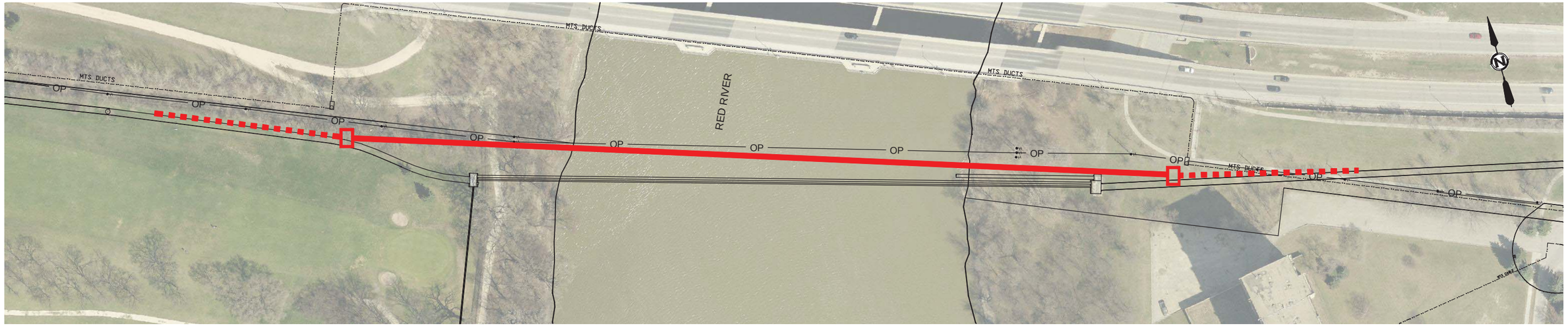
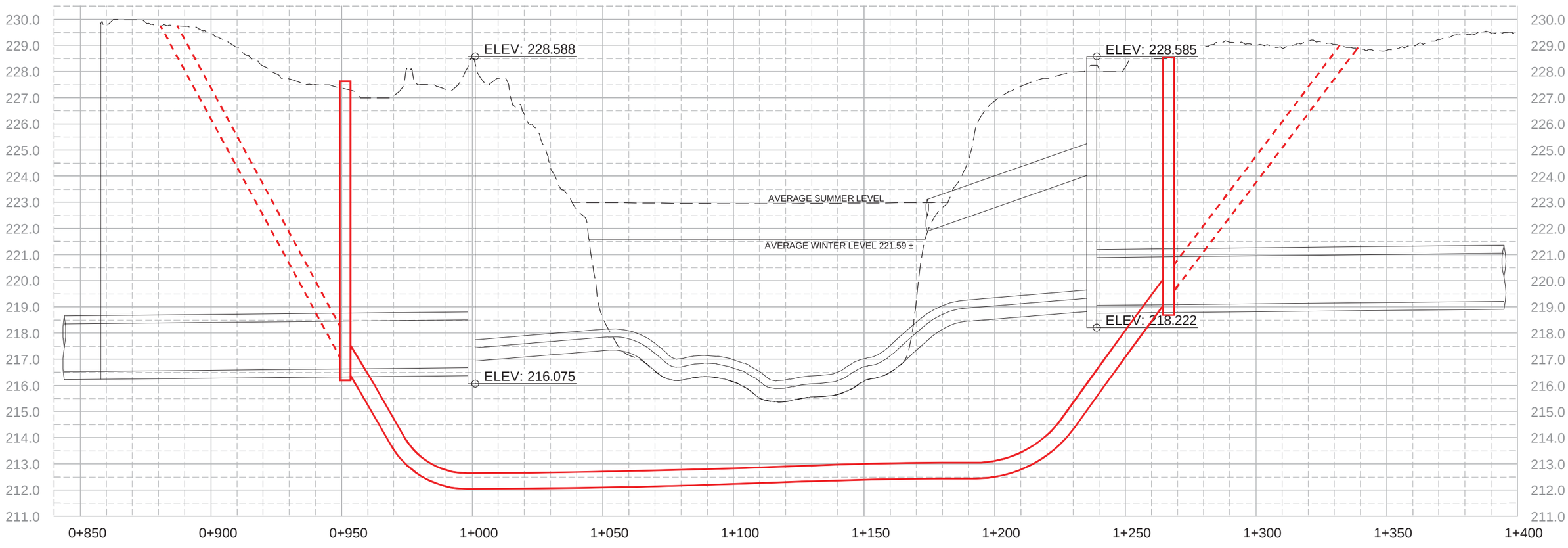




Associated Engineering

AE PROJECT No.	20154653-00
SCALE	H 1:1500 / V 1:150
APPROVED	J. LUEKE
DATE	20150729
REV	X
DESCRIPTION	ISSUED FOR REPORT

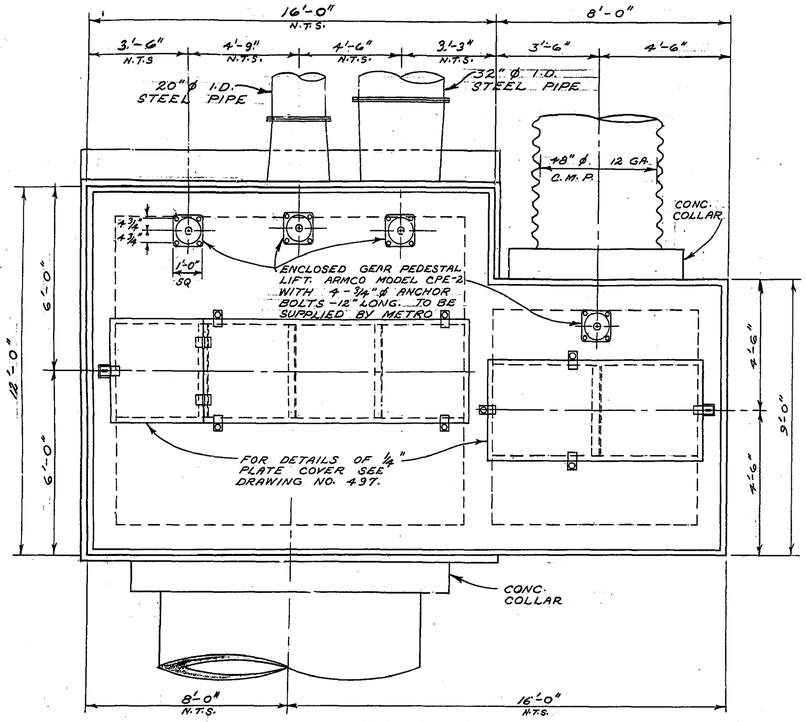
FIGURE 3-2

CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

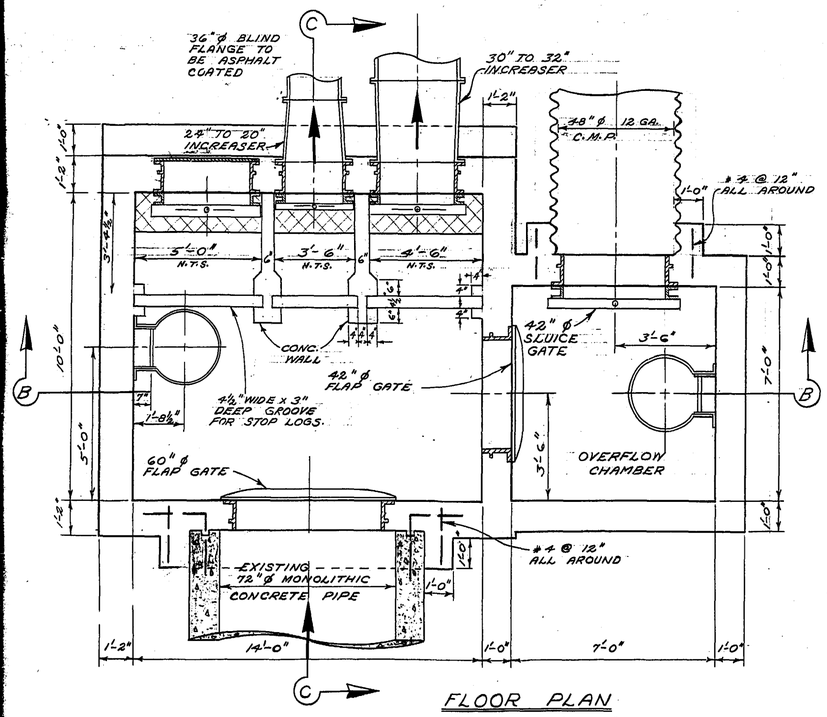
NORTHEAST INTERCEPTOR CROSSING
OPTION ASSESSMENT STUDY
HORIZONTAL DIRECTIONAL DRILLING OPTION 2

SURVEYED & PLAN CHECKED
BY
APPROVED AS BUILT
BY V.D Apeltz D.S.

