increased by the amount of paved area. Also, the building shall be located in consideration of any existing structures, pavement or operations at the site to prevent obstruction of free venting and air movement under and around new or existing buildings.

4. Underground building services entering the building through the floor slab shall be isolated to prevent any transmission of methane gas through the slab, or within the service lines themselves.

5. Safety procedures during any excavations for the building or services shall be in accordance with the City of Winnipeg, Works and Operations, Standard Construction Specifications, Provisions CW 1100 23. In addition, water shall be added during augering for piles to prevent heating and ignition of combustibles in the fill.

6. The building and underground services shall be designed by a qualified registered engineer. The design of the building and services shall consider the chemical and physical effects of fill materials present at the site on the integrity of the building and services.

7. Twice a year, or at times satisfactory to the Manager of Development & Inspections, the owner shall submit a report to the said Manager, by a qualified registered engineer, certifying
   (a) that the structure and underground services have been tested for methane gas,
   (b) that the structure and underground services have been examined structurally, and
   (c) that venting and free air movement is being maintained under and around the

structure in accordance with conditions 1, 2, and 3. The report shall state whether the structure and services are performing as designed. In the event the results of testing and/or inspections indicate unsatisfactory conditions, the report shall set out the recommended remedial measures.

8. The owner shall execute any legal documents required by the City Solicitor.

Policy adopted by Council - December 19, 1984.

2. POLICY FOR BUILDING ON NAIRN-ELMWOOD LANDFILL SITES

Building permits on the Nairn - Elmwood landfill sites are allowed subject to compliance with the following conditions:

a) An investigation of the subject site approved by the Water and Waste Department must be undertaken to determine the nature and extent of methane generating material.

b) If methane generating material is found, it must be removed from the subject site and replaced with an inorganic fill to the satisfaction of the Water and Waste Department.

c) Methane protective measures approved by the Planning, Property & Development Department must be incorporated in the design of buildings and services.

3. POLICY REGARDING BUILDING PERMITS ADJACENT TO LANDFILLS

Zones of Concern (also known as Control Zones) from the landfill boundary in the City of Winnipeg vary from either 15 metres, 45 metres, or 90 metres. Current interim policy regarding building permits within the Zone of Concern adjacent to landfill sites states:

That building permits within the Zone of Concern adjacent to landfill sites be granted where:

(a) Test results indicate that there does not appear to be significant amounts of gas, or
(b) Acceptable safety measures are incorporated where test results indicate significant amounts of gas are reaching the permit area.

The owner must execute any forms or documents, as required by the City Solicitor. The Standard Acknowledgement Form is a minimum requirement.

If the City's monitoring program is not in place at the particular site, the owner must also install and maintain for up to three years acceptable gas test probes and must grant the City access for testing.

B. STANDARDS:

1. DEVELOPMENT AND CONSTRUCTION OF BUILDINGS ON LANDFILL SITES

Landfill sites may represent an opportunity for development, especially in areas where available land surrounding the landfill site is significantly developed and has high real estate or commercial value. The development of landfill sites require that a number of factors be addressed. The most significant factors to be addressed are:

1) Landfill Gases

The most dangerous landfill gas to be considered is methane gas, which can build up to explosive levels. Other gases that are generated are carbon dioxide and hydrogen sulphide. Trace levels of volatile hydrocarbons such as benzene, toluene, and xylene may also be generated. Mitigation measures are required in the development of the site and buildings to preclude their infiltration into buildings and structures. Adequate precautions are also required during construction and these precautions may impact on standard construction practises.

2) Leachate

The fluid in the landfill site known as leachate must be controlled to eliminate build up and "break-out" seepage, and percolation into ground water aquifers . Leachate is considered to adversely impact the environment. Leachate is also considered to have adverse impacts to health. Leachate may also be corrosive to structures and materials. Adequate precautions are to be implemented in the development and construction on landfill sites which address the adverse impacts presented by leachate.

3) Settlement

The settlement of landfills must be considered in the design of foundations and structures on landfills. The differential settlement and the unpredictability of settlement must be considered in the design and construction of access roads, utilities, light standards, parking lots, land use, land drainage, and in the long term maintenance and cost.

4) Final Cover Material and Grading

The final cover material and grading must be designed to maintain the cover integrity. Cover materials that promote infiltration are undesirable. Surfaces that are too steeply graded are subject to erosion. Steep grades are also subject to slope failures. Surface drainage that results in water accumulation and "ponding of water" must be avoided.

5) Vegetation

Careful selection of trees, shrubs, and ground covers is required to ensure that roots do not penetrate the landfill cap (clay cover) and increase its permeability. The vegetation must also tolerate the stresses of landfill gases. Some trees may require protective measures for landfill gases. Other vegetation may require enhanced nutrient soils (compost & fertilizer). Properly planned vegetative cover can assist in controlling surface erosion and infiltration. Phytoremediation can also used to treat landfill leachate

Safety is the prime objective. Ongoing surveillance and maintenance of the site is necessary in order to monitor any changes and identify any potential problems.

2. STANDARDS FOR CONSTRUCTION ON LANDFILL WASTE

POLICY - The City policy for Building on Landfill Sites requires that elevated construction must be used for enclosed buildings overlying waste, such that the lowest part of the floor is a minimum of 750 mm above finished grade level. Other conditions required include free air access under the building, venting around the building, measures to prevent methane transmission through underground services, safety measures during construction, evaluation of waste compatibility with structures, inspections, monitoring and legal arrangements.

A special policy applies to the Nairn and Elmwood Landfill sites, where random pockets of waste are spread out over a large area. At the Nairn and Elmwood sites, a property proposed for a building site must be investigated with a drilling program. If the methane generating material is found within the proposed building limits, the material must be replaced with inorganic fill. Methane protective measures must also be incorporated in the design of buildings and services.

IMPLEMENTATION - New buildings are required to use elevated construction. Other buildings previously constructed on waste are reviewed on a building specific basis with engineered gas controls, retrofit protective measures, and monitoring systems or programs.

3. STANDARDS FOR CONSTRUCTION ADJACENT TO LANDFILL WASTE

POLICY - Building permits are granted for construction in control zones adjacent to waste where test results indicate there does not appear to be “significant” amounts of gas in soil. Builders must drill or excavate to a radius equal to the control zone around their building to prove that there is no waste under the building. Where “significant” amounts of landfill gas are reaching the site, building permits may be granted, where acceptable safety measures are incorporated. If the City’s monitoring program is not in place at the particular site, the owner must also maintain acceptable gas probes and grant the City access for testing for 3 years. The City is also open to petition to reduce a control zone, subject to technical verification by the proponent.

IMPLEMENTATION - The policy does not specify a number for "significant" levels of gas. In practise, levels of methane greater than or equal to 20% LEL (1% methane in air) in the subsurface in the control zone are considered significant and would require building control measures. If levels are less than 20% LEL, an evaluation is done on a site specific basis based on the City's historical monitoring at the site and on a monitoring system set up by the proponent. A specified period of monitoring is not set, since landfill gas concentrations may vary widely with weather conditions. A three year period has been used in some cases.

4. NATIONAL BUILDING CODE OF CANADA 1995 SECTION 4.2.4.15. CONSTRUCTION ON FILL

4 . 2 . 4 . 15 . Construction on Fill

(1) *Buildings* may be placed on *fill* if it can be shown by *subsurface* investigation that:

a) the *fill* is or can be made capable of supporting the *building*,
b) detrimental movement of the *building* or services leading to the *building* will not occur, and
c) **explosive gases can be controlled or do not exist.**

Note also the previously used : MANITOBA BUILDING CODE 1992

SUBSECTION 4 . 2 . 4 DESIGN REQUIREMENTS

SECTION 4 . 2 . 4 . 15 . Construction on Fill

(1) *Buildings* may be placed on *fill* if it can be shown by *subsurface* investigation that:

a) the *fill* is or can be made capable of supporting the *design loads*,
b) detrimental movement of the *building* or services leading to the *building* will not occur, and
c) **explosive gases can be controlled or do not exist.**

There are areas in the City of Winnipeg that were investigated as landfill sites, but were not determined to be, and therefore, not designated as landfill sites. The investigations carried out at these sites showed no significant domestic refuse or commercial industrial type refuse disposal at these sites. In most cases the sites were "fill" sites - filled with a variety of fill materials described as construction demolition waste, concrete & stone rubble, "not so clean" fill, highly organic soil backfill, and clay fill. In terms of organic content, municipal landfill material contains 25 - 30%, typical Manitoba soils up to 12% in the top meter, and "fill" usually significantly lower than 10%.

The results of the Landfill Environmental Section investigation into these type of fill sites showed that when organic soils are subjected to the proper conditions for methanogen activity;

more specifically; warm, moist, anaerobic conditions; then methane gas is generated. These sites are not designated as landfill sites and the policies related to landfill sites are generally not applicable to these sites. The development of these sites and the construction of buildings on these sites is referenced in the building codes. The National Building Code of Canada 1995, Section 4.2.4.15 as presented above and the previously used Manitoba Building Code 1992 have specific reference to this situation.

The reference to explosive gases is directed at the production of methane gas in the organic fill and the requirement to include mitigation measures into the building design similar to the policies and recommended guidelines for the construction on landfills.

5. STANDARDS FOR LANDFILL GAS AT WASTE AND PROPERTY BOUNDARIES

POLICY - The lower explosive limit (LEL) of methane is 5% in air. City policy states that if gas concentrations immediately outside of the fill exceed 20% LEL (1% methane in air), gas barrier controls (with monitoring) are to be considered at the landfill. Where gas concentrations immediately outside the fill are less than 20% LEL, long term monitoring would be continued. Long term monitoring is necessary, since gas generation and migration can vary with weather conditions and soil disturbance, and because gas production is not to be reduced greatly in the foreseeable future (City of Winnipeg 1984).

IMPLEMENTATION - The City policy has been implemented as follows:

- Where the property boundary is beyond the waste boundary, the 1% methane standard applies at the property boundary instead of the waste boundary.

- Where no buildings exist beyond the property boundary, no controls are implemented. Probes have been drilled close to the waste boundaries first and then into the control zone. Barrier controls have been constructed at Kimberly Landfill and Margaret Park Landfill. Landfill gas management strategies have been developed for sites where methane is found beyond the waste boundary. These strategies include soil probe and building monitoring, reliance on natural barriers such as ditches and high water tables and engineering controls.

C. GUIDELINES:

1. DESIGN GUIDELINES FOR CONSTRUCTION ON LANDFILL SITES

The design guidelines for landfill site construction presented as follows are general in nature, and are meant to assist the owner, developer, and consultant in the interpretation of a site and how to best address the concerns related to landfill sites. The specifications are generic and are useful in developing construction drawings and construction specifications for your particular project. The methods and specifications presented here are not to be construed as policy and design approved by the City of Winnipeg. Site assessment and development plans must be accepted by the Solid Waste Division of the Water and Waste Department. Any methane protective measures incorporated into a building must be approved by the Development and Inspections Division of the Planning, Property and Development Department.

ACCEPTABLE METHODS OF CONSTRUCTION

A. ADJACENT TO LANDFILL SITES

1. Slab on grade (may require modification ie. membranes)
2. Traditional friction pile design
3. Gas migration infiltration shall be prevented by one of the following methods:
   a) elevated construction
   b) the interceptor vent trench
   c) membrane layer and collector system
   d) an intensive, approved monitoring program

B. ON LANDFILL SITES

1. Elevated construction (City of Winnipeg Policy)
2. Special conditions, alternatives to be considered
   a) Modified slab on grade construction (protective membranes) and all the refuse below the building removed. -- ie, Nairn - Elmwood Landfill site
   b) Gas infiltration prevented by one of the following methods:
      i) elevated construction
      ii) interceptor vent trench (gas barrier) may be used if refuse is completely removed behind the barrier trench.
      iii) an engineered, monitored, detection and ventilation system.
3. Note that for pile foundations, the thickness of the refuse layer must be deducted from the effective length of friction piles, and consideration given to preventing landfill fluids seeping around piles or into pile holes.