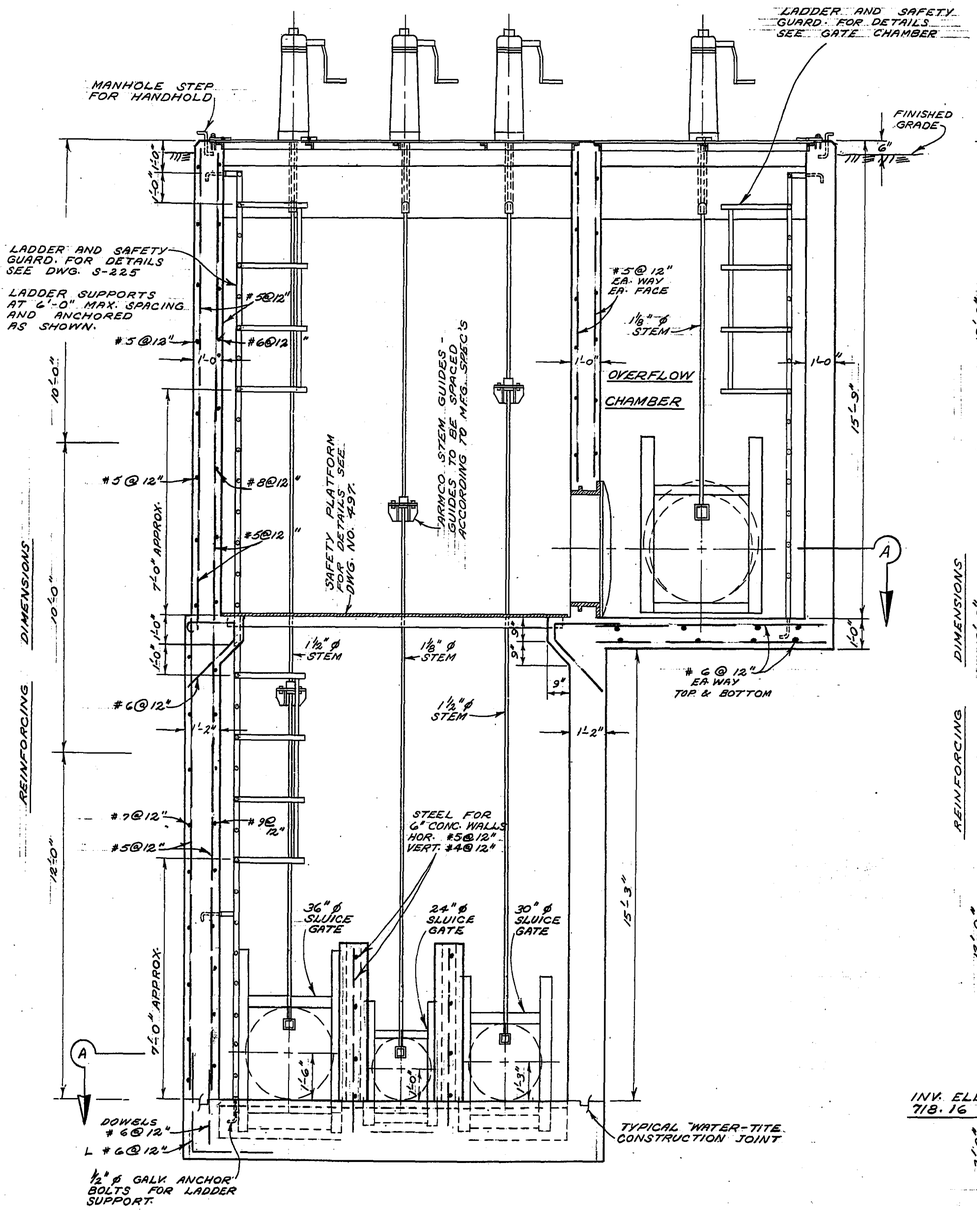

SITE PLAN
SCALE: 1"=2000'
MAIN STREET
RED RIVER
SUBURBAN BELTWAY
WHELLAMS LANE
RIVER CROSSING
KILDONAN GOLF COURSE
KILDONAN PARK
R.M. OF NORTH KILDONAN
R.M. OF OLD KILDONAN
CITY OF WEST KILDONAN
RED RIVER
LIMIT OF CONTRACT STA. 0+15
LIMIT OF CONTRACT STA. 8+07.3
HYDRO POLE LINE
GUY WIRE
TREES
SHRUBS
REFUGE PILE
DITCH
60'
45'
30'
72" ϕ INTERCEPTOR
SIPHON OUTLET CHAMBER
KILDONAN GOLF COURSE
GREEN No. 7
RIVER BANK IMPROVEMENT AREA
CEMENT BAG OR ROCK RIP RAP
NO ANCHORAGE SIGN SEE DETAIL BELOW
32" ϕ I.D. STEEL PIPE
20" ϕ I.D. STEEL PIPE
FUTURE 36" ϕ PIPE
100' ±
330'
93.4'
15'
WHELLAMS LANE
BUSH AREA
SIPHON INLET CHAMBER
48" ϕ C.M.P. OUTFALL
SLIP JOINTS
SIGN
METRO EASEMENT
DETAIL
N.T.S.
STA. 6+46
STA. 7+95.3
770
760
750
740
730
720
710
700
4'-0"
2'-0"
NO ANCHORAGE
SIGN DETAIL
SIPHON OUTLET CHAMBER STA. 0+15 FOR DETAILS SEE DWG. NO. 496
TOP OF CHAMBER 749.96
IMPROVED BANK GRADE
SIGN
RIP RAP
RIVER BOTTOM PROFILE ℄ OF PIPE
INV. 711.93
INV. 710.86
EXISTING 72" ϕ MONOLITHIC SEWER
WATER LEVEL ELEV
AVERAGE WINTER LEVEL
PIPE LAID ON RIVER BED CONC. ANCHOR BLOCK PLACED ON BOTH PIPES
REFUSAL TO 3/4" ϕ PROBING ROD
SLIP JOINTS
20" ϕ AND 32" ϕ STEEL PIPE
SIPHON INLET CHAMBER STA. 8+07.3 FOR DETAILS SEE DWG. NO. 495
GROUND PROFILE ℄ OF PIPE
IMPROVED BANK GRADE
EXISTING 72" ϕ MONOLITHIC SEWER
SLOPE 0.10%
INV. 718.13
INV. 719.14
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
8+00
9+00
10+00
11+00
12+00
THE METROPOLITAN CORPORATION OF GREATER WINNIPEG
WATERWORKS & WASTE DISPOSAL DIVISION
NORTH-EAST INTERCEPTOR RIVER CROSSING
494



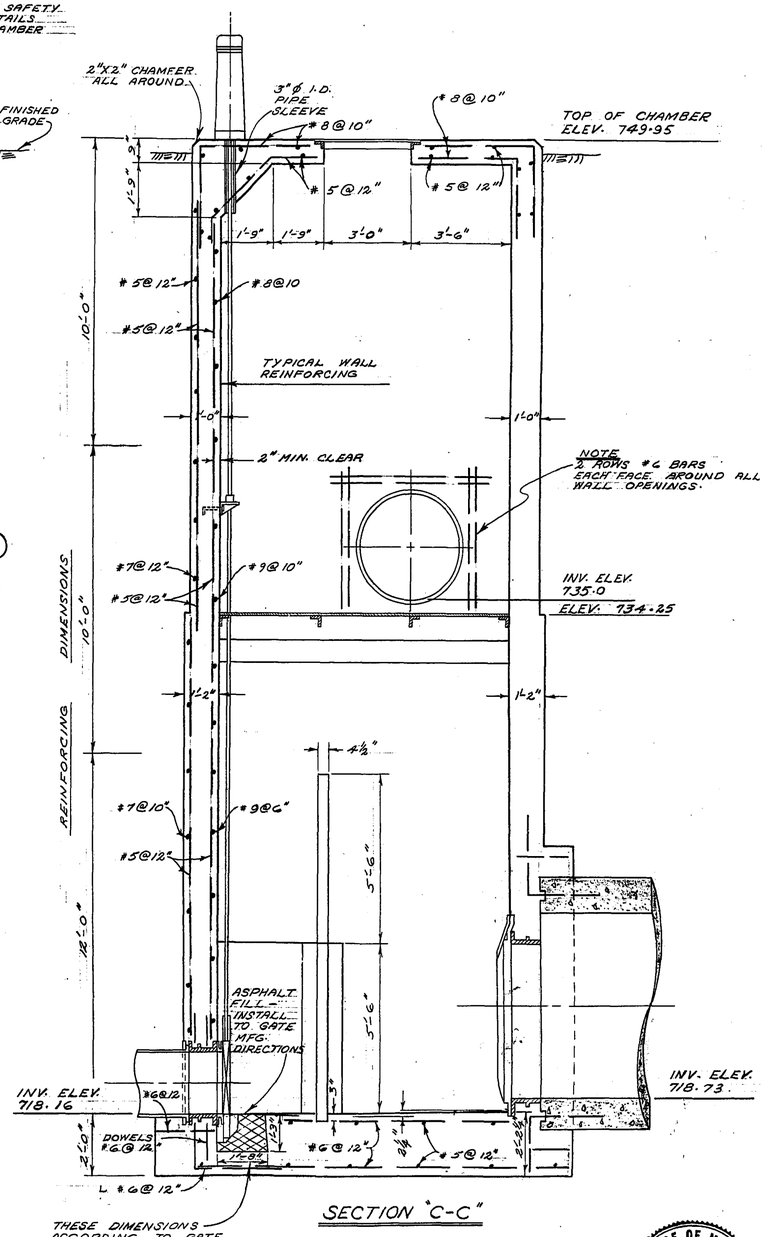
ROOF PLAN



FLOOR PLAN
SECTION "A-A"



SECTION "B-B"



SECTION "C-C"

NOTES

1. 24", 30" & 36" SLUICE GATES TO BE ARMCO MODEL 55-10 FLANGE BACK FLUSH BOTTOM HEAVY DUTY.
2. 42" SLUICE GATE TO BE MODEL 55-10 FLANGE BACK, STANDARD CLOSURE, MEDIUM DUTY.
3. 42" & 60" FLAP GATE TO BE ARMCO FLAT BACK HEAVY DUTY.
4. 24", 30" & 36" WALL THIMBLES TO BE SQUARE FLANGED ROUND OPENING ARMCO TYPE "E".
5. 42" & 60" WALL THIMBLE TO BE SQUARE FLANGED ROUND OPENING ARMCO TYPE "F"

SURVEYED & PLAN CHECKED
BY
APPROVED AS BUILT
BY N.D.S.
MAR 1972

PROVINCE OF MANITOBA
C. H. TOTTLE
REGISTERED ENGINEER

THE METROPOLITAN CORPORATION OF GREATER WINNIPEG
WATERWORKS & WASTE DISPOSAL DIVISION
A. PENMAN — DIRECTOR

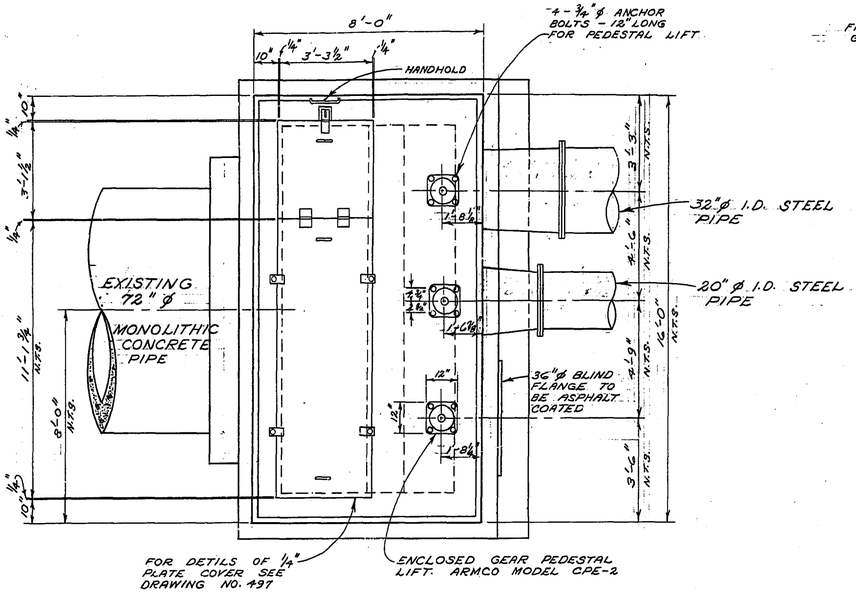
SEWAGE DISPOSAL DEPT.

NORTH-EAST INTERCEPTOR
RIVER CROSSING
SIPHON INLET CHAMBER

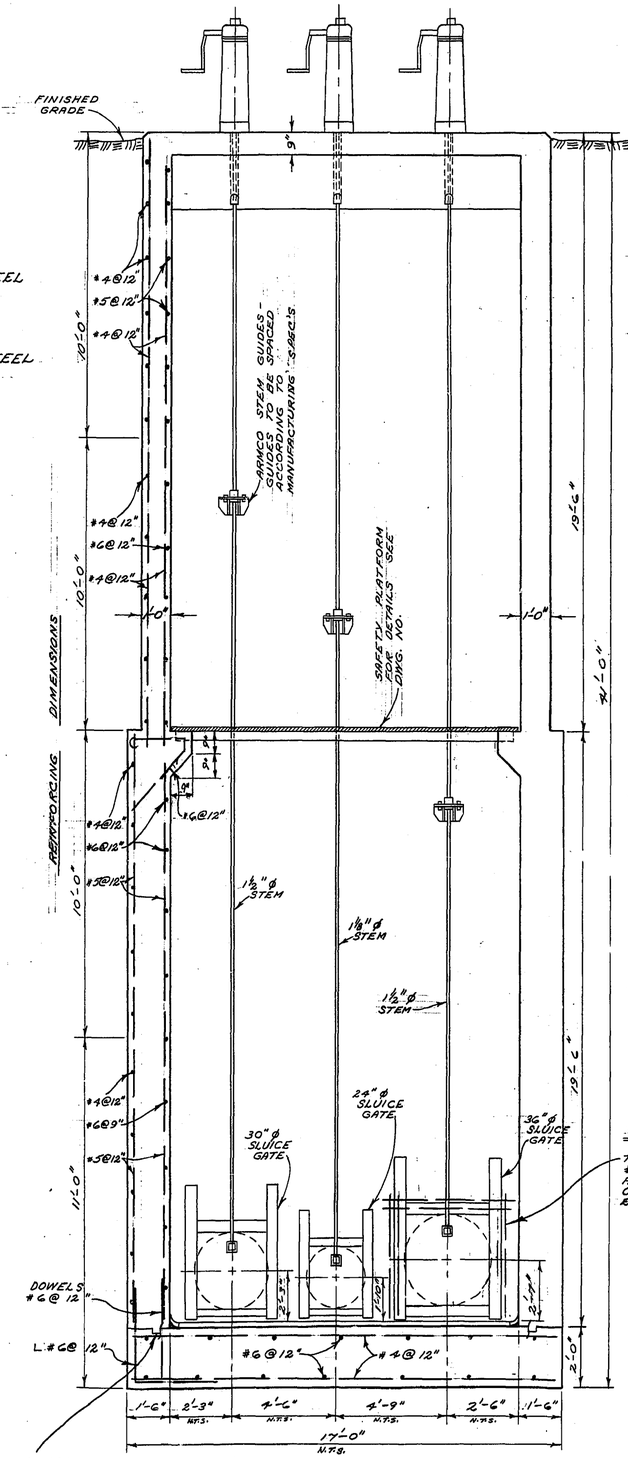
DES. CH'K'D.
DRN. V. DUMORE DATE Aug. 3/20
ENG. DES.
ENG.
APPROVED

SCALES
3/8" = 1'-0"