2. FOUNDATIONS FOR BUILDINGS ON LANDFILL

If the development of a landfill site includes the construction of buildings, then in addition to addressing all the other issues and policies related to development on landfills, consideration must be made in the construction and design of the buildings' foundation. Included in the Appendix are some examples of building foundations of a general nature that present the design objectives of construction on landfill sites. Each individual building foundation design must be examined on a site specific basis, and judged according to whether it addresses the landfill site hazards present, and meets the policies of the permitting authority. The permitting authority in the City of Winnipeg is the Development and Inspections Division of the Planning, Property & Development Department.

The examples presented in the Appendix include:

Figure 1 Construction of Buildings on Landfill - Elevated Construction
This figure shows a schematic of a building with a structural slab floor elevated on piles. Note that the services to the building are sealed against infiltration of landfill gases.

Figure 2 Construction of Buildings on Landfill - Slab-on-Grade Construction
This figure shows the schematic of a building with a slab-on-grade floor which has been modified to prevent the infiltration of landfill gases into the building. The modified slab-on-grade construction includes membranes, and a collection and venting system.

Figure 3 Design Guidelines for Landfill Site Construction
- Modified Slab-on-Grade Construction - Plan View
This figure shows the plan view of a collection and venting system.

Figure 4 Design Guidelines for Landfill Site Construction
- Modified Slab-on-Grade Construction - Cross-Section
This figure provides a cross-section view of this design, showing the placement of membranes, collection pipes, and granular fills.

Figure 5 Design Guidelines for Landfill Site Construction
- Modified Slab-on-Grade Construction - Cross-Section Detail
This figure shows the placement of membranes, collection pipe, and granular fills in more detail than Figure 4.

3. UTILITY TRENCHES AND SERVICES ON OR NEAR LANDFILL SITES

The development and construction of buildings or structures on or near a landfill site usually require utilities and services such as water, waste water sewers, land drainage sewers, hydro, and telephone. The installation and construction related to these services generally involve trenching and augering, and the installation of poles, transformers, switch boxes, catch basins, and manholes. All these utilities' installations must be designed to address the hazards related to landfill sites, mainly settlement and methane gas. The concern to address in design and installation with respect to methane gas is that:

1) methane gas may be present during construction,
2) the utility trench and/or conduit may create a corridor or pathway for significant gas migration to appurtenances or buildings, and
3) the utility facilities, ie. boxes, vaults, terminals, transformers, structures, posts, & conduits may accumulate concentrations of methane gas to explosive levels.

The placement of underground services and utility installations on landfill sites is not rcommended. Specific safety requirements both in design and during installation must be employed.

The area at the landfill boundary and beyond for specified distances (15, 45, & 90 meters), known as Zones of Concern, are usually where most utility and service installations are located. The design and installation of these require measures which address the possibility of methane gas migration from the landfill site.

The safety measures to be implemented during construction are referenced in the City of Winnipeg's Standard Construction Specification manual, Provision CW 1100 23. Construction Safety In and Around Landfills.

In general, mitigation measures such as barriers would be required where the potential exists for methane gas migration in concentrations at or approaching 20% of the lower explosive limit (20% L.E.L.), or 1% methane gas in air by volume, to occur at the installation site.

The Solid Waste Services Division of the Water and Waste Department should be contacted regarding:

a) Assessment of site conditions to determine the mitigation measures required.
b) Clearance for procedures involving trenching and augering for installations.
c) Approval of installation details relating to the design, and safety measures to be employed during the installation (reference CW 1100-R2, Cl. 23).
d) Monitoring following installation.

Typical utility trench barrier installations are shown in the figures included in the Appendix.

4. GAS INFILTRATION PREVENTION MEASURES

A. MEMBRANE AND COLLECTION-VENTILATION SYSTEMS

1. Primary membrane

A gas impermeable membrane installed above granular sub-base.
Typical membrane materials:

a) Polyolefin (elasticized)
b) Hypalon (chlorosulfonated polyethylene) (CSPE)
c) CPE (chlorinated polyethylene)
d) HDPE (high density polyethylene)
e) PVC membrane

Numerous types of membranes with different formulations are available from a variety of manufacturers. The membrane selected must have material performance specifications that meet the criteria for the use intended. The membrane shall be installed by an experienced membrane installer, carefully following manufacturer's instructions for installation, seaming, and joining with dissimilar materials, ie. adhering to concrete. In almost all installations, the membrane must be a minimum 20 mil thickness; continuous under the floor and extend to the grade beam; and have "slack" to allow for settlement.

2. Gas Collection System

a) Material
   i) The aggregate size for the gas collection system shall be 3" gravel down to pea size gravel. The gravel should not contain more than 10% material finer than 2 millimetres in size.

   ii) The aggregate should be durable and not subject to acid attack.

   iii) The aggregate material should be well rounded.

b) Placement of Material
   i) The aggregate should be placed in a single layer throughout the area beneath the membrane.
   ii) The layer of aggregate shall be a minimum of 8" thick.
   iii) The soil surface on which the porous material is placed should be sloped at least 1% to drain to a low point.
   iv) Provision must be made to remove condensate from the low point.
   v) The layer of porous granular material shall be discontinued at a distance of 3 metres (10 feet) from the inside perimeter of the building.

c) Gas Collector Piping

i) The gas collector piping shall be laid within the porous granular material beneath the membranes; approximately 2" beneath the primary membrane.

ii) The gas collector pipe shall be laid out in a rectangular grid pattern approximately on 20 foot centers.

iii) The pipe shall be perforated with drilled holes 3/8" to 5/8" in diameter, or slots sawed to a depth of 1/4 to 1/3 the pipe diameter, or a manufactured gas collector pipe.

iv) A minimum of four rows of drilled holes, or two rows of saw cuts, should be used on gas collector pipes.

v) Typical pipe materials include PVC, High density polyethylene, fibreglass, and ABS.

vi) Gas monitoring ports are usually provided within the system. Other monitoring probes may be installed into the granular sub-base to monitor gas accumulations below the membranes.

3. Sand Layer Above Primary Membrane

A dry 4" layer of sand shall be laid above the primary membrane. Gas probes installed into this layer of sand monitor the performance of the primary membrane. The gas probes are designed so that penetrations through membranes are properly sealed.

4. Secondary Membrane

The secondary membrane is usually identical to the primary membrane in both material and installation. It is placed above the primary membrane on top of the sand layer. This membrane provides a second level of protection for the building.

5. Protection of Secondary Membrane

A 2" layer of sand shall be placed above the secondary membrane to provide some protection from damage. Gas probes installed to monitor this layer for any accumulation of gas do not penetrate any membranes. A drilled hole through the floor slab provides access to this layer.

6. Vertical Vents

a) The vertical vents shall be located at the high points of the collection system piping. The vertical vents should be installed so that the horizontal run of the collection piping does not exceed 200 feet between vertical vents. In most designs for small buildings the spacing between vertical vents rarely exceeds 100 feet.

b) The vent piping shall be non-perforated, non-corrosive pipe. Usually the vent pipe is of the same material as the collection pipe. The vent pipe should be protected

from damage and breakage.

c) Where the vent pipe is exposed to freezing, the diameter of the vent pipe should be large enough that condensate freezing does not plug the pipe. Otherwise, alternative heat source is required for the piping, ie., heat tape.

d) The vent pipe termination, whether it is through the roof or outside wall, should be protected from precipitation and from birds.

e) Vent pipe inside the building shall be properly identified and marked distinctly.

7. Ventilation Systems

a) Passive system - The vertical vents can vent naturally into the atmosphere, or

b) Active system - a mechanical ventilation system can be connected to the collection system to extract the air and gases from the system. This system may be as simple as a "whirlybird" extractor installed at the termination of the vent stack, or a highly complex system of fans, detectors, sensors, manometers, automatic baffles, shutters, and back-up systems. The latter has detailed operating procedures and strict maintenance programs that make them expensive to install and maintain.

c) The ventilation system design and drawings shall be approved by a registered, professional engineer and stamped accordingly. Various components of the system may have to be designed for an explosive, gaseous environment. The system shall be installed by qualified professionals.

d) The system and installation must be approved by the Development and Inspections Division of the Planning, Property and Development Department.

e) Safety guidelines for construction on or adjacent to landfills must be adhered to in the installation of the collection-ventilation system.

B. INTERCEPTOR VENT TRENCH (GAS BARRIER)

For some site conditions and building development requirements, it may be desirable to install an interceptor vent trench, or gas barrier, as it is generally known, as opposed to other typical prevention measures. The interceptor vent trench can be placed immediately adjacent to the building or at any distance from the building. However, all waste material, refuse, and organic fill must be removed from under the building site, and from behind the interceptor vent trench (protected area).

a) Material

i) The granular backfill aggregate for the trench shall be well-graded, rounded, with a maximum aggregate size of 75 mm and not more than

10% finer than 2 mm. The aggregate shall be durable and not susceptible to acid attack.

ii) The membrane selected shall have the material performance specifications that meet the criteria for the use intended. The membrane shall be installed by an experienced membrane installer, carefully following manufacturer's instructions for installation, seaming, and joining with dissimilar materials, ie. adhering to concrete. The membrane must be a minimum 20 mil thickness.

iii) Typical gas collector piping materials include PVC, high density polyethylene, fibreglass, and ABS. Perforated 4" diameter pipe is the usual selection.

iv) The geotextile fabric filter selected shall have the material performance specifications that meet the criteria for the use intended. The geotextile fabric filter is used to impede the infiltration of "fines" into the trench aggregate.

b) Installation

i) The depth of the trench shall be 2 feet below the depth governed by the following:
- the depth of fill material over undisturbed clay
- the depth of silt layers or sand layers (migration corridors) in the unsaturated zone
- the depth of frost penetration and depth to continuously saturated zone.

The minimum depth of trench shall be 8 feet measured from final grade.

ii) The membrane shall be laid along the "building side" of the excavated trench wall, continue all around and down to the bottom of the trench to the opposite side. The trench shall be backfilled with granular aggregate to within 2 feet of the ground level.

iii) The geotextile fabric filter shall be placed on the top of the granular aggregate to impede the infiltration of "fines" into the trench. Under some conditions, the entire trench may have to be lined with a geotextile fabric filter. A layer of compacted clay fill shall be placed on top of the trench as a cap. Final backfill grade material shall be placed on the clay cap.

iv) The gas collection piping shall be placed in the upper section of the trench. The gas collector system shall have vertical vent stacks installed at appropriate intervals around the collection system. The vertical vent stacks shall be extended to exhaust passively or actively, and the termination protected from precipitation and birds.

v) The trench shall be capped with a layer of compacted clay approximately 2 feet thick, and a final backfill sloped away from the building foundation.

2. Interceptor Vent Trench (Gas Barrier) - Basement Foundation

a) Material

The material specifications are the same as for previous installation.

b) Installation

The installation specifications are the same as the previous interceptor trench, except as to the placement of the membrane barrier adjacent to the foundation and the installation and /or interconnection to weeping tile.

i) The membrane shall be continuous around the foundation, and shall be placed against the foundation down to the bottom and then to the outside edge of the excavation. The membrane shall be protected from punctures and tears.

ii) The weeping tile shall be installed outside the membrane and the membrane penetration shall be sealed. Designs shall have to address the possibility of gas migration through the weeping tile into the building. The weeping tile may be directly connected to the gas collection system.

iii) The gas collector piping (perforated) shall be placed to connect the lower and upper areas of the interceptor trench. More than one collection pipe around the building may be used, and installed at various levels within the trench.

iv) Monitoring programs incorporating gas probes and detection systems shall be included with this type of building protection.

c) Design

i) The design shall address the site specific conditions as determined by professional engineering investigations approved by the Solid Waste Division of the Water and Waste Department.

ii) The interceptor trench design and installation shall be approved by the Development and Inspections Division of the Planning, Property and Development Department.

iv) The safety guidelines for construction on or adjacent to landfills shall be

adhered to in the installation and maintenance of the interceptor vent trench.