DRAWING NO.
495

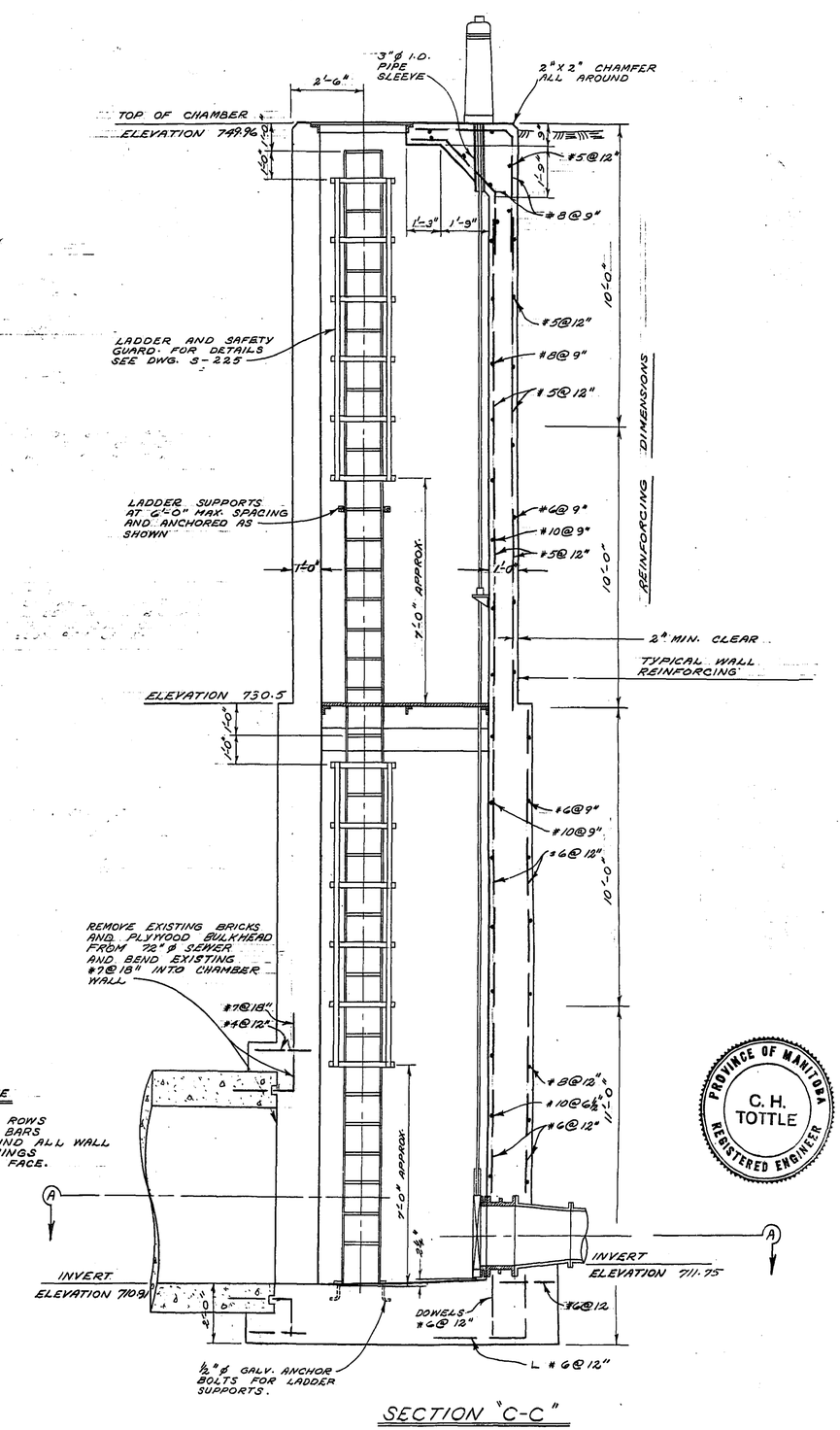


ROOF PLAN



SECTION "B-B"

SECTION "A-A"



SECTION "C-C"

PROVINCE OF MANITOBA
C. H. TOTTLE
REGISTERED ENGINEER

SURVEYED & PLAN CHECKED
BY
APPROVED AS BUILT
BY H.D.S.
MAR. 1972

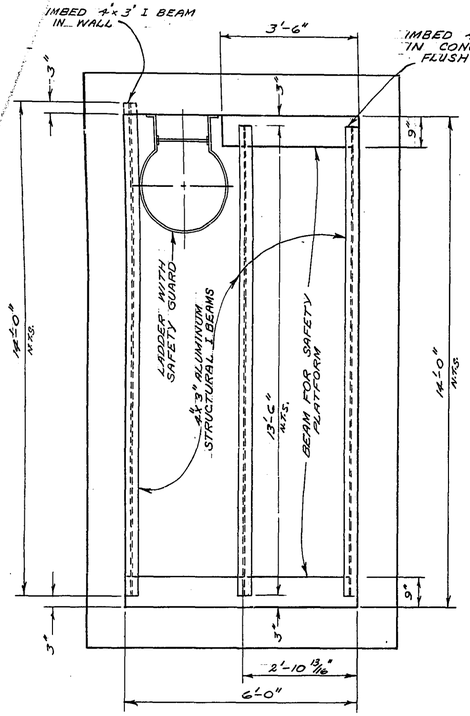
THE METROPOLITAN CORPORATION OF GREATER WINNIPEG
WATERWORKS & WASTE DISPOSAL DIVISION
A. PENMAN — DIRECTOR

SEWAGE DISPOSAL DEPT.
NORTH-EAST INTERCEPTOR
RIVER CROSSING
SIPHON OUTLET CHAMBER

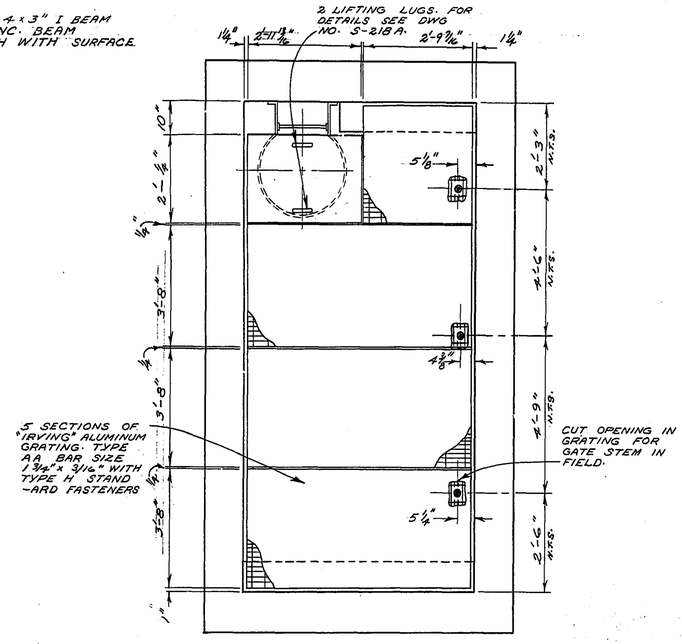
DES. C.H.T. CH'K'D.
DRN. V. DUMORE DATE JULY 1970
ENG. DES.
ENG.
APPROVED

SCALES
⅜" = 1'-0"

DRAWING NO.
496

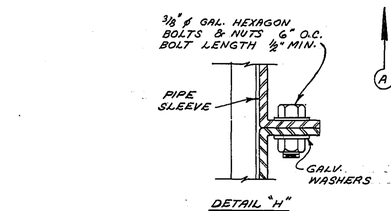


CONCRETE BEAMS AND ANGLE IRON DETAILS

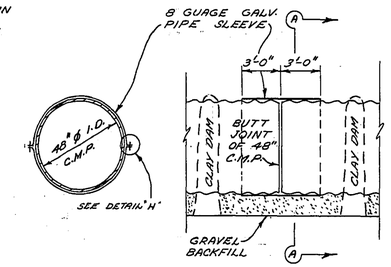


GRATING DETAIL

DETAIL OF SAFETY PLATFORM SIPHON OUTLET CHAMBER



DETAIL "H"

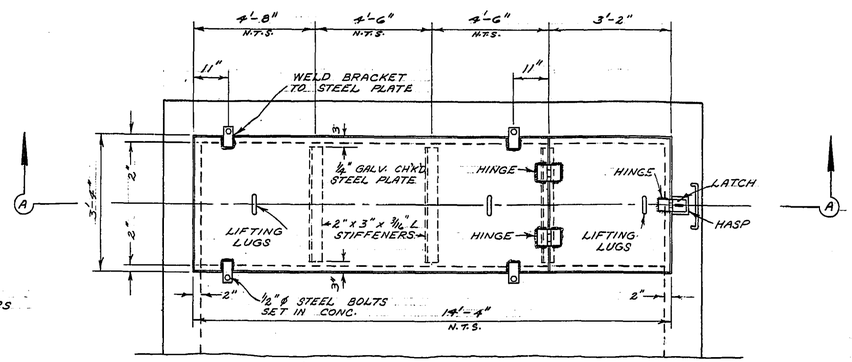


SECTION "A-A"

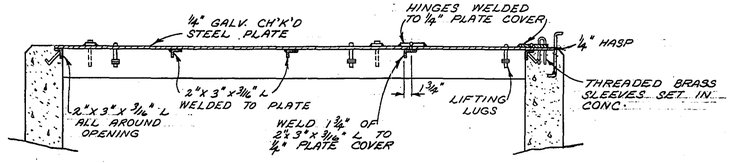
LONGITUDINAL SECTION

SLIP JOINT DETAIL

N.T.S.

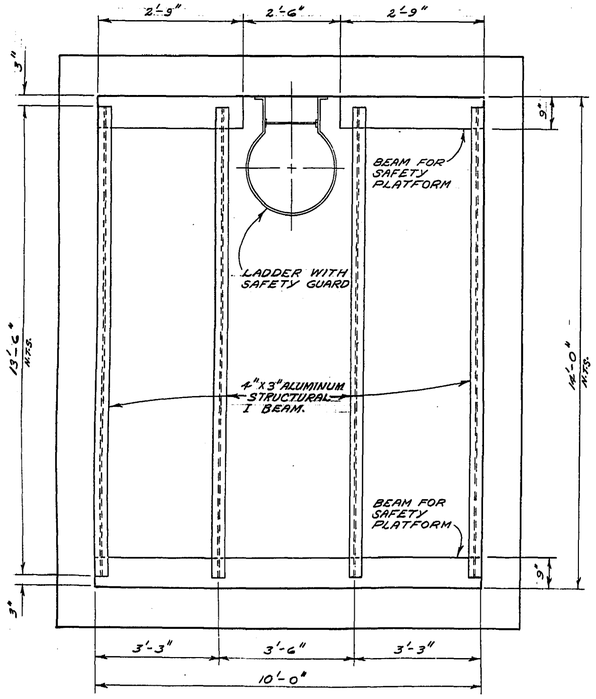


PLAN

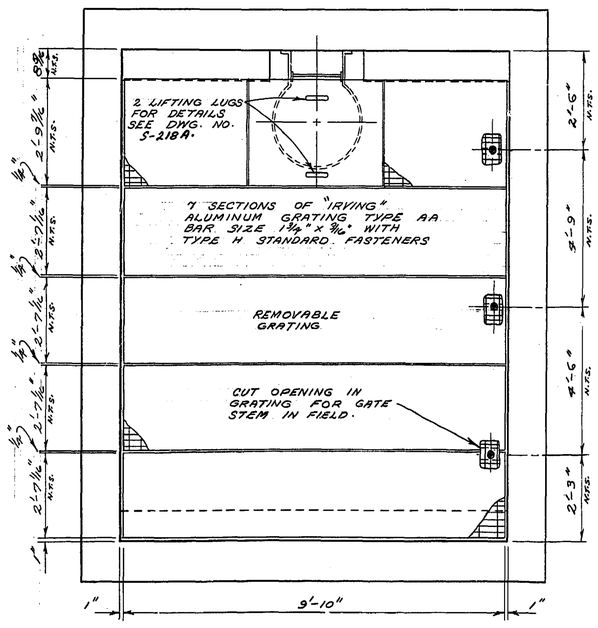


SECTION "A-A"

PLATE COVER FOR INLET AND OUTLET CHAMBERS

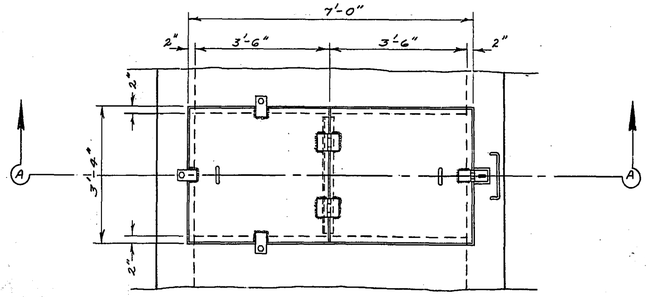


CONCRETE BEAM AND ANGLE IRON DETAIL



GRATING DETAIL

DETAIL OF SAFETY PLATFORM SIPHON INLET CHAMBER



PLAN

SECTION "A-A"

PLATE COVER FOR OVERFLOW CHAMBER

PROVINCE OF MANITOBA
C. H. TOTTLE
REGISTERED ENGINEER

SURVEYED & PLAN CHECKED
BY
APPROVED AS BUILT
BY
Mar. 1972

THE METROPOLITAN CORPORATION OF GREATER WINNIPEG
WATERWORKS & WASTE DISPOSAL DIVISION
PENMAN — DIRECTOR

SEWAGE DISPOSAL DEPT.