C. ELEVATED CONSTRUCTION

The current accepted policy in the City of Winnipeg; adopted by Council December 19, 1984; for construction on a landfill site, to protect the building from gas infiltration, is elevated construction. The objective of this type of protection is to elevate the structure above the landfill, allowing free air movement around and under the structure, venting diffusing gases directly into the atmosphere, and creating no features within the foundation to trap gases migrating from the landfill deposits. Services provided to the building are designed so as not to create a passageway for gas infiltration. The Policy is detailed in "City Of Winnipeg Policy For Building On Landfill Sites". The policy includes the following:

1. The elevation of the lowest part of the floor structure shall be a minimum 750 mm (2 1/2 feet) above the finished grade level.

2. A minimum clear, unpaved (allowing gas diffusion) area around the building is defined by the policy, and must be maintained throughout the life of the building.

3. Provisions for ensuring that the structure does not trap gases migrating or diffusing from the landfill, and that the utility services to the building do not provide a passageway for gas to enter the building.

4. The safety regulations related to landfill construction must be adhered to in the construction and maintenance of the building, and the installation of gas protective systems.

5. A continued program of building monitoring must be carried out by the building owner and submitted to the Supervisor of Building Inspections.

6. Legal documents as required by the City Solicitor related to the landfill development policies and the building's construction and maintenance must be executed by the owner.

CAP 2001 03 19
G:\DATA\WPDOCS\BUILDING\POL01GDL.WPD

STANDARD ACKNOWLEDGEMENT FORM

Date: .....

Mr. Deepak Joshi
Manager of Development & Inspections
Planning, Property & Development Department
Mezzanine 84 - 30 Fort St.
Winnipeg, Manitoba
R3C 4X7
Phone: (204) 986-5104 Fax: (204) 986-3045

Dear Sir:

RE: _____

Property Legal Description:

I/we
being the registered owner/s of the above described property hereby acknowledge the possibility of Landfill Gas being present on, in or under the building/s and /or land affected by my application to build thereon.

I/we
understand that it might be necessary to incorporate safety measures into the design of any building located on the said lands and hereby agree to install or incorporate any such safety measures as the Manager of Building Inspections may from time to time deem necessary.

Yours truly,

....

....

AUTHORIZATION FORM
FOR
THE INVESTIGATION OF LANDFILL GAS

AUTHORIZATION

TO: THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

RE: Property described as:

In consideration of the City of Winnipeg carrying out, at its own cost, work it may consider appropriate to assess whether landfilled waste material exists which may produce or is producing landfill gases, mainly methane gas, in quantities which may present a hazard to buildings on or adjacent to said landfilled waste materials:

I/we

for myself/ourselves and for my/our heirs, executor, administrators and assigns hereby authorize the City of Winnipeg to enter on the above land and premises for the purpose of doing such work.

I/we further agree not to cause or commit any act which may disrupt or effect the City's work herein.

It is agreed and understood that the investigation, exploration and monitoring to be carried out by the City is intended to determine whether there is a presence of landfill gases within and beneath the building, and that such monitoring is not intended to prevent the entry or accumulation of landfill gases on lands or in buildings at the above noted premises.

SIGNED AND SEALED

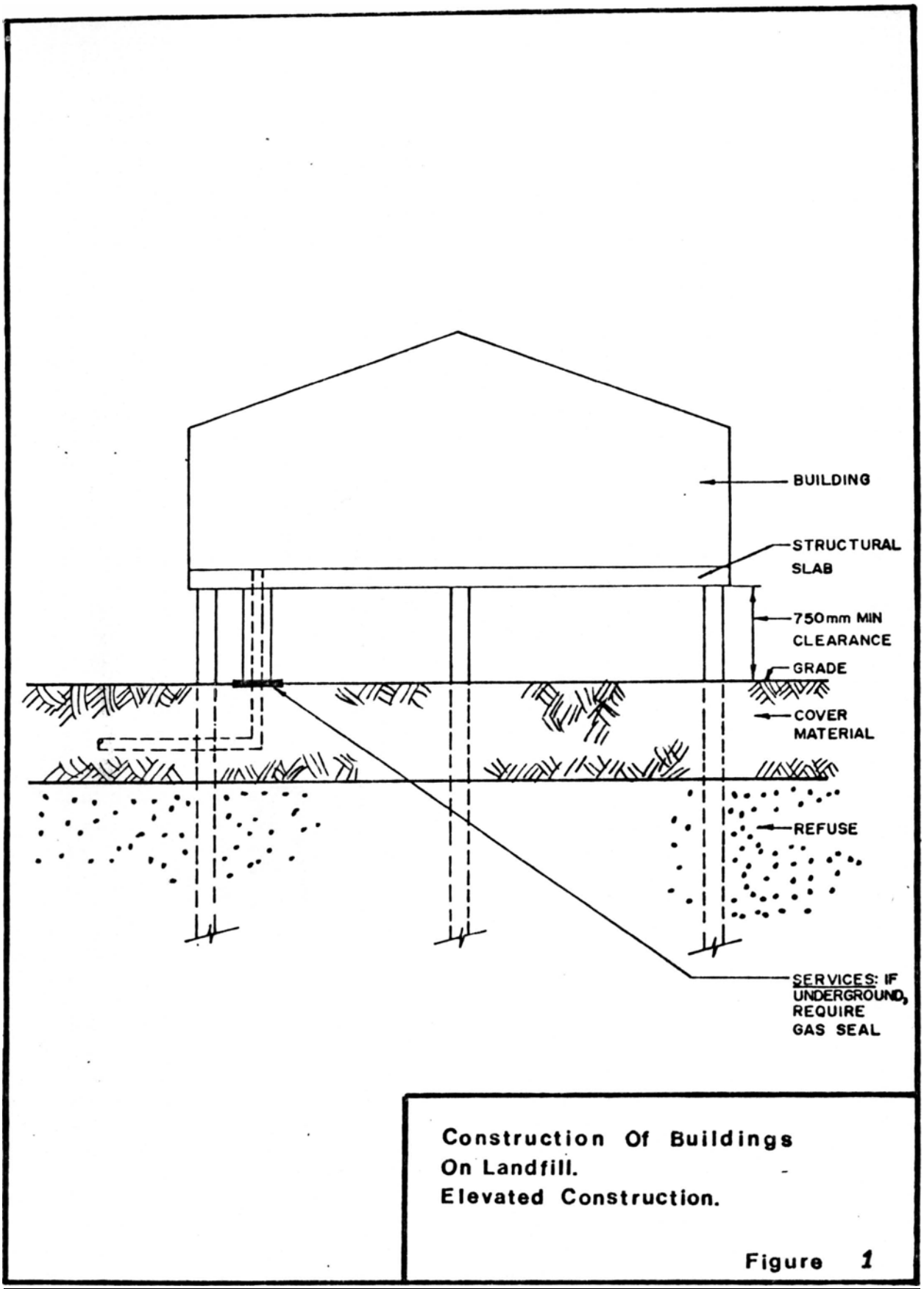
DATED the _____ day of _____ , ____ .

WITNESS:

CAP 2001 03 16

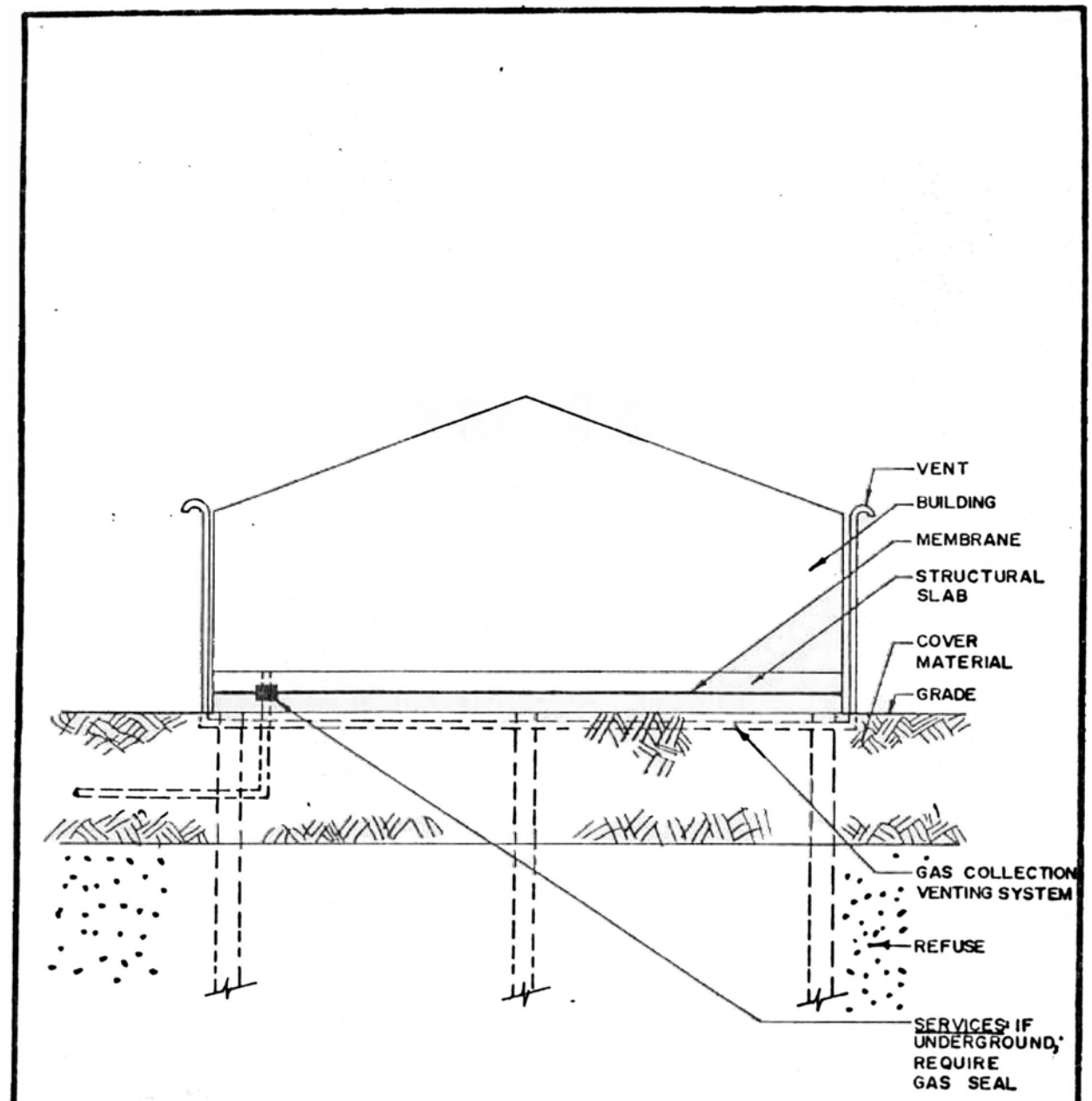
APPENDIX

LIST OF FIGURES



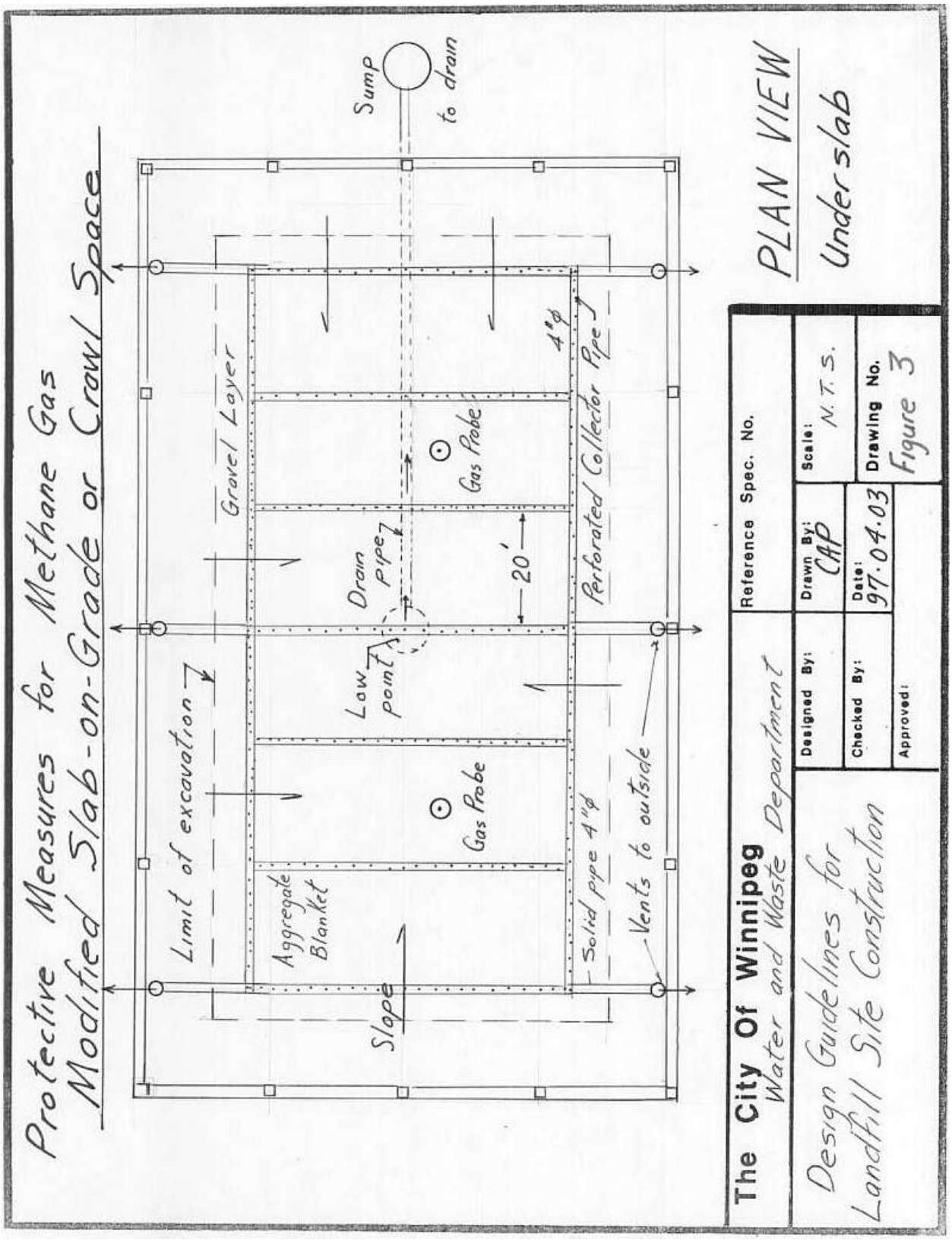
Construction Of Buildings On Landfill. Elevated Construction.

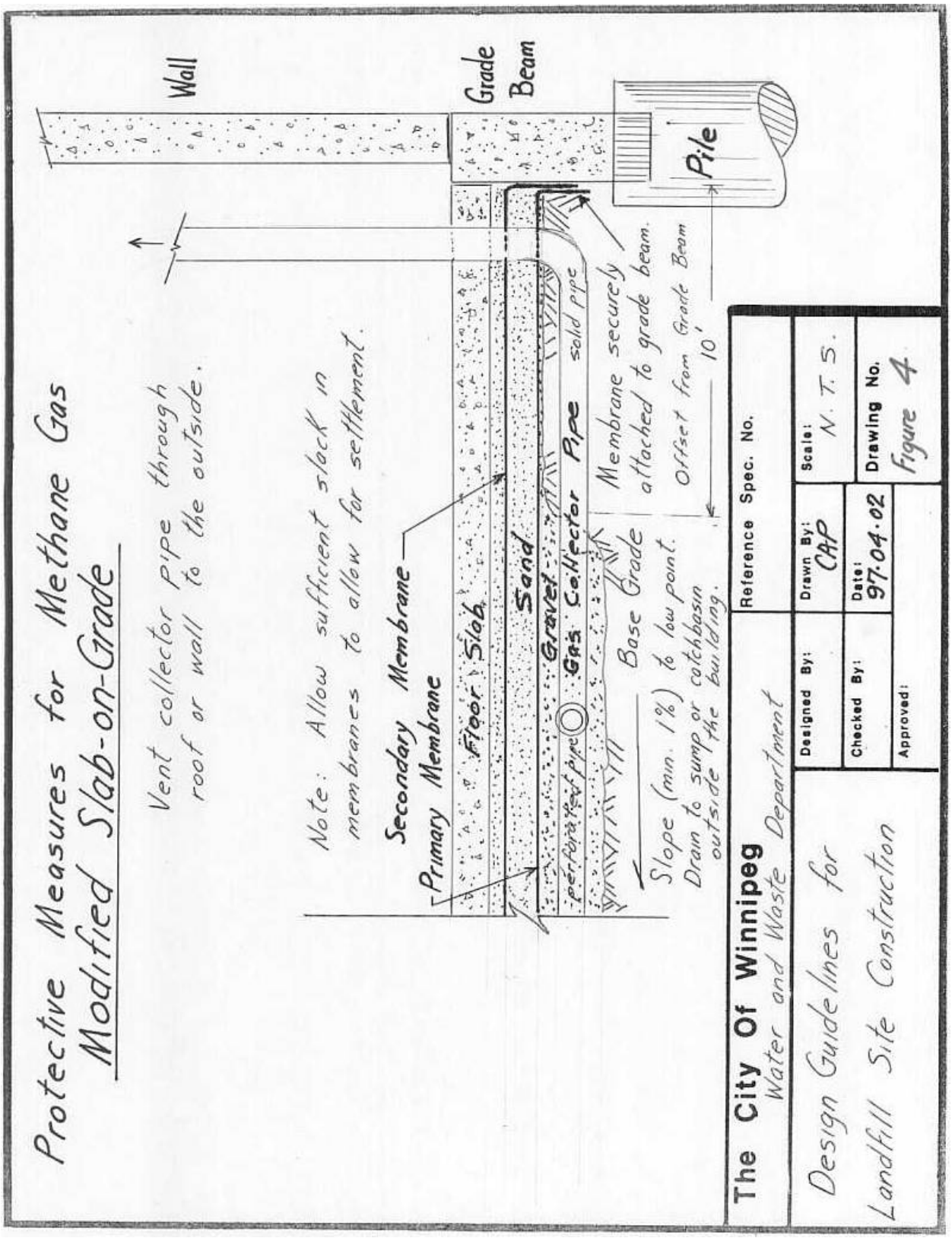
Figure 1

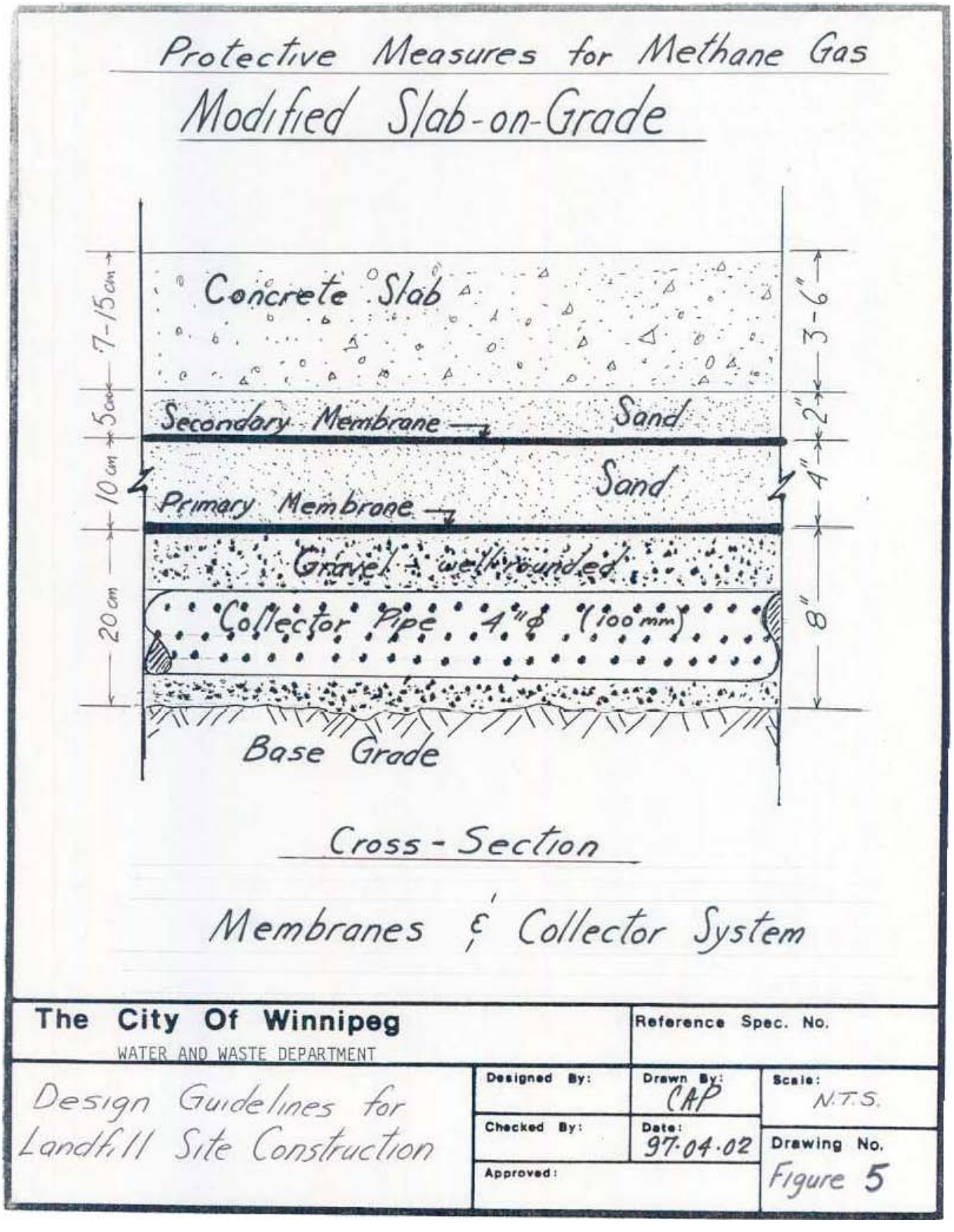


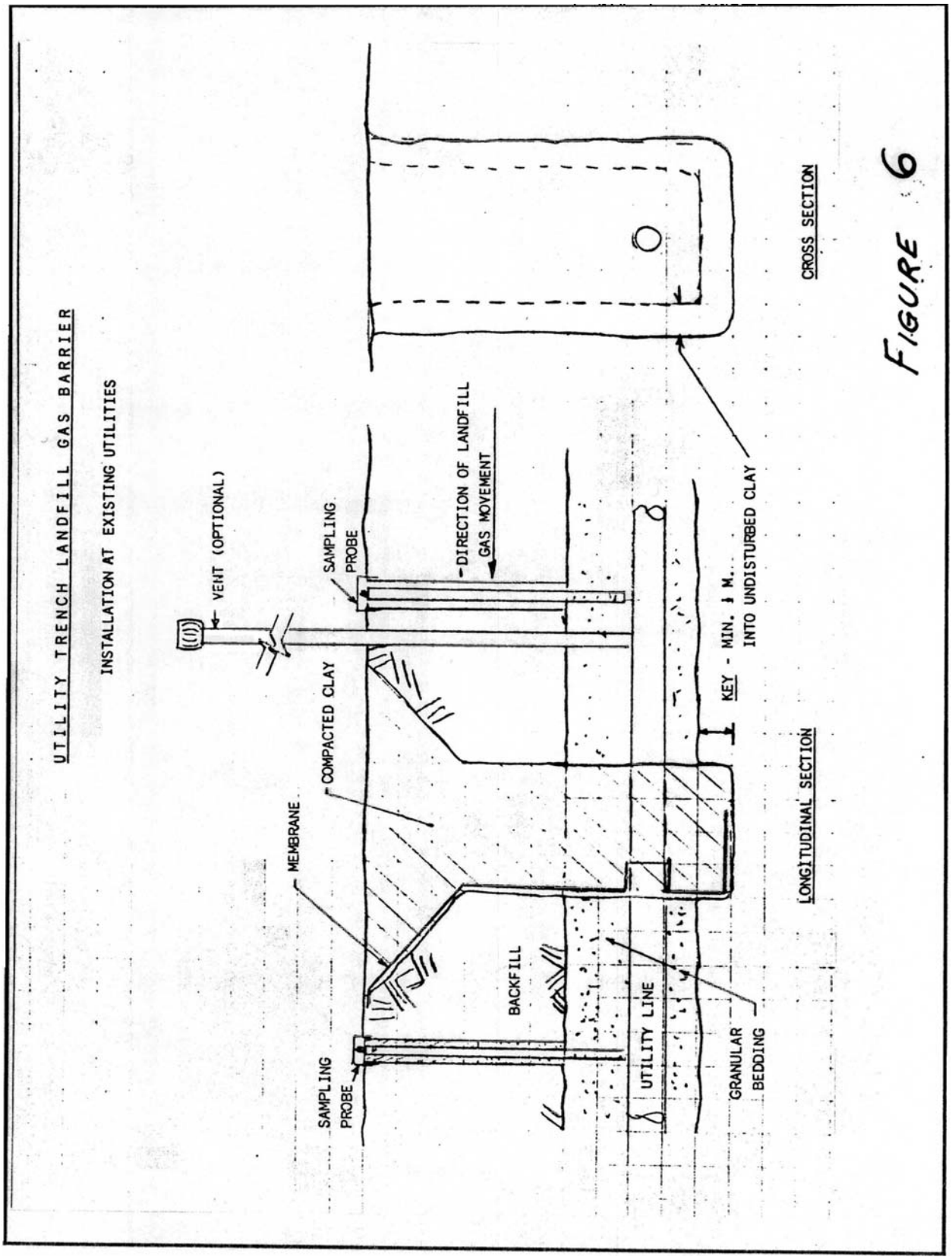
Construction Of Buildings On Landfill. Slab-on-Grade Construction

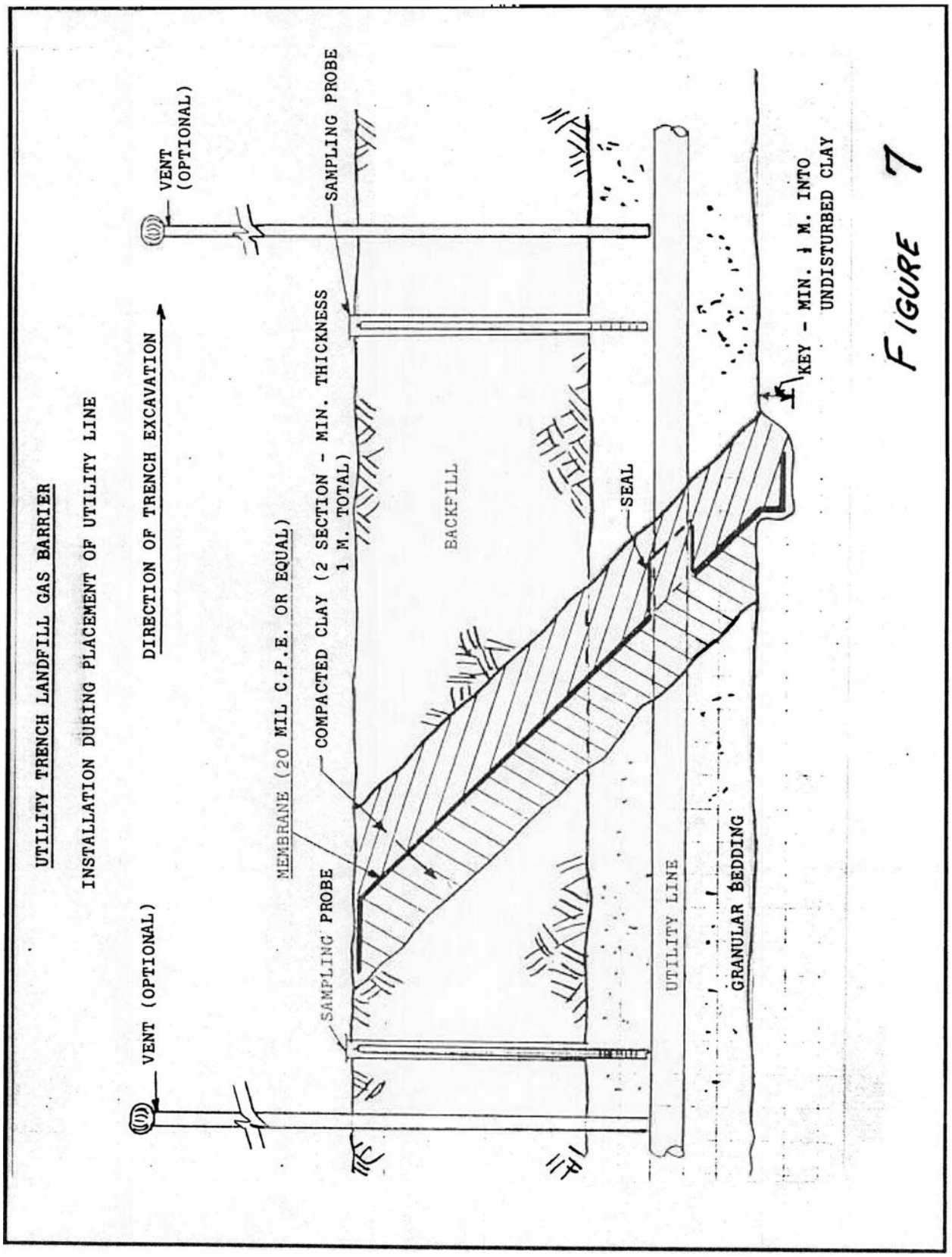
Figure 2

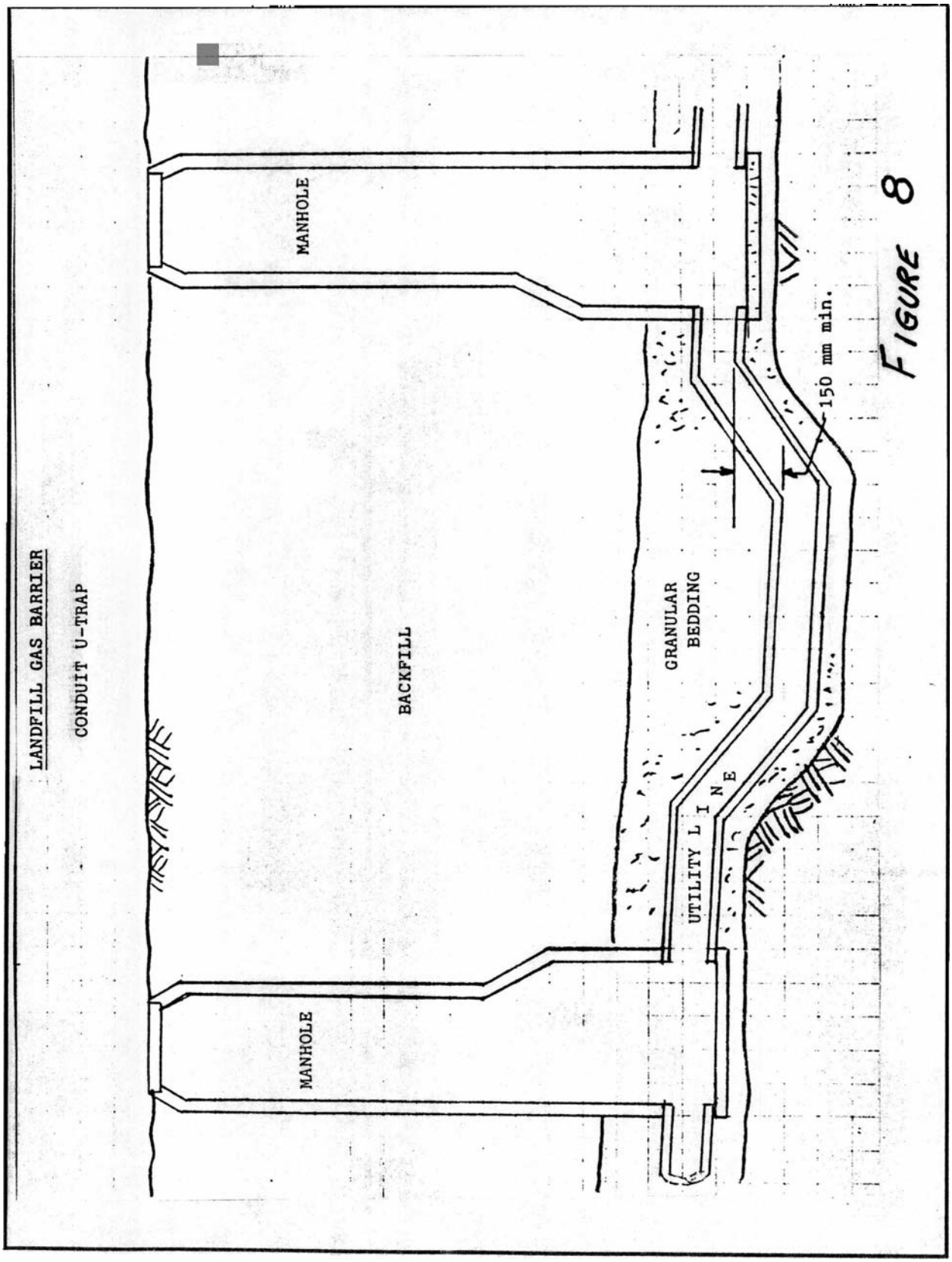

Protective Measures for Methane Gas
Modified Slab-on-Grade or Crawl Space
PLAN VIEW
Under slab
Sump
to drain
Gravel Layer
4"ϕ
Perforated Collector Pipe
Gas Probe
Drain pipe
20'
Low point
Limit of excavation
Aggregate Blanket
Gas Probe
Solid pipe 4"ϕ
Vents to outside
Slope
The City Of Winnipeg
Water and Waste Department
Reference Spec. No.
Designed By:
Drawn By: CAP
Checked By:
Date: 97.04.03
Approved:
Scale: N.T.S.
Drawing No. Figure 3
Design Guidelines for
Landfill Site Construction