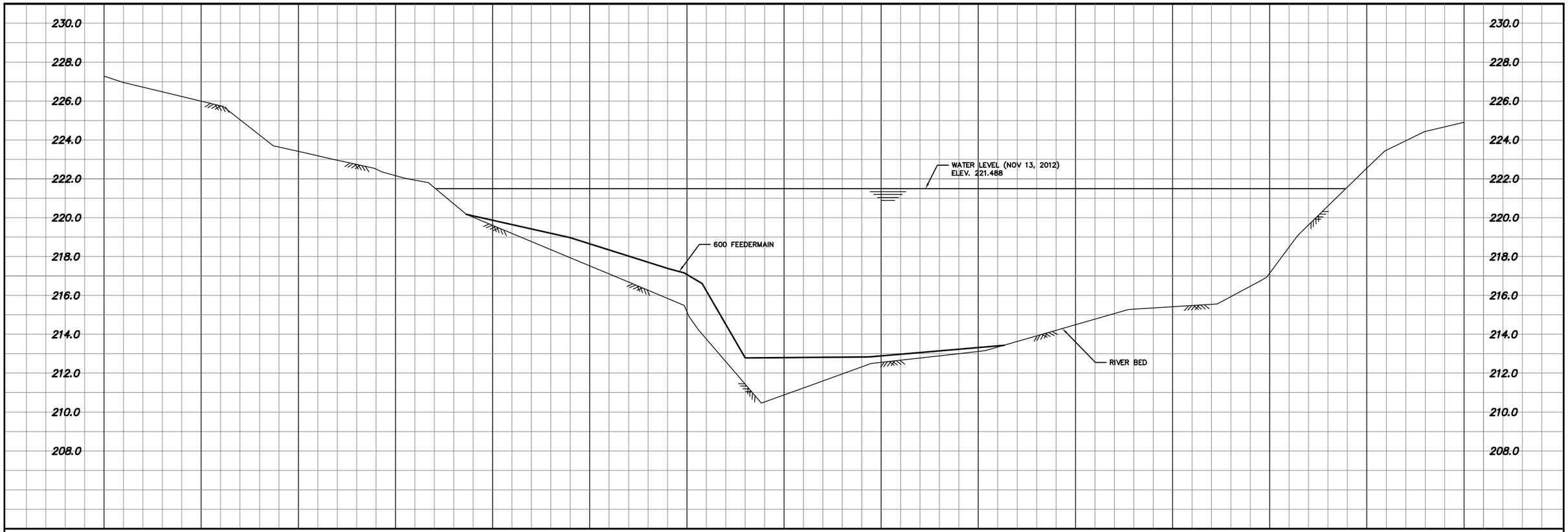
NORTH-EAST INTERCEPTOR
RIVER CROSSING
MISC. DETAILS

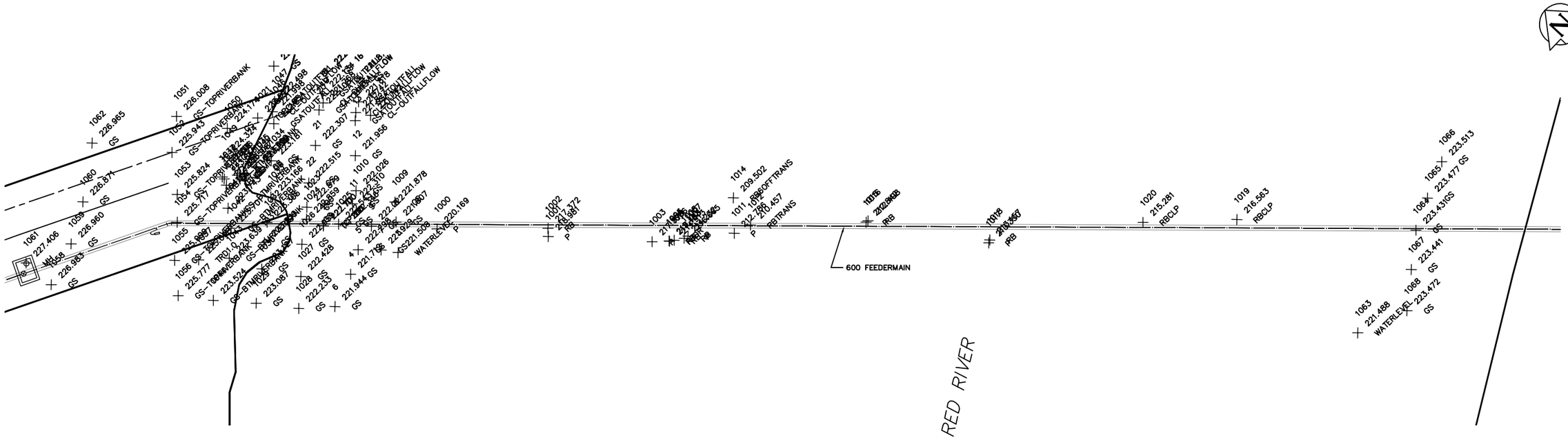
DES. CH'K'D.
DRN. V. DUMORE DATE SEPT 3/70
ENG. DES.
ENG.
APPROVED

SCALES
1/2" = 1'-0"

DRAWING NO.
497


SEC. D-D
42"ø CONC. PIPE C-76 CLASS IV
HORIZ. NEG. STEEL
42"ø FLAP GATE SHOWN IN FULL OPEN POSITION.
42"ø SLUICE GATE
CONC. COLLAR
CONC. RING
10"ø STEEL PIPE .250 WALL THICKNESS
48"ø CORR. METAL PIPE #12 GUAGE
SPECIAL REINF. AS DETAILED IN SEC. C-C
DETAIL OF FIXED COVER
SCALE: 1/2 SIZE
3/4"ø BOLT W/NUT
1/4" CHK'D PL.
2 1/2 x 2 1/2 x 1/4 ∠ FRAME
#5 ANCHORS
NOTE: CHANGE OF DIRECTION AT THIS POINT ON FAR WALL, 60°∠
#5 @ 6" (HOOKED)
EL. 755.0'
1 1/2" CHAMFER @ 45°
SEC. "A-A"
2" SKIN COAT
#4 @ 12" DOWELS
UNDISTURBED SOIL
#6 @ 12" (HOOKED) ALL ROUND.
#6 SEMI-CIRCULAR
42"ø CONC. PIPE, C-76 CLASS IV.
SEC. "B-B"
TYPICAL REINF. FOR ALL WALLS EXCEPT AS NOTED.
SHAFT BEARINGS AS PER MANUFACTURERS SPECIFICATIONS
STD. METRO. M.H. STEPS @ 15" C.-C.
42" DIA. SLUICE GATE
42" DIA. OPENING
HANDHOLD RUNG #6 BAR
#5 @ 9" BOTH WAYS TOP & BOTTOM OF FL. SLAB.
2 #5 ALONG EA. WALL
SEC. "C-C"
LIFTING LUGS
42"ø FLAP GATE (CLOSED POSITION)
SPECIAL REINF. FOR PORTION OF WALL AS DESIGNATED IN SEC. "D-D"
10"ø STEEL PIPE WALL THICKNESS .250"
INV. 736.67'
#4 @ 12" DOWELS
PLAN
4 - 3/8"ø BOLTS W/NUTS ONE PER CORNER
2 - #6 BARS ENTIRE LENGTH
FIXED COVER 1/4" CHK'D PL.
2'-8" x 2'-10 1/2" HINGED M.H. HATCH 1/4" CHK'D PL.
2'-11" x 3'-1" HINGED M.H. HATCH 1/4" CHK'D PL.
#6 HAND HOLD RUNGS
TYP. SEC. THRU HINGED M.H. HATCHES
SCALE 3"=1'-0"
HINGES WELDED TO HATCH & IMBEDED IN CONCRETE.
HASP WELDED TO 2 1/2 x 2 1/2 x 1/4 ∠
LOCK
2 1/2 x 2 1/2 x 1/4 ∠ FRAME ALL ROUND.
#5 CONC. ANCHORS @ 2'-0" C.-C.
TYP. SEC. THRU REMOVABLE CONC. SLAB
SCALE 1 1/2" = 1'-0"
LIFTING LUG #5 BAR
#6 BAR
#4 @ 15"
4 - #5
REVISIONS
NO. DESCRIPTION DATE BY
THE METROPOLITAN CORPORATION OF GREATER WINNIPEG
WATERWORKS & WASTE DISPOSAL DIVISION
SEWAGE DISPOSAL DEPT.
NORTH EAST TRUNK SEWER STAGE 1.
GATE CHAMBER DETAILS.
APPROVED BY
CHIEF ENGINEER
DESIGNED BY
CHECKED BY
DRAWN BY HB
DATE 18 JUN. 64
SCALES 1/2"=1'-0" & AS NOTED
DRAWING NO. 497





METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

0.0 5.0 10.0 15.0 20.0 25.0

WARNING

IF POWER EQUIPMENT OR EXPLOSIVES ARE TO BE USED FOR EXCAVATION ON THIS PROJECT THE CONTRACTOR MUST:

1) NOTIFY THE GAS COMPANY OF THE PROPOSED LOCATION OF EXCAVATION.

2) TAKE PRECAUTION TO AVOID DAMAGE TO GAS COMPANY INSTALLATIONS.

SEE PROVINCIAL REGULATION 210/72 FOR DETAILS

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE _____ DATE _____

NOTE:

LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

B.M.
ELEV.

COSTRUCTION COMPLETION DATE: YYYY MM DD

NO.	REVISIONS	DATE	BY

DESIGNED BY XX
DRAWN BY XX
SCALE:
HORIZONTAL 1:250
VERTICAL 1:100
DATE 2012 11 14
PLOT DATE: 2012 11 14

CHECKED BY XX
APPROVED BY XX
RELEASED FOR CONSTRUCTION
DATE

ENGINEER'S SEAL

CONSULTANT DRAWNG NUMBER
–

BID OPPORTUNITY: XXX–20XX
CONTRACT NUMBER: X

Winnipeg

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT
ENGINEERING DIVISION

JOHN BLACK RIVER CROSSING
RIVER BED PROFILE

SHEET X OF X
CITY DRAWING NUMBER
–

FILE PATH: R:\DRAWINGS\WATER\RENEWAL\2013_RENEWALS\John Black Feedermain Crossing\
FILE NAME: SHOTS.dwg

DYREGROV & BURGESS

BOREHOLE LOG

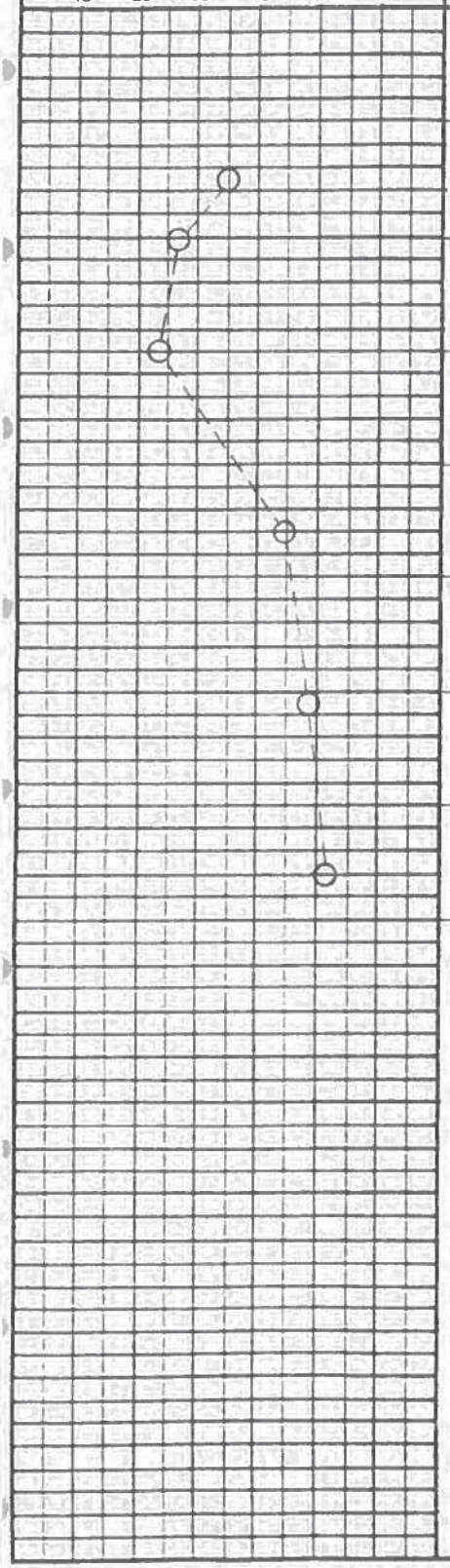
PROJECT: Kildonan Corridor

LOGGED/DWN	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	6/08/87	87422	1

DRILL TYPE: 450 & 500 mm Augers

DATUM: Geodetic

SURFACE ELEVATION: 230.63 m



SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
	Fill				
	Clay -black				
	Clay -silty -brown -stiff -alluvial				
	Silt -tan -wet to saturated -firm				
	Clay -mottled brown -highly plastic -stiff -lacustrine		U		qu=109.7kpa γ_w=16.48kn/m^3 pp=146.0kpa Tv=84.7kpa
	End hole at 7.6 m. Seepage and caving from 2.4 to 2.7 m.				

Plate A-2

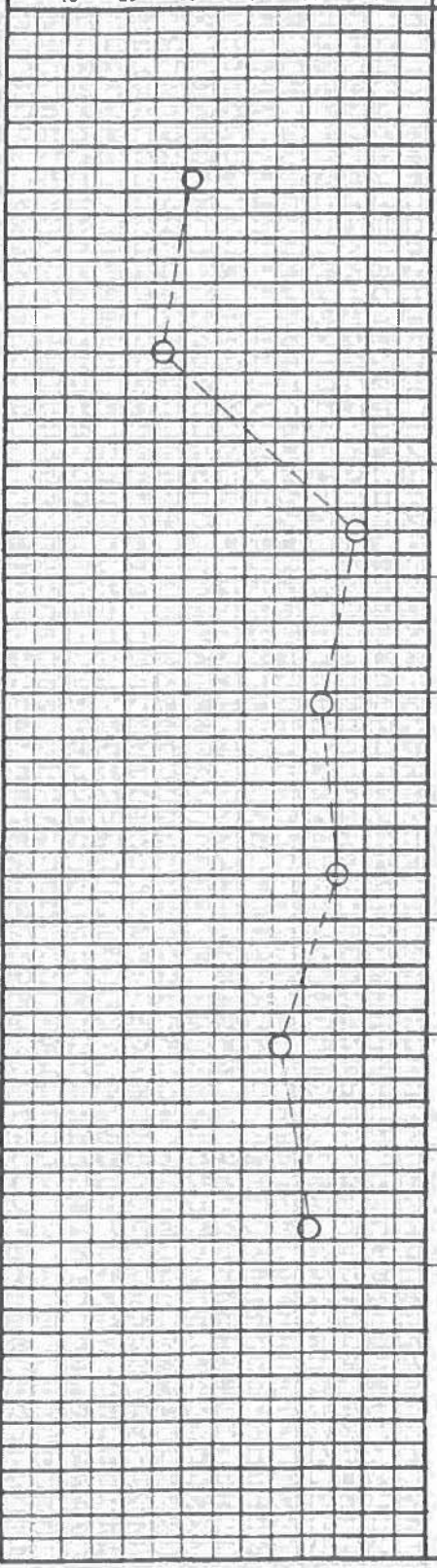
DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	6/08/87	87422	2

DRILL TYPE: 450 &500 mm Augers



DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION (DATUM Geodetic; SURFACE ELEVATION 230.91 m)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay, silt, some gravel				
1		Clay -black				
2		Clay -silty -brown -stiff				
3		Silt -tan -saturated				
4		Clay -mottled brown -highly plastic -firm to stiff -lacustine				
5				U		qu=47.2kpa γ_w=16.51kn/m^3 pp=93.4kpa Tv=81.2kpa
6						
7						
8		- - - grey		U		qu=150.1kpa γ_w=16.85kn/m^3 pp=125.4kpa Tv=77.8kpa
9						
10						
11		End hole at 10.7 m. Seepage and caving from silt layer		U		qu=131.8kpa γ_w=17.60kn/m^3 pp=117.8kpa Tv=60.3kpa

Plate A-3

DYREGROV & BURGESS

BOREHOLE LOG

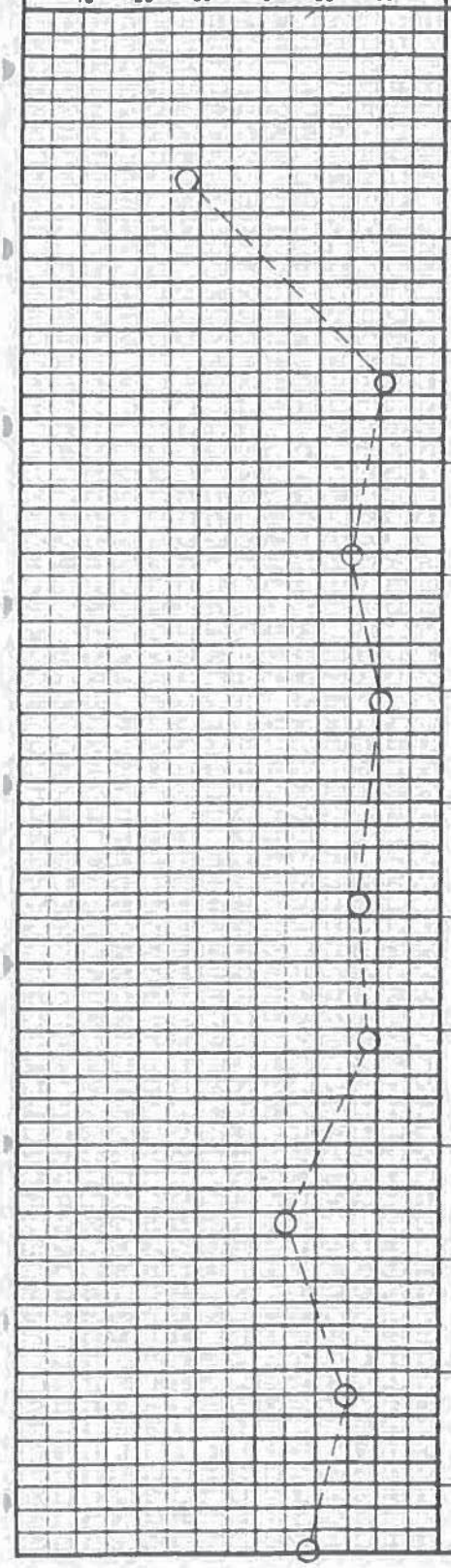
PROJECT: Kildonan Corridor

LOGGED/DWN	CKD	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	6/08/87	87422	3

DATUM: Geodetic

SURFACE ELEVATION: 230.58 m

DRILL TYPE: 500 mm Auger



SOIL SYMBOL	SOIL DESCRIPTION	CONDITION	TYPE	PENETRATION RESISTANCE	OTHER TESTS
	Topsoil				
	Clay -silty -brown -stiff				
	Silt -tan -wet to saturated				
	Clay -mottled brown -highly plastic -stiff to firm -lacustrine		U		qu=57.4kpa γ_w=16.40kn/m^3 pp=132.9kpa Tv=71.3kpa
	---grey		U		qu=117.3kpa γ_w=16.27kn/m^3 pp=119.7kpa Tv=74.7kpa
			U		qu=148.5kpa γ_w=16.81kn/m^3 pp=95.8kpa Tv=60.6kpa
					qu=147.3kpa γ_w=16.58kn/m^3 pp=68.9kpa Tv=54.6kpa
	End of hole at 13.7 m in clay.		U		

Plate A-4

DYREGROV & BURGESS

BOREHOLE LOG

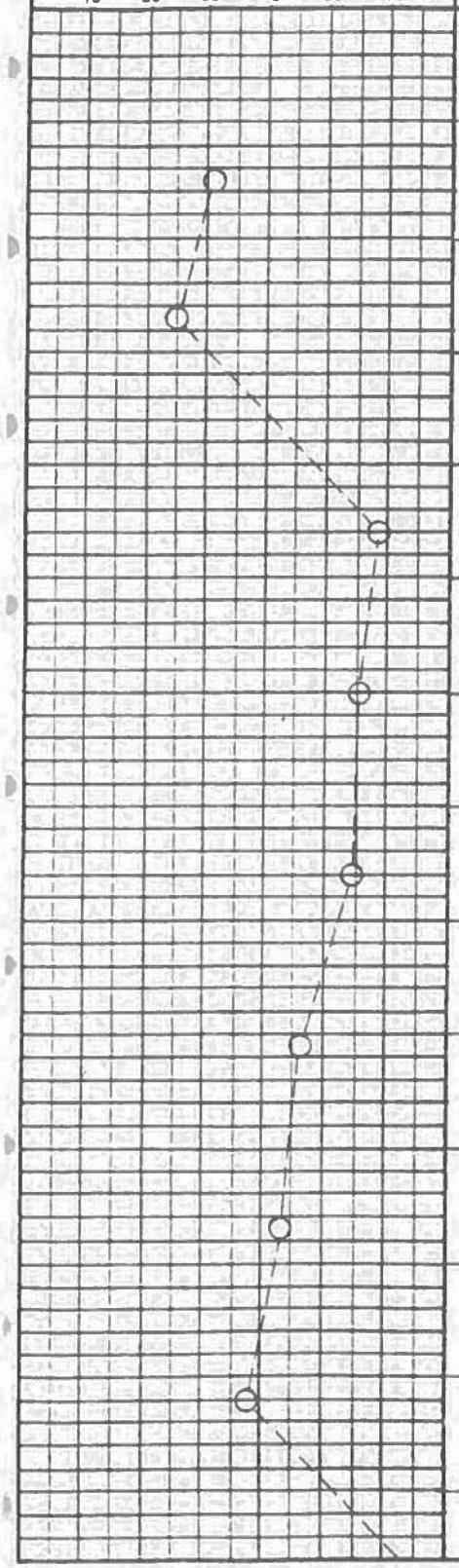
PROJECT: Kildonan Corridor

LOGGED/OWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	6/08/87	87422	4

DRILL TYPE: 450 & 500 mm Augers

DATUM: Geodetic

SURFACE ELEVATION: 230.64 m



DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay -concrete rubble				
1						
		Clay -silty -brown				
2						
		Silt -tan -wet to saturated				
3						
		Clay -mottled brown -highly plastic -stiff to firm -lacustrine				
4						
						γ_w=16.30kn/m^3
5				U		pp=108.9kpa Tv=57.4kpa
6						
		- - -grey				
7						
						qu=135.1kpa
8				U		γ_w=17.00kn/m^3 pp=147.5kpa Tv=72.8kpa
9						
10						
						qu=106.7kpa
11				U		γ_w=16.72kn/m^3 pp=93.8kpa Tv=56.0kpa
12						
13						

Plate A-5

DYREGROV & BURGESS

BOREHOLE LOG

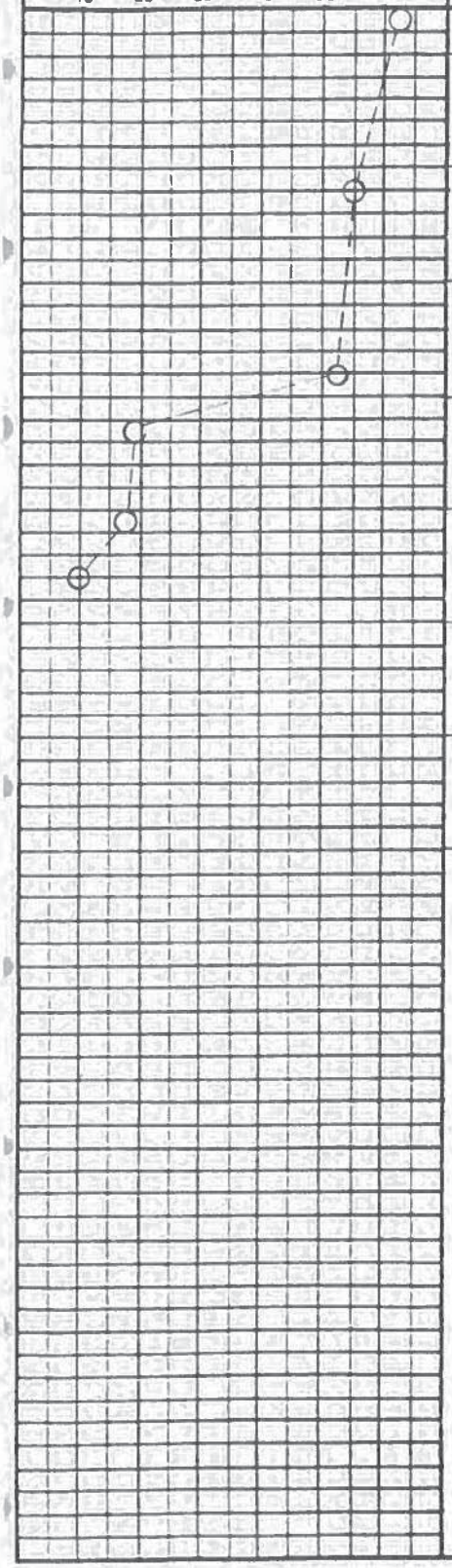
PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	6/08/87	87422	4

DRILL TYPE: 450 & 500 mm Augers

DATUM: Geodetic

SURFACE ELEVATION: 230.64 m



DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		Clay -grey -highly plastic -lacustrine		U		qu=68.2kpa γ_w=16.04kn/m^3 pp=94.2kpa Tv=47.4kpa
15						
16						
17						qu=128.4kpa γ_w=16.51kn/m^3 pp=81.4kpa Tv=43.6kpa
18						
19		Silt (Glacial Till) -sandy, gravelly -wet -loose to 19.5 m -medium dense below 19.5 m				
20						
21		End of hole at 20.4 m. -Smooth auger refusal -Possible bedrock at 20.4 m -Water inflow from 20.4 m -Water level stabilized at 9.4 m in about 15 minutes				