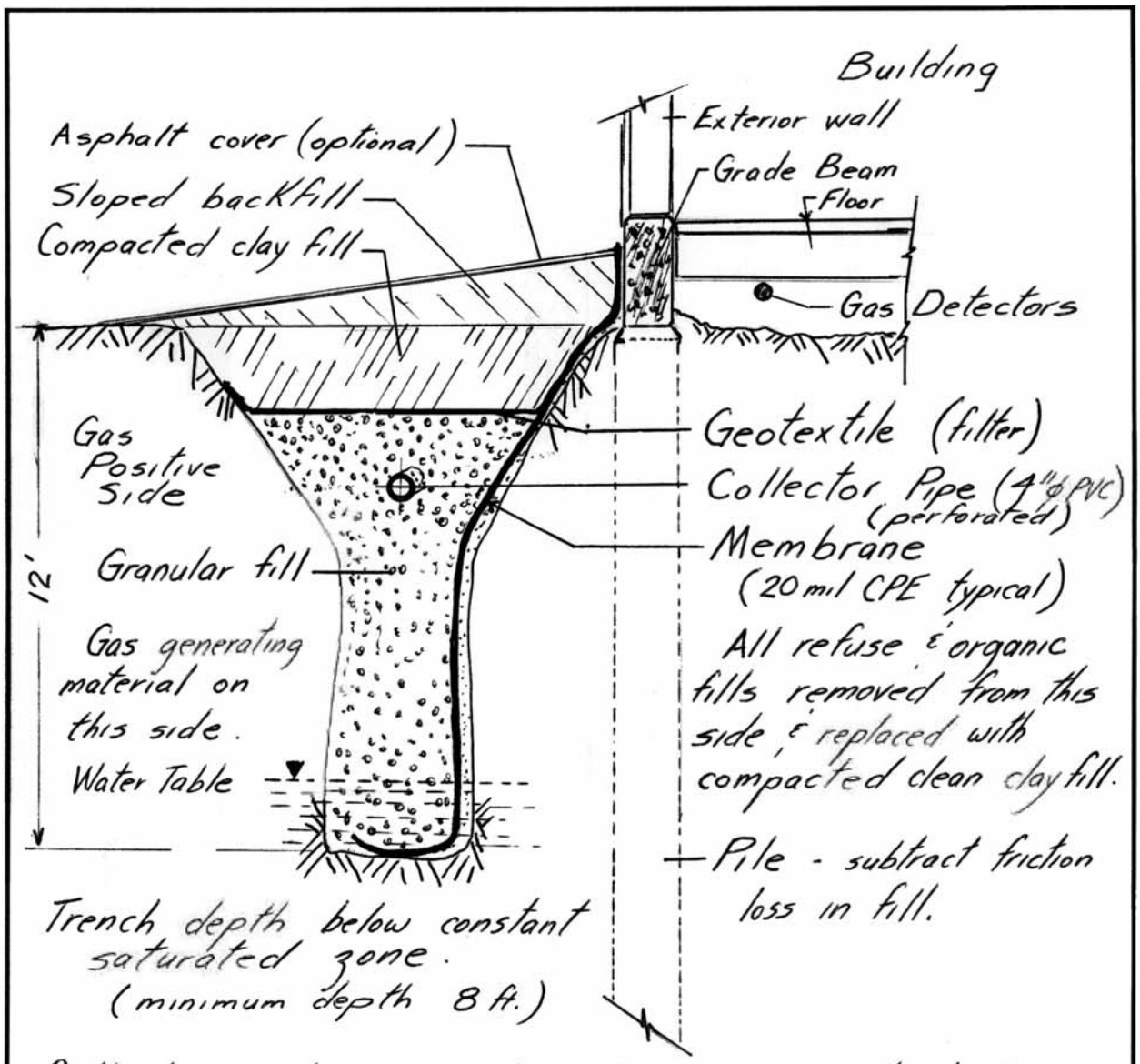

Protective Measures for Methane Gas
Modified Slab-on-Grade
Vent collector pipe through roof or wall to the outside.
Note: Allow sufficient slack in membranes to allow for settlement.
Secondary Membrane
Primary Membrane
Floor Slab
Sand
Gravel
perforated pipe
Gas Collector Pipe solid pipe
Base Grade
Slope (min. 1%) to low point. Drain to sump or catchbasin outside the building.
Membrane securely attached to grade beam.
Offset from Grade Beam 10'
Wall
Grade Beam
Pile
The City Of Winnipeg
Water and Waste Department
Reference Spec. No.
Designed By:
Drawn By: CAP
Scale: N. T. S.
Checked By:
Date: 97.04.02
Drawing No. Figure 4
Approved:
Design Guidelines for Landfill Site Construction


Protective Measures for Methane Gas
Modified Slab-on-Grade
Concrete Slab
Secondary Membrane
Sand
Primary Membrane
Sand
Gravel - well rounded
Collector Pipe 4" ϕ (100 mm)
Base Grade
7-15 cm
5 cm
10 cm
20 cm
3-6"
2"
4"
8"
Cross-Section
Membranes & Collector System
The City Of Winnipeg
WATER AND WASTE DEPARTMENT
Reference Spec. No.
Design Guidelines for Landfill Site Construction
Designed By:
Drawn By: CAP
Scale: N.T.S.
Checked By:
Date: 97-04-02
Approved:
Drawing No. Figure 5

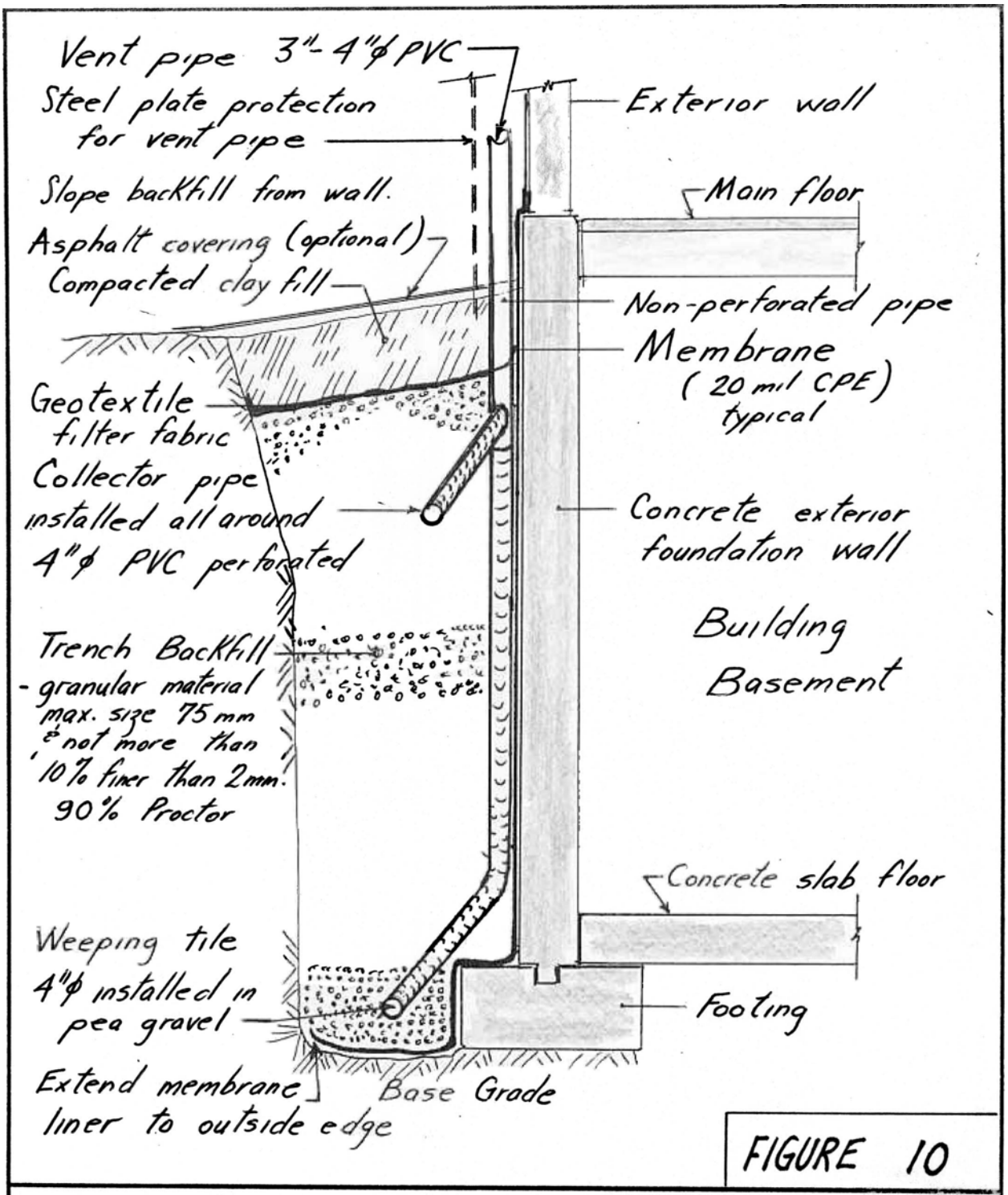

UTILITY TRENCH LANDFILL GAS BARRIER
INSTALLATION AT EXISTING UTILITIES
VENT (OPTIONAL)
SAMPLING PROBE
DIRECTION OF LANDFILL GAS MOVEMENT
COMPACTED CLAY
MEMBRANE
BACKFILL
SAMPLING PROBE
UTILITY LINE
GRANULAR BEDDING
KEY - MIN. 1 M. INTO UNDISTURBED CLAY
CROSS SECTION
LONGITUDINAL SECTION
FIGURE 6

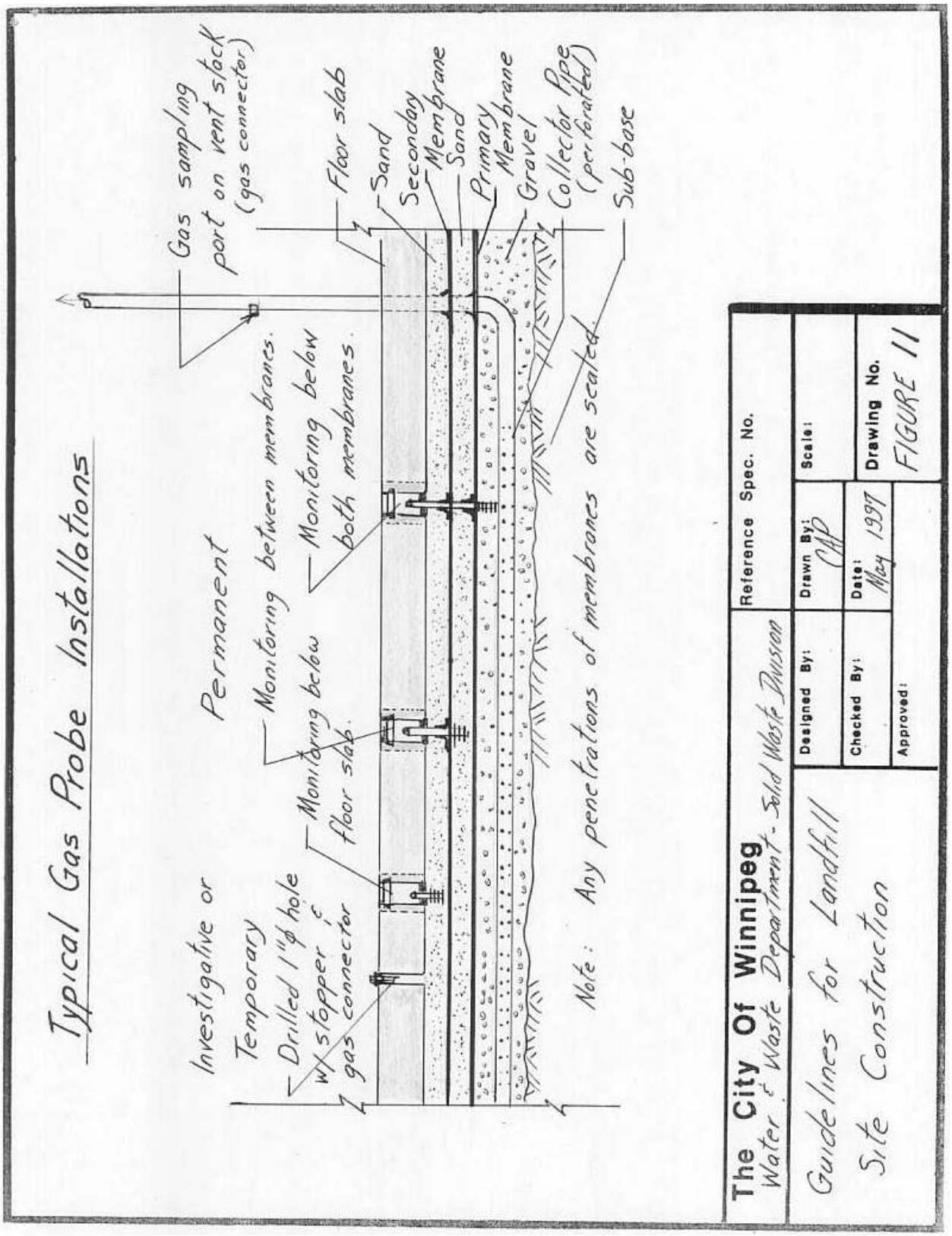

UTILITY TRENCH LANDFILL GAS BARRIER
INSTALLATION DURING PLACEMENT OF UTILITY LINE
DIRECTION OF TRENCH EXCAVATION
VENT (OPTIONAL)
SAMPLING PROBE
COMPACTED CLAY (2 SECTION - MIN. THICKNESS 1 M. TOTAL)
MEMBRANE (20 MIL C.P.E. OR EQUAL)
BACKFILL
SEAL
KEY - MIN. 1 M. INTO UNDISTURBED CLAY
VENT (OPTIONAL)
SAMPLING PROBE
UTILITY LINE
GRANULAR BEDDING
FIGURE 7