Plate A-6

DYREGROV & BURGESS

BOREHOLE LOG

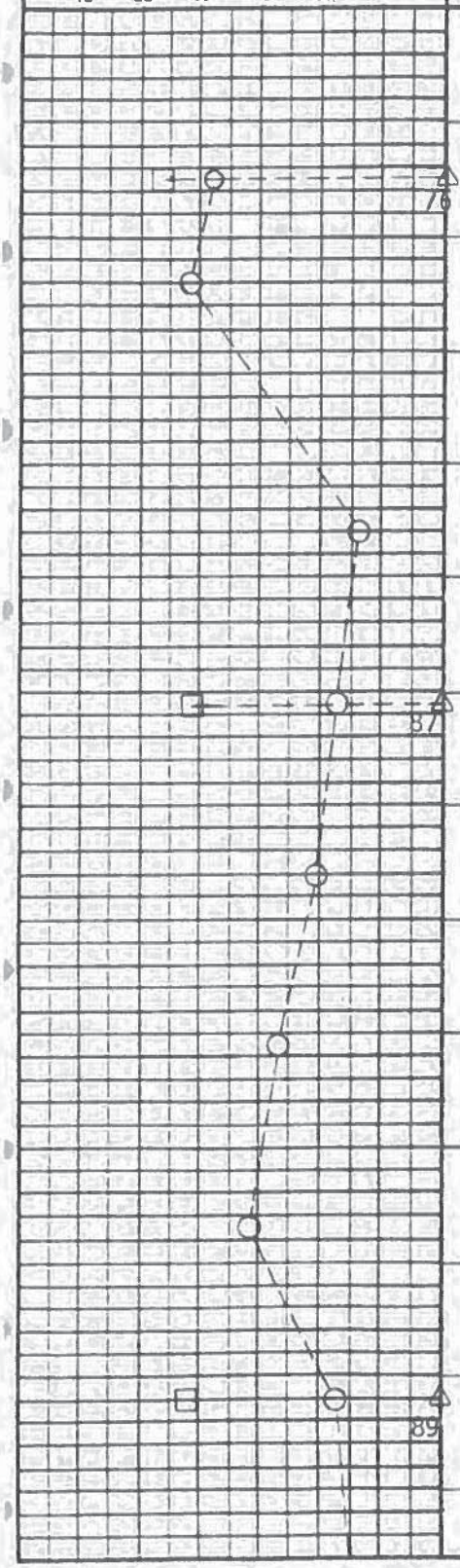
PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	6/08/87	87422	5

DRILL TYPE: 450 & 500 mm Augers

DATUM: Geodetic

SURFACE ELEVATION: 228.72 m



SOIL SYMBOL	SOIL DESCRIPTION	CONDITION	TYPE	PENETRATION RESISTANCE	OTHER TESTS
	Fill -silty -clay				
	Clay -black				
	Clay -silty -brown -alluvial				See Dilatometer Test Results (DMT 2)
	Clay -mottled brown -highly plastic -stiff to firm -lacustrine				
			U		qu=53.7kpa γ_w=16.18kn/m^3 pp=112.5kpa Tv=59.4kpa
	---grey				
			U		qu=114.2kpa γ_w=17.38kn/m^3 pp=122.6kpa Tv=62.7kpa
			U		qu=95.3kpa γ_w=17.78kn/m^3 pp=66.1kpa Tv=39.7kpa

Plate A-7

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	6/08/87	87422	5

DRILL TYPE: 450 & 500 mm Augers

DATUM: Geodetic

SURFACE ELEVATION: 228.72 m

WATER CONTENT (W_P-□ W-○ W_L-△. PERCENT % 10 20 30 40 50 60)	DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
	14		Clay (cont'd)		U		qu=118.4kpa γ_w=16.51kn/m^3 pp=103.4kpa Tv=49.3kpa
	15						
	16		Silt (Glacial Till) -sandy gravelly -clayey -loose				
	17						
	18						
	19		End of hole at 18.7 m -Possible bedrock -No seepage				

Plate A-8

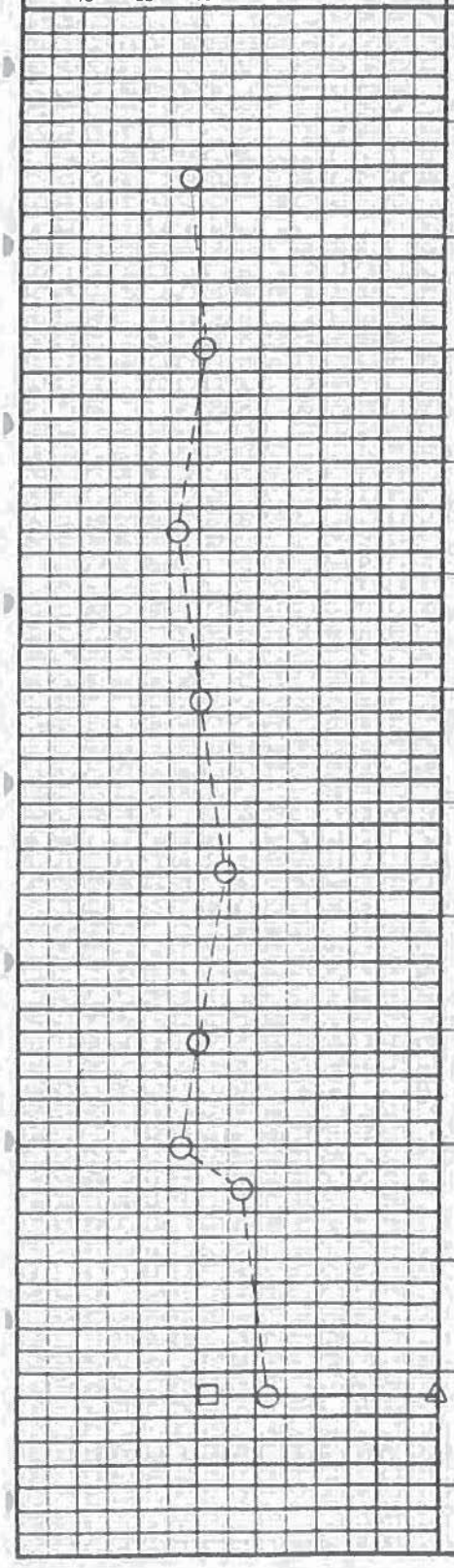
DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN: SDG | CKD: NCB | DATE OF INVEST.: 10/08/87 | JOB NO.: 87422 | HOLE NO.: 6

DRILL TYPE: Hollowstem 550 & 600 mm Augers



SOIL SYMBOL	SOIL DESCRIPTION (DATUM Geodetic; SURFACE ELEVATION 227.47 m)	SOIL SAMPLE: CONDITION / TYPE / PENETRATION RESISTANCE	OTHER TESTS
	Clay -silty -some sand -alluvial -stiff to 1.2 m -soft from 1.2 to 3.3 m	U	See dilatometer test results to 15.2 m depth (DMT 1) γ_w=17.90kg/m^3 pp=114.9kpa
	Sand -little to some silt -trace to some clay -fine to medium grained very dense, 5.2 - 6.4 m		MA
	medium grained, grey, saturated	U	MA pp=35.9kpa
	Silt -some sand -some to little clay -firm to stiff	U	MA γ_w=18.00 kg/m^3 pp=67.0kpa Tv=31.6kpa
		U	γ_w=17.71kg/m^3 pp=88.6kpa Tv=15.8kpa
		U	MA γ_w= 14.97kg/m^3 pp=52.7kpa
	Clay -silty, very stiff, alluvial	U	pp=148.4kpa Tv=67.0kpa
	End of hole at 12.5 m Standpipe piezometers SP 1 and SP 2 installed		

Plate A-9

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	10/08/87	87422	6

WATER CONTENT: W_P - □ W - ○ W_L - △. PERCENT %. 10 20 30 40 50 60

DEPTH | SOIL SYMBOL

SOIL DESCRIPTION

DATUM: Geodetic

SURFACE ELEVATION: 227.47 m

SOIL SAMPLE: CONDITION | TYPE | PENETRATION RESISTANCE

DRILL TYPE: Hollowstem 550 & 600 mm Augers

OTHER TESTS

SP 1
Tip at 12.2 m
Sand to 11.6 m
Bentonite to 10.4 m
230 mm Ø augers

SP 2
Tip at 6.1 m
Sand at 5.6 m
Bentonite to 4.6 m
230 mm Ø augers
Pipe ID - 19 mm

Plate A-10

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	7/08/87	87422	7

DRILL TYPE: 450 & 600 mm Augers

DATUM: Geodetic

SURFACE ELEVATION: 227.13 m

WATER CONTENT — W_P - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		~~Topsoil~~				
1		Silt -sandy -some clay -brown -alluvial				
2						
3		Sand -some silt -trace clay – – – saturated				MA
4						
5		Silt -some sand and clay -grey -wet -firm				
6						
7						
8				U		MA γ_w=17.95kg/m^3 pp=61.3kpa Tv=32.6kpa
		Sand -fine grained -grey, saturated				
9		Silt -some sand and clay				
10		Clay -grey -highly plastic -firm				
		– – – 100 mm gravel layer, shells				qu=67.7kpa
11				U		γ_w=18.34kg/m^3 pp=151.2kpa Tv=69.9kpa
12						
13						

Plate A-11

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	7/08/87	87422	7

WATER CONTENT: W_P - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60

DRILL TYPE: 550 &600 mm Augers

OTHER TESTS

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION (DATUM Geodetic; SURFACE ELEVATION 227.13 m)	SOIL SAMPLE: CONDITION	TYPE	PENETRATION RESISTANCE
14		Clay & Glacial Till			
15					
		Silt (Glacial Till) -wet, loose, clayey			
16					
		End of hole at 16.2 m. -Smooth auger refusal -Water seepage 20 minutes after completion of drilling -600 mm casing to 10 m depth -Possible bedrock at 16.2 m			
17					

Plate A-12

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/OWN	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	7/08/87	87422	8

DRILL TYPE: 550 & 600 mm Augers

OTHER TESTS

WATER CONTENT

W_P - □ W - ○ W_L - △

PERCENT %

10 20 30 40 50 60

DATUM: Geodetic

SURFACE ELEVATION: 227.17 m

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay, concrete rubble				
1		Silt -clayey, brown, stiff -alluvial				
2		Sand -fine grained -some silt -brown				
3		---saturated		U		γ_w=18.01kg/m^3 pp=56.2kpa Tv=39.7kpa
4						
5		---grey				
6						
7						
8						
9		Silt -some sand and clay -wet -stiff to firm		U		qu=57.3kpa γ_w=16.97kg/m^3 pp=183.8kpa Tv=62.2kpa
10						
11		---50 mm gravel layer				
12				U		qu=49.1kpa γ_w=15.97kg/m^3 pp=101.5kpa Tv=57.4kpa
13		Clay -grey -highly plastic -stiff to firm				

Plate A-13

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	7/08/87	87422	8

DRILL TYPE: 550 & 600 mm Augers

DATUM: Geodetic

SURFACE ELEVATION: 227.17 m

WATER CONTENT — W_P - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		Clay (cont'd)				
15		---gravelly				
16		Silt (Glacial Till) -sandy, gravelly -some clay -tan -seepage from 16.5 m				
17						
18		End of hole at 17.7 m -Rough auger refusal at 17.7 m -Water level at 7.2 m on completion of drilling -600 mm casing to 4.6 below grade				

Plate A-14

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	27/08/87	87422	12

DRILL TYPE: Hollow Stem

DATUM: Geodetic

SURFACE ELEVATION: 226.74 m

WATER CONTENT: W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay -some gravel				P1 Pneumatic piezometer tip @ 7.8m sand to 7.1 m bent. to6.1m
1		Clay -silty -brown -stiff -alluvial -medium to highly plastic				
2						
3				U		qu=46.4kpa γ_w=18.00kn/m^3 pp=97.0kpa Tv=27.8kpa
4						
5		--grey				
6				U		γ_w=17.37kn/m^3 pp=59.8kpa
7						
8						
9				U		qu=67.4kpa γ_w=19.95kn/m^3 pp=143.6kpa
10		Clay -mottled brown to grey -highly plastic -lacustrine				
11						
12				U		qu=51.2kpa γ_w=17.60kn/m^3 pp=87.8kpa Tv=58.4kpa
13		End of hole at 12.8 m. Install pneumatic piezometer				

Plate A-18

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN	CKD	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	27/08/87	87422	13

DRILL TYPE: Hollow Stem

DATUM: Geodetic

SURFACE ELEVATION: 227.60 m

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay -some gravel				Station - 3+90.9
1		Clay -silty -brown -alluvial				
2		Clay -mottled brown -highly plastic -stiff to firm -lacustrine				
6				U		qu=56.5kpa γ_w=16.77kn/m^3 pp=93.8kpa Tv=48.8kpa
12				U		

Plate A-19

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	27/08/87	87422	13

DRILL TYPE: Hollow Stem

DATUM: Geodetic

SURFACE ELEVATION: 227.60 m

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		Clay (cont'd)				
15						
16						
17						
18		Silt (Glacial Till) -sandy and gravelly -bouldery				
19		End of hole at 18.6 in glacial till.				
20		Backfill with sand to 14.9. Place pneumatic piezometer @ 14.9 (P2) Sand to 14.2 m Bentonite to 13.1 m Set pneumatic piezometer (P3) with tip @ 9.1 m. Sand to 8.5 m. Bentonite to 7.5 m.				