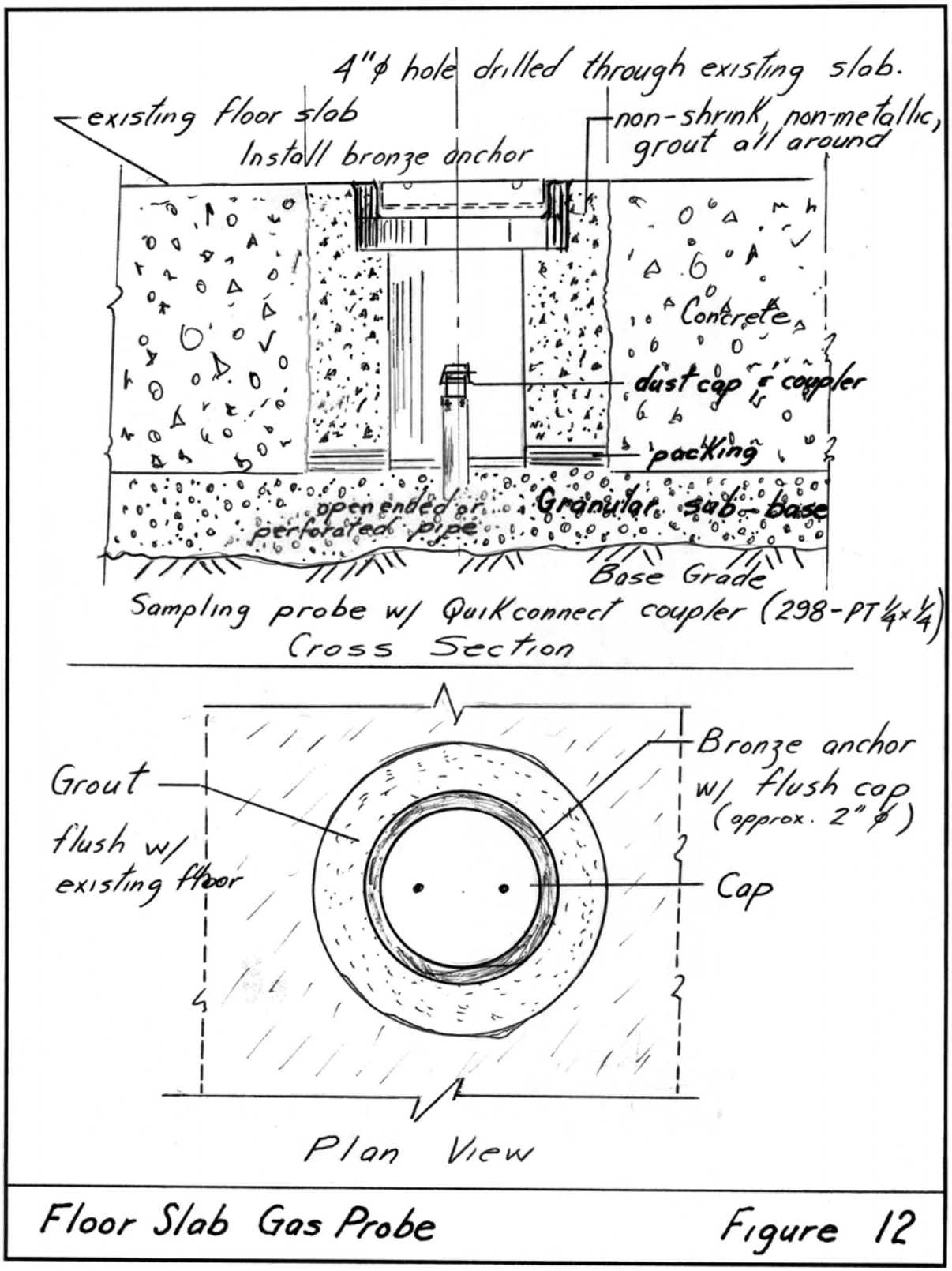

LANDFILL GAS BARRIER
CONDUIT U-TRAP
MANHOLE
BACKFILL
GRANULAR BEDDING
UTILITY LINE
150 mm min.
MANHOLE
FIGURE 8



Design Guidelines for Landfill Site Construction	FIGURE 9


Vent pipe 3"-4"ϕ PVC
Steel plate protection for vent pipe
Slope backfill from wall.
Asphalt covering (optional)
Compacted clay fill
Geotextile filter fabric
Collector pipe installed all around 4"ϕ PVC perforated
Trench Backfill - granular material max. size 75 mm & not more than 10% finer than 2mm. 90% Proctor
Weeping tile 4"ϕ installed in pea gravel
Extend membrane liner to outside edge
Base Grade
Exterior wall
Main floor
Non-perforated pipe
Membrane (20 mil CPE) typical
Concrete exterior foundation wall
Building Basement
Concrete slab floor
Footing
FIGURE 10
Design Guidelines for Landfill Site Construction
Interceptor Vent Trench - Basement Foundation


Typical Gas Probe Installations
Investigative or Temporary
Drilled 1" ϕ hole w/ stopper & gas connector
Permanent
Monitoring between membranes.
Monitoring below floor slab.
Monitoring below both membranes.
Gas sampling port on vent stack (gas connector)
Floor slab
Sand
Secondary Membrane
Sand
Primary Membrane
Gravel
Collector Pipe (perforated)
Sub-base
Note: Any penetrations of membranes are sealed.
The City Of Winnipeg
Water & Waste Department - Solid Waste Division
Reference Spec. No.
Designed By:
Drawn By: CAP
Scale:
Checked By:
Date: May 1997
Drawing No. FIGURE 11
Approved:
Guidelines for Landfill Site Construction


4"ϕ hole drilled through existing slab.
existing floor slab
Install bronze anchor
non-shrink, non-metallic, grout all around
Concrete
dust cap & coupler
packing
open ended or perforated pipe
Granular sub-base
Base Grade
Sampling probe w/ Quikconnect coupler (298-PT 1/4 x 1/4)
Cross Section
Grout flush w/ existing floor
Bronze anchor w/ flush cap (approx. 2" ϕ)
Cap
Plan View
Floor Slab Gas Probe
Figure 12

Appendix D6

Land Titles

Cert. No. 640500

MANITOBA

Certificate of Title

UNDER "THE REAL PROPERTY ACT."

THE CITY OF SAINT BONIFACE.

IS *now seized of an estate in fee simple in possession subje such encumbrances liens and interests as are notified by memo dum underwritten (or endorsed hereon) in all those piece or pa of land known and described as follows* IN THE CITY OF SAINT BONIFACE, THE PROVINCE OF MANITOBA, AND BEING FIRSTLY: ALL THOSE PORTIONS OF RIVER LOTS SEVENTY-TWO AND SEVEN THREE ACCORDING TO THE DOMINION GOVERNMENT SURVEY OF THE PARISH OF SAINT BONIFACE, BOUNDED AS FOLLOW ON THE NORTH BY THE NORTHERN LIMIT OF SAID RIVER LOT SEVENTY-TWO, ON THE SOUTH BY THE SOUTHERN LIMI SAID RIVER LOT SEVENTY-THREE, ON THE WEST BY A STRAIGHT LINE DRAWN EAST OF PARALLEL WITH AND PERPEN CULARLY DISTANT SEVEN HUNDRED AND NINETY-TWO FEET FROM THE PRODUCTION IN A STRAIGHT LINE NORTHERLY THE WESTERN LIMIT OF PAULIN STREET AS THE SAME IS SHEWN ON A PLAN OF SURVEY OF PART OF LOTS SEVENTY AND SEVENTY-FIVE OF THE PARISH OF SAINT BONIFACE, REGISTERED IN THE WINNIPEG LAND TITLES OFFICE AS NO. 1053, AND ON THE EAST BY A STRAIGHT LINE DRAWN SOUTHERLY ACROSS THE SAID LOTS SEVENTY-TWO AND SEVENTY-THREE AT RIGHT ANGLES TO THE NORTHERN LIMIT OF SAID RIVER LOT SEVENTY-TWO FROM A POINT IN T SAME DISTANT WESTERLY THEREON NINE HUNDRED AND SIXTY-FEET FROM THE NORTH EAST CORNER OF SAID RIVER SEVENTY-TWO, SECONDLY: ALL THAT PORTION OF RIVER LOT SEVENTY-FOUR, ACCORDING TO THE DOMINION GOVERN SURVEY OF THE PARISH OF SAINT BONIFACE, BOUNDED AS FOLLOWS: ON THE NORTH BY THE NORTHERN LIMIT OF S RIVER LOT SEVENTY-FOUR, ON THE SOUTH BY THE NORTHERN LIMIT OF THE LAND TAKEN FOR THE RIGHT OF WAY O GRAND TRUNK PACIFIC RAILWAY ACCORDING TO A PLAN OF SAME FILED IN THE WINNIPEG LAND TITLES OFFICE IN NO. 1560, ON THE EAST BY A STRAIGHT LINE DRAWN SOUTHERLY AT RIGHT ANGLES TO THE NORTHERN LIMIT OF S RIVER LOT SEVENTY-FOUR, FROM A POINT IN THE SAME DISTANT WESTERLY THEREON NINETEEN HUNDRED AND SEVE FEET FROM THE NORTH EAST CORNER THEREOF, AND ON THE WEST BY THE EASTERN LIMIT OF THE LAND CONTAINED WITHIN THE LIMITS OF A SURVEY THE PLAN OF WHICH IS REGISTERED IN THE SAID OFFICE AS NO. 1053.