Plate A-20

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	18/09/87	87422	14

DRILL TYPE: B-24, 75 mm Bit

WATER CONTENT: W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DATUM: Geodetic

SURFACE ELEVATION: 223.64

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Water				
1						
2						
3						
4						
5						
6						
7						
8		Overburden Soils				For DMT results see DMT 5
9		Glacial Till				
10						
11						
12						
13		Limestone Bedrock				

Plate A-21

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: Kildonan Corridor

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
NCB	NCB	18/09/87	87422	14

WATER CONTENT — W_p - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DRILL TYPE: B-24, 75 mm Bit

DEPTH (M)	SOIL SYMBOL	SOIL DESCRIPTION (DATUM Geodetic; SURFACE ELEVATION 223.64 m)	SOIL SAMPLE: CONDITION / TYPE / PENETRATION RESISTANCE	OTHER TESTS
14		Sound Rock		Rec. - 100%
15		Sound Rock 25 mm clay seam at 15.2 m		Rec. - 91% RQD -80%
16		Sound Rock 25 mm clay seam at 16.7 m		REC. -94% RQD -75%
17				
18		Sound Rock No clay seams		Rec. -100% RQD - 95%
19				
20		End hole at 19.1 m. Rock surface estimated at Elev. - 210.38 m. Top 150 mm unsound.		

Plate A-22

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 24/09/87	JOB NO. 87422	HOLE NO. 15

WATER CONTENT — W_P - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

DATUM

SURFACE ELEVATION 223.67 m

DEPTH m	SOIL DESCRIPTION
1	WATER
2	
3	
4	
5	
6	
7	
8	
9	
10	ALLUVIAL SOILS
11	GLACIAL TILL (depth to till extrapolated from DMT 6)
12	
13	LIMESTONE BEDROCK

PLATE A-23

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN | CKD | DATE OF INVEST. 24/09/87 | JOB NO. 87422 | HOLE NO. 15

WATER CONTENT: W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	DRILL TYPE / OTHER TESTS
14		BROKEN ROCK				
		SOUND ROCK				REC - 99% RQD - 60%
		NO RECOVERY				
15		SOUND ROCK				REC - 99% RQD - 60%
		NO RECOVERY				
16		SOUND ROCK				REC - 99% RQD - 79%
17		SOUND ROCK				REC - 100% RQD - 70%
18		NO RECOVERY				
		BROKEN ROCK				
19		SOUND ROCK				REC - 84%
20						RQD - 17%
		SOUND ROCK				REC - 100% RQD - 45%
21						
22		End hole at 21.7 m. Rock surface estimated at elev. 210.53 Ton 0.9 m unsound rock.				

PLATE A-24

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN	CKD	DATE OF INVEST. 25/09/87	JOB NO. 87422	HOLE NO. 16

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH m

SOIL SYMBOL

SOIL DESCRIPTION

DATUM

SURFACE ELEVATION 223.61 m

SOIL SAMPLE: CONDITION | TYPE | PENETRATION RESISTANCE

DRILL TYPE

OTHER TESTS

1 WATER

2

3

4

5

6

7

8

9

10 ALLUVIAL SOILS

11 GLACIAL TILL
- -SOFT/LOOSE
- -PUSHED DRILL RODS TO BEDROCK SURFACE

12

13 LIMESTONE BEDROCK

FOR TESTS IN ALLUVIUM SEE DMT 7

PLATE A-25

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 25/09/87	JOB NO. 87422	HOLE NO. 16

WATER CONTENT — W_P - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	DRILL TYPE / OTHER TESTS
14		BROKEN ROCK TO 13.7 m				
		3 - 6mm clay seams at 14.0 m				REC - 75%
15		SOUND ROCK				REC - 95% RQD - 68%
16		225 mm seam or soft rock				REC - 98%
17						
18		SOUND ROCK				REC - 93%
19		NO RECOVERY				
20		Abandon hole at 20.1 m Drill rods jamming				

PLATE A-26

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 06/10/87	JOB NO. 87422	HOLE NO. 16A

WATER CONTENT — W_p - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION — DATUM — SURFACE ELEVATION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

1
WATER

2

3

4

5

6

7

8

9

10
ALLUVIAL SOILS

11
GLACIAL TILL
(deoth extrapolated from DMT 7)

12

13

PLATE A-27

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 06/10/87	JOB NO. 87422	HOLE NO. 16A

WATER CONTENT: W_P - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60

DRILL TYPE

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
		GLACIAL TILL				
14		LIMESTONE BEDROCK				REC - 100% ROD - 67%
15		UNSOUND ROCK NO CORE RECOVERY				
16						
17						
18						
19						
20		UNSOUND ROCK NO CORE RECOVERY				
21						
22						
23		UNSOUND ROCK				REC - 30%
24		End hole at 23.6 m.				

PLATE A-28

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 07/10/87	JOB NO. 87422	HOLE NO. 16B

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH m

SOIL SYMBOL

SOIL DESCRIPTION

DATUM

SURFACE ELEVATION 223.69 m

SOIL SAMPLE — CONDITION | TYPE | PENETRATION RESISTANCE

DRILL TYPE

OTHER TESTS

1 2 3 4 5 6 7 8 9 10 11 12 13

WATER

ALLUVIUM

GLACIAL TILL

(depth to till extrapolated from DMT 7)

PLATE A-29

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 07/10/87	JOB NO. 87422	HOLE NO. 16B

WATER CONTENT: W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DRILL TYPE

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION 223.69 m)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		LIMESTONE BEDROCK SOUND ROCK				REC - 100% ROD - 56%
15		SOUND ROCK				REC - 98% ROD - 83%
16						
17		SOUND ROCK				REC - 96% ROD - 90%
18		SOUND ROCK				REC - 94% ROD - 73%
19						
20		NO RECOVERY End hole at 20.0 m Drill rods jamming in broken rock and clay.				

PLATE A-30

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 14/10/87	JOB NO. 87422	HOLE NO. 16C

WATER CONTENT: W_p - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60

DRILL TYPE

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
1		WATER				
2						
3						
4						
5						
6						
7						
8						
9		ALLUVIUM				
10						
11		GLACIAL TILL (depth to till extranolated from DMT 7)				
12						
13						

PLATE A-31

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN	CKD.	DATE OF INVEST. 14/10/87	JOB NO. 87422	HOLE NO. 16C

WATER CONTENT: Wp - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 80

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	DRILL TYPE / OTHER TESTS
14		LIMESTONE BEDROCK SOUND ROCK				REC - 100% RQD - 85%
15		SOUND ROCK				REC - 92% RQD - 91%
16						
17		SOUND ROCK				REC - 98% RQD - 96%
18		SOUND ROCK				REC - 100% RQD - 100%
19		NO RECOVERY				
20		BROKEN ROCK, NO RECOVERY NO RECOVERY				
21		SOUND ROCK				REC - 93% RQD - 73%
22						
23		End hole at 22.3 m.				

PLATE A-32

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 15/10/87	JOB NO. 87422	HOLE NO. 16D

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION — DATUM — SURFACE ELEVATION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

1
2
3
4
5
6
7
8
9
10
11
12
13

WATER

ALLUVIUM

GLACIAL TILL
(depth to glacial till extrapolated from DMT 7)

LIMESTONE BEDROCK

PLATE A-33

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 15/10/87	JOB NO. 87422	HOLE NO. 16D

WATER CONTENT — Wp - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DRILL TYPE

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		150 mm clay or soft rock				REC - 69% RQD - 67%
		---- 150 mm clay or soft rock				
15		NO RECOVERY				
16		SOUND ROCK				REC - 88%
17		SOUND ROCK				REC - 100% RQD - 93%
18		SOUND ROCK				
		NO RECOVERY				
19		SOUND ROCK				
20		UNSOUND ROCK				REC - 30% RQD - 10%
21		SOUND ROCK				REC - 80%
22						RQD - 63%
		BROKEN ROCK				
		End hole at 22.5 m.				

PLATE A-34

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN	CKD.	DATE OF INVEST. 06/10/87	JOB NO. 87422	HOLE NO. 17

WATER CONTENT — W_p - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

DATUM

SURFACE ELEVATION 223.65 m

1 WATER

2

3

4

5

6

7

8

9 ALLUVIAL SOILS

10

11 GLACIAL TILL

VERY DENSE? HARD BELOW 11.2 m

12

13

For tests in alluvium see DMT 7

PLATE A-35

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 06/10/87	JOB NO. 87422	HOLE NO. 17

WATER CONTENT — W_P - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	DRILL TYPE / OTHER TESTS
14		GLACIAL TILL				
		LIMESTONE BEDROCK				
15		NO RECOVERY 14.3 to 15.5 m				
16		SOUND ROCK				REC - 99% RQD - 99%
17		SOUND ROCK				REC - 97% RQD - 75%
18		SOUND ROCK				REC - 97% RQD - 79%
19		SOUND ROCK				REC 100%
20		BROKEN ROCK				REC 0%
		SOUND ROCK				REC - 100% RQD - 70%
21		SOUND ROCK				REC - 93% RQD - 30%
22						
23		End hole at 22.6 m.				

PLATE A-36

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN	CKD	DATE OF INVEST. 21/09/87	JOB NO. 87422	HOLE NO. 18

WATER CONTENT — W_P - □ W - ○ W_L - △ — PERCENT % — 10 20 30 40 50 60

DEPTH m

SOIL SYMBOL

SOIL DESCRIPTION

DATUM

SURFACE ELEVATION 223.68

SOIL SAMPLE — CONDITION | TYPE | PENETRATION RESISTANCE

DRILL TYPE

OTHER TESTS

Depth (m)	Soil Description
0 – 11	WATER
11 – 12	GLACIAL TILL
12 – 13.1	LIMESTONE BEDROCK, BROKEN TO 13.1m
13.1 – 13.8	SOUND ROCK, 13.1 - 13.8 m

PLATE A-37

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 21/09/87	JOB NO. 87422	HOLE NO. 18

WATER CONTENT: W_P - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE / OTHER TESTS

DATUM

SURFACE ELEVATION 223.68 m

DEPTH m	SOIL DESCRIPTION	OTHER TESTS
14	NO RECOVERY 13.8 - 13.9 m SOUND ROCK 25 mm clay seam at 14.6 m	REC - 87% RQD - 82%
15	SOUND ROCK	REC - 95% RQD - 87%
16	SOUND ROCK	REC - 95%
17		RQD - 65%
18	SOUND ROCK	REC - 95% RQD - 87%
19	SOUND ROCK	REC - 95%
20		
21	SOUND ROCK	REC - 93%
22		
23	End hole at 22.3 m.	

PLATE A-38

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 19/09/87	JOB NO. 87422	HOLE NO. 19

WATER CONTENT — W_P - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

DATUM

SURFACE ELEVATION 223.62

1 2 3 4 5 6 7 8 9 10 11 12 13

WATER

GLACIAL TILL
(depth to glacial till extrapolated from DMT 5)

PLATE A-39

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN: | CKD: | DATE OF INVEST. 19/09/87 | JOB NO. 87422 | HOLE NO. 19

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	DRILL TYPE / OTHER TESTS
		GLACIAL TILL				
14		LIMESTONE BEDROCK BROKEN ROCK TO 14.6 m				REC - 30%
15		SOUND ROCK				REC - 100%
16						
		SOUND ROCK				REC - 96% RQD - 94%
17						
18		SOUND ROCK				REC - 96% RQD - 74%
19						
		SOUND ROCK				REC - 97%
20						
21		End hole at 20.7 m.				

PLATE A-40

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN. | CKD. | DATE OF INVEST. 03/10/87 | JOB NO. 87422 | HOLE NO. 20

DRILL TYPE

OTHER TESTS

WATER CONTENT

W_P - □ W - ○ W_L - △

PERCENT %

10 20 30 40 50 60

DEPTH m

SOIL SYMBOL

SOIL DESCRIPTION

DATUM

SURFACE ELEVATION 223.61 m

SOIL SAMPLE: CONDITION | TYPE | PENETRATION RESISTANCE

DEPTH m	SOIL DESCRIPTION
1	WATER
2	ALLUVIAL SOILS (for test results see DMT 4)
8	GLACIAL TILL (depth to till extrapolated from DMT 4)
13	LIMESTONE BEDROCK

PLATE A-41

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 03/10/87	JOB NO. 87422	HOLE NO. 20

WATER CONTENT — W_p - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DRILL TYPE

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION DATUM SURFACE ELEVATION 223.61 m	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		BROKEN ROCK 13.4 - 14.0 m SOUND ROCK BELOW 14.0 m				REC - 64% RQD - 53%
15		SOUND ROCK				REC - 97% RQD - 81%
16						
17		SOUND ROCK				REC - 95% RQD - 93%
18		SOUND ROCK				REC - 92% RQD - 69%
19		100 mm clay seam				
20		SOUND ROCK				REC - 97% RQD - 73%
21		SOUND ROCK				REC - 92% RQD - 79%
22						
23		End hole at 22.6 m.				