Pt RLs 72 & 73 now
pt pcl A Pl 20704
March 9/87 sm

The duplicate of this Certificate of Title has been cancelled.
Date May 11/04
for District Registrar

IN WITNESS WHEREOF *I have hereunto signed my name and affixed my Seal of office this* THIRTEENTH *day of* SEPTEMBER *One thousand nine hundred and* FORTY-SIX *Signed in the presence of*

Deputy District Registrar for Winnipeg

Pt RLs 72 & 73 Pl 20704
WITHIN LAND IS NOW IN THE NAME(S) OF
BY VIRTUE OF INSTRUMENT NO. 82-2246a
REGISTERED IN THE WINNIPEG LAND TITLES OFFICE

From No. 502785 Transfer 60628

Nature of Instrument	Day and Hour of its Production	Names of the Parties
~~Mortgage~~ for $	The 5th day of May 1926 at 11.16 o'clock in the forenoon	
Mortgage for $	The day of 19 at o'clock in the noon	
Mortgage for $	The day of 19 at o'clock in the noon	
Mortgage for $	The day of 19 at o'clock in the noon	
Mortgage for $	The day of 19 at o'clock in the noon	
Mortgage for $	The day of 19 at o'clock in the noon	
Mortgage for $	The day of 19 at o'clock in the noon	

Deputy District Registrar

DATE: 2010/02/05
TIME: 11:05

MANITOBA

STATUS OF TITLE

TITLE NO: 1454205

PAGE: 1

STATUS OF TITLE..... ACCEPTED
ORIGINATING OFFICE... WINNIPEG
REGISTERING OFFICE... WINNIPEG
REGISTRATION DATE.... 1996/06/20
COMPLETION DATE..... 1996/06/27

PRODUCED FOR.. S
ADDRESS.....

CLIENT FILE... NA
PRODUCED BY... S.WARWICK

LEGAL DESCRIPTION:

CAMBRIAN EQUIPMENT SALES LTD.

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND:

LOT 2 PLAN 16198 WLTO
IN RL 72 TO 74 PARISH OF ST BONIFACE

ACTIVE TITLE CHARGE(S):

81-92038 WPG ACCEPTED CAVEAT **REG'D:** 1981/12/18
FROM/BY: THE CITY OF WINNIPEG
TO:
CONSIDERATION: **NOTES:**

1001140 WPG ACCEPTED CAVEAT **REG'D:** 1988/03/16
FROM/BY: PETER BOYKO AND TENA BOYKO
TO:
CONSIDERATION: **NOTES:**

1001141 WPG ACCEPTED CAVEAT **REG'D:** 1988/03/16
FROM/BY: ALBERT ARTHUR GROSS
TO:
CONSIDERATION: **NOTES:**

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	CAMBRIAN EQUIPMENT SALES LTD. 494 PANET ROAD WINNIPEG MB	R2C 3B9

ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
2031119 WPG	T	1996/06/20	$267,500.00	$267,500.00

PRESENTED BY: WILDER, WILDER & LANGTRY
FROM: ALBERT ARTHUR GROSS
TO: CAMBRIAN EQUIPMENT SALES LTD.

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM ON 2010/02/05 OF TITLE NUMBER 1454205

********** STATUS OF TITLE 1454205 WPG CONTINUED ON NEXT PAGE **********

STATUS OF TITLE.....	**ACCEPTED**	**PRODUCED FOR..**	S
ORIGINATING OFFICE...	WINNIPEG	**ADDRESS.....**	
REGISTERING OFFICE...	WINNIPEG		
REGISTRATION DATE....	1996/06/20		
COMPLETION DATE.....	1996/06/27		
		CLIENT FILE...	NA
		PRODUCED BY...	S.WARWICK

FROM TITLE NUMBER(S):

H4910 WPG ALL

LAND INDEX:

LOT	BLOCK	SURVEY PLAN
2		16198

NOTE:

DUPLICATE PRODUCED FOR.. WILDER, WILDER & LANGTRY **ON** 1996/06/28
ADDRESS..... 1500-ONE LOMBARD PLACE
WINNIPEG MB

POSTAL CODE..... R3B 0X3

ACCEPTED THIS 20TH DAY OF JUNE, 1996
BY J.MOFFAT FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF WINNIPEG.

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA
STORAGE SYSTEM ON 2010/02/05 OF TITLE NUMBER 1454205.

********** END OF STATUS OF TITLE 1454205 WPG **********

DATE: 2010/02/04
TIME: 09:32

MANITOBA

STATUS OF TITLE

TITLE NO: 1055859

PAGE: 1

STATUS OF TITLE.....	ACCEPTED	PRODUCED FOR..	X
ORIGINATING OFFICE...	WINNIPEG	ADDRESS.....	
REGISTERING OFFICE...	WINNIPEG		
REGISTRATION DATE....	1992/01/22		
COMPLETION DATE.....	1992/01/30		
		CLIENT FILE...	NA
		PRODUCED BY...	R.SOLVASON

LEGAL DESCRIPTION:

THE CITY OF WINNIPEG

IS REGISTERED OWNER SUBJECT TO SUCH ENTRIES RECORDED HEREON IN THE FOLLOWING DESCRIBED LAND:

PARCEL A PLAN 20704 WLTO
IN RL 72 AND 73 PARISH OF ST BONIFACE

ACTIVE TITLE CHARGE(S):

NO ACTIVE TITLE CHARGES EXIST ON THIS TITLE

ADDRESS(ES) FOR SERVICE:

EFFECT	NAME AND ADDRESS	POSTAL CODE
ACTIVE	THE CITY OF WINNIPEG 510 MAIN STREET WINNIPEG, MANITOBA	R3B 1B9

ORIGINATING INSTRUMENT(S):

REGISTRATION NUMBER	TYPE	REG. DATE	CONSIDERATION	SWORN VALUE
1505105 WPG	EREQ	1992/01/22	$0.00	$0.00
PRESENTED BY:	WLTO INTERNAL			
FROM:	WLTO CONVERSION			
TO:				

FROM TITLE NUMBER(S):

J88770 WPG ALL

LAND INDEX:

LOT	BLOCK	SURVEY PLAN
A		20704

NOTE:

**ACCEPTED THIS 22ND DAY OF JANUARY, 1992
BY W.BROWN FOR THE DISTRICT REGISTRAR OF
THE LAND TITLES DISTRICT OF WINNIPEG.**

CERTIFIED TRUE EXTRACT PRODUCED FROM THE LAND TITLES DATA STORAGE SYSTEM ON 2010/02/04 OF TITLE NUMBER 1055859.

********** END OF STATUS OF TITLE 1055859 WPG **********

Appendix D7

Plan of Survey – Snow Dump Site

DEP. NO. 19/87

No (1)

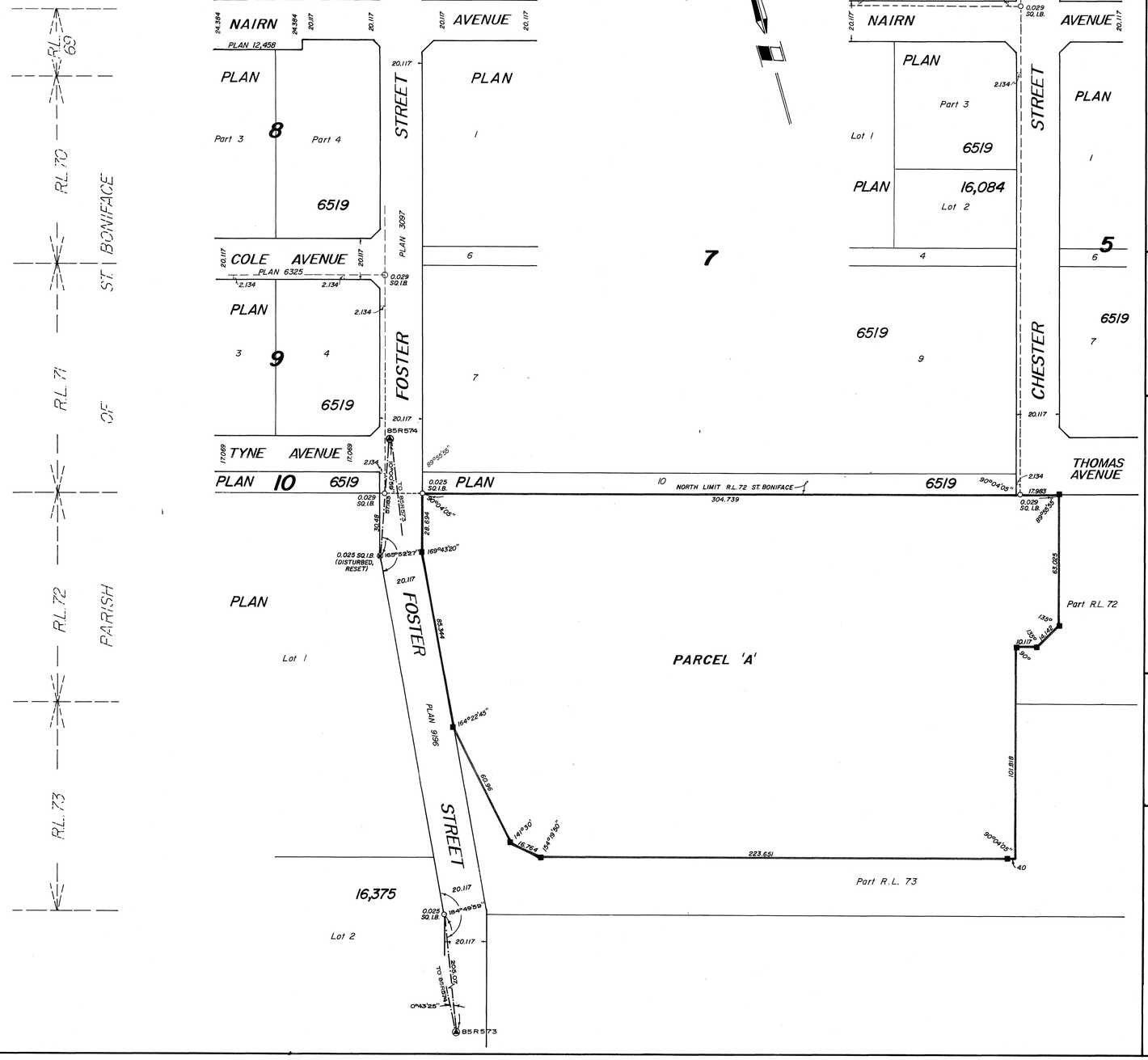
Plan No. 20704
Fee $30.00
City of Winnipeg

MAR 03 1987
30.00

57 22459

64

METRIC



PLAN OF SURVEY
OF PART OF
RIVER LOTS 72 AND 73, PARISH OF ST. BONIFACE
INCLUDING PART PARCEL 7, PLAN 8626

CITY OF WINNIPEG
MANITOBA

SCALE 1:1000
20m 10m 0 20m 40m

NOTES
All distances are in metres and decimals thereof and may be converted to feet by multiplying by 3.280 84.
Survey monuments found on the ground are described and shown ----------○
Iron Bars 0.025 x 0.025 x 0.914 marked 'M.L.S.' and 'C.W.' are placed at points shown ---■
This Plan is made in accordance with Sectional Plan No. 10 of the Special Survey of the City of Winnipeg.
All Plans referred to are on record in the Winnipeg Land Titles Office.
Portion affected by this Plan is shown bordered ▬▬▬▬
City of Winnipeg Geodetic Control Survey Monuments (G.C.S.M.) are shown ----------Ⓐ

AFFIDAVIT
I, Samuel Doyle, of the City of Winnipeg, Manitoba Land Surveyor, make oath and say that I did personally superintend the survey represented by this Plan, that the survey was made between the 16th day of September and the 1st day of December 1986, and that the survey and plan are correct and true to the best of my knowledge and belief.

Manitoba Land Surveyor

Sworn to before me at the City of Winnipeg this 8th day of December 1986.

A Surveyor authorized to practise under 'The Land Surveyors Act'.

APPROVAL
Approved by the City of Winnipeg on the 20TH day of FEBRUARY 1987.

Director of Environmental Planning

DASSF 45/87

Entered and filed in the Winnipeg Land Titles Office this 9th day of March 1987 as PLAN NO. 20704

~~Deputy or~~ Assistant District Registrar

Priority No. 87-22459

This Approval is Valid for 12 months unless registered
Approved
This 9th day of March 1987

Examiner of Surveys

Re-approved ____ ____ ____

Re-approved ____ ____ ____

THE CITY OF WINNIPEG
LAND SURVEYS & REAL ESTATE DEPT
WO. 207/86 FILE SB 5482 FB. 86-256-56/63

SM