PLATE A-42

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 28/09/87	JOB NO. 87422	HOLE NO. 21

WATER CONTENT — W_p - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m

SOIL SYMBOL

SOIL DESCRIPTION

DATUM

SURFACE ELEVATION 223.63 m

SOIL SAMPLE — CONDITION | TYPE | PENETRATION RESISTANCE

DRILL TYPE

OTHER TESTS

1 — WATER

2 — ALLUVAIL SOILS
(for test results see DMT 4)

3

4

5

6

7

8 — GLACIAL TILL
(depth to till extrapolated from DMT 4)

9

10

11

12

13 — LIMESTONE BEDROCK

PLATE A-43

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN. | CKD. | DATE OF INVEST. 23/09/87 | JOB NO. 87422 | HOLE NO. 21

WATER CONTENT (Wp - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60)	DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	DRILL TYPE / OTHER TESTS
	14		NO RECOVERY TO 14.2 m				
			SOUND ROCK, 14.2 - 14.8 m				
	15		— — 25 mm clay seam SOUND ROCK				REC - 99% RQD - 44%
	16						
			SOUND ROCK				REC - 97% RQD - 81%
	17						
	18		— — 6 mm clay seams (2) — — 12 mm clay seam				REC - 95% RQD - 45%
			SOUND ROCK				
	19						
	20		SOUND ROCK				REC - 98% RQD - 67%
	21		SOUND ROCK				REC - 100% RQD - 36%
	22						
	23		End hole at 22.4 m.				

PLATE A-44

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 23/09/87	JOB NO. 87422	HOLE NO. 22

WATER CONTENT — W_P - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60

DEPTH m

SOIL SYMBOL

SOIL DESCRIPTION

DATUM

SURFACE ELEVATION 223.68 m

SOIL SAMPLE: CONDITION | TYPE | PENETRATION RESISTANCE

DRILL TYPE

OTHER TESTS

Depth (m)	Soil Description
1	WATER
2	ALLUVIAL SOILS (for testing see DMT 3)
8	GLACIAL TILL (depth to glacial till extranolated from DMT 3)
13	LIMESTONE BEDROCK

PLATE A-45

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN	CKD.	DATE OF INVEST. 23/09/87	JOB NO. 87422	HOLE NO. 22

WATER CONTENT: Wp - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DRILL TYPE:

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION 223.68 m)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		BROKEN ROCK, 13.0-13.8 m				no REC
		SOUND ROCK				REC - 99% RQD - 45%
15		SOUND ROCK				REC - 99% RQD - 83%
16		SOUND ROCK				REC - 96% RQD - 73%
17						
18		SOUND ROCK				REC - 93% RQD - 66%
19		End hole at 19.0 m.				

PLATE A-46

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 22/09/87	JOB NO. 87422	HOLE NO. 23

WATER CONTENT — W_p - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH M | SOIL SYMBOL | SOIL DESCRIPTION (DATUM; SURFACE ELEVATION 223.70 m) | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

DEPTH M	SOIL DESCRIPTION
1	WATER
2	ALLUVIAL SOILS (For testing see DMT 3)
8	GLACIAL TILL (Depth to till extrapolated from DMT 3)
13	LIMESTONE BEDROCK

PLATE A-47

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 22/09/87	JOB NO. 87422	HOLE NO. 23

WATER CONTENT: W_p - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DRILL TYPE

DEPTH	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION 223.70 m)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
14		SOUND ROCK				REC.- 87% RQD. - 83%
15		SOUND ROCK				REC. - 97% RQD - 70%
16		SOUND ROCK				REC. - 100% RQD - 88%
17		SOUND ROCK				REC. - 95% RQD - 47%
18		SOUND ROCK				REC. - 97% RQD - 61%
19						
20						
21		End hole at 20.9 m.				

PLATE A-48

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 22/09/87	JOB NO. 8/422	HOLE NO. DMT 3

WATER CONTENT: W_P - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60

DEPTH m

SOIL SYMBOL

SOIL DESCRIPTION

DATUM

SURFACE ELEVATION 223.70 m

SOIL SAMPLE: CONDITION | TYPE | PENETRATION RESISTANCE

DRILL TYPE

OTHER TESTS

Depth (m)	Soil Description	UNDRAINED SHEAR STRENGTH (kPa)
1	WATER	
2	SILT - clayev	10.3
3	CLAY - silty	11.3
4		12.1
5		13.1
6		13.9
7	STRATIFIED SILTY CLAY AND CLAYEY SILT	14.8
8		15.8
		16.6
		15.8
		26.9
		20.7
		19.8
		31.2
		27.9
		34.5
		38.6
	End Dilatometer testing at 7.9 m. Refusal on glacial till or boulder at 7.9 m.	

PLATE A-49

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN. | CKD. | DATE OF INVEST. 30/09/87 | JOB NO. 87422 | HOLE NO. DMT 4

DRILL TYPE

WATER CONTENT — W_P - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION 223.61)	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS: UNDRAINED SHEAR STRENGTH (kPa)
1		WATER				
2		CLAYEY SILT				28 27 27
3		STRATIFIED SILT, SAND, AND CLAY				36
4						45 39
5		SILTY SAND				$\phi=34^{o}$ $\phi=36^{o}$
6						
7		SILTY CLAY				51 59 58
8		End dilatometer test at 7.5 m. Refusal on boulder or glacial till.				

PLATE A-50

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 30/09/87	JOB NO. 87422	HOLE NO. DMT 5

WATER CONTENT — W_P - □ W - ○ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

DATUM

SURFACE ELEVATION 223.61

DEPTH m	SOIL DESCRIPTION
1	WATER
2	
3	
4	
5	
6	
7	
8	CLAYEY SILT, SILTY CLAY AND SAND
9	End dilatometer testing at 8.5 m Refusal on glacial till

OTHER TESTS:

UNDRAINED SHEAR STRENGTH (kPa)

- 24
- 34
- $\phi = 39^{0}$

PLATE A-51

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN.	CKD.	DATE OF INVEST. 30/09/87	JOB NO. 87422	HOLE NO. DMT 6

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

DATUM

SURFACE ELEVATION 223.61

1
2
3
4
5
6
7
8
9
10
11
12

WATER

ALLUVIAL SOILS

Drill rod pushed from 10.0 to 10.6 m. Refusal on glacial till or boulder at 10.6 m.

PLATE A-52

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: KILDONAN CORRIDOR

LOGGED/DWN	CKD	DATE OF INVEST. 30/09/87	JOB NO. 87422	HOLE NO. DMT 7

WATER CONTENT — W_p - □ W - ⊙ W_L - △ PERCENT % (10 20 30 40 50 60)

DEPTH m | SOIL SYMBOL | SOIL DESCRIPTION | SOIL SAMPLE: CONDITION, TYPE, PENETRATION RESISTANCE | DRILL TYPE | OTHER TESTS

DATUM

SURFACE ELEVATION

WATER

1 2 3 4 5 6 7 8 9 10

11 12 13

GLACIAL TILL - soft/loose
- Drill rods pushed with no rotation from 10.4 to 13.1 m. Refusal on probable bedrock at 13.1 m.

Drive Shoe

PLATE A-53

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. TH12-02

SHEET 1 of 3

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT
PROJECT	Chief Peguis Bridge Sewer Replacement
SITE	East of Red River and South of Chief Peguis Trail
LOCATION	South of Existing Sewermain on the Upper Bank
DRILLING METHOD	Acker Track Drill Rig, 125 mm ø Solid Stem and HQ Core Barrel

JOB NO. 12-0107-018
GROUND ELEV. 228.37
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 11/8/2012
UTM (m) N 5,534,757
E 636,604

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ / PL MC LL %
	0			SILTY CLAY FILL - Brown, moist, stiff, intermediate to high plasticity some medium to coarse grained sand, some f ne grained gravel trace coarse grained gravel, trace rootlets.			S1			
	1			SILTY CLAY - Brown, moist, stiff, high plasticity, trace fine to medium grained sand.						
		5		- Increased sand content below 1.83 m.						
	2			SAND - Brown, moist; compact, fine to medium grained, trace coarse grained sand, trace silt, trace clay.			S2			
	3	10		SILTY SAND - Brown, moist, loose, fine to medium grained, with silt, trace clay.			S3			
	4			SAND - Brown, moist, compact, fine to medium grained, trace silt.						
		15		- Water noticed on sample at ~ 5.49 m.			S4			
	5			SANDY SILT - Brown, moist, firm, intermediate to high plasticity, trace oxidation						
	6	20		SILTY SAND - Brown, moist, soft, fine to medium grained, trace oxidation.			S5			
				- Grey, no oxidation below 6.71 m.						
	7			SAND - Grey, moist, compact, medium grained, some fine and coarse grained sand.						
		25		SILTY CLAY - Grey, moist, firm, high plasticity. - Medium grained sand layer between 7.39 and 7.47 m.						
	8			SILTY SAND - Grey, moist, soft, fine to medium grained sand, with silt			S6			
				- Organic layer between 8.53 and 8.64 m.						
	9	30		SILTY CLAY - Grey, moist, firm, high plasticity, trace fine grained sand.						
				- Increased sand between 9.75 and 9.96 m.			S7			

SAMPLE TYPE ▨ Auger Grab ☒ Split Spoon ▮ Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL-SOIL LOG P:\PROJECTS\2012\12-0107-018\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-02**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
	11	35		- Increased sand between 10.36 and 10.52 m.							
				SILTY SAND - Grey, moist, compact, medium grained, trace fine grained sand, trace clay.							
				- Test hole squeezing at 10.67 m.			S8				
	12	40									
				- 25 mm thick organic layer at 12.50 m.							
	13			- Decreased sand between 12.95 and 13.26 m.							
		45					S9				
	14			**SILTY CLAY** - Grey, moist, firm, high plasticity, trace coarse grained sand, trace fine grained gravel, trace silt nodules.							
				- Grain Size Distribution: Gravel (1.0%), Sand (8.8%), Silt (21.9%), Clay (57.0%) at 14.63 m.			S10				
	15	50									
	16			**SILT TILL** - Tan, moist, compact, with medium to coarse grained sand, some fine grained gravel, trace coarse grained gravel.			S11				
				- Loose, decreased gravel below 16.48 m.							
		55					S12		100	▲ 2 ▲ 4 ▲ 4	
	17										
	18						S13				
		60		- Auger refusal at 18.34 m on bedrock. Switched over to core below 18.34 m.							
				LIMESTONE BEDROCK - White, competent, vertical and horizontal fractures.							
	19						R1		98		
	20	65									
							R2		98		
	21	70									

SAMPLE TYPE ▨ Auger Grab ☒ Split Spoon ▮ Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-02**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
	22					22.2	R3		98		
	23	75		- Increased fractures below 22.94 m. - Vertical fracture between 23.01 and 23.67 m.			R4		100		
	24	80									
	25						R5		100		
	26	85				25.8 26.1					
				END OF TEST HOLE AT 26.06 m							
	27	90		Notes: 1. Installed casagrande standpipe at a depth of 26.06 m with a stick-up of 0.64 m. 2. Backfilled test hole with silica sand between 26.06 and 22.17 m and bentonite chips from 22.17 m to grade.							
	28										
	29	95									
	30	100									
	31										
	32	105									
	33	110									

SAMPLE TYPE ⊠ Auger Grab ☒ Split Spoon ▮ Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL-SOIL LOG P:\PROJECTS\2012\12-0107-01\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-01**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

PROJECT Chief Peguis Bridge Sewer Replacement

SITE East of Red River and South of Chief Peguis Trail

LOCATION North of Existing Sewermain on the Lower Bank

DRILLING METHOD Acker Track Drill Rig, 125 mm ø Solid Stem and HQ Core Barrel

JOB NO. 12-0107-018

GROUND ELEV. 226.37

TOP OF PVC ELEV.

WATER ELEV.

DATE DRILLED 11/7/2012

UTM (m) N 5,534,788 E 636,543

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
	1	5		SILTY CLAY - Brown, damp, firm, intermediate plasticity, trace rootlets, trace fine grained sand, trace fine grained gravel.		S1			
	2	10		SAND & GRAVEL - Light grey, moist, dense, medium to coarse grained sand, fine to coarse grained gravel, some clay. - Hole squeezing at 1.83 m.		S2			
	3								
	4	15		SAND - Brown, moist to wet, loose, fine to medium grained, trace oxidation. - Water noticed on sample below 4.57 m.		S3			
	5			- Grey, no oxidation below 5.33 m.		S4			
	6	20		SILTY CLAY - Grey, moist, firm, high plasticity.		S5			
	7	25		SAND - Grey, moist, loose, medium grained, trace coarse grained sand.					
	8			- Some to with silt, reduced sand below 7.92 m.		S6			
	9	30		SILTY CLAY - Grey, moist, firm, high plasticity, trace silt nodules, trace medium grained sand, trace fine grained gravel.					

SAMPLE TYPE Auger Grab ▮ Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL-SOIL LOG P:\PROJECTS\2012\12-0107-01\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-01**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %
				- Stiff below 10.06 m.	S	S7	
	11	35		- Reduced fine grained gravel below 10.67 m.			
				- Grain Size Distribution: Gravel (1.2%), Sand (11.7%), Silt (30.5%), Clay (56.6%) at 11.58 m.	S	S8	
	12	40		- Reduced silt nodules below 12.50 m.			
	13	45		- Firm below 12.95 m. - Grain Size Distribution: Gravel (0.8%), Sand (10.2%), Silt (23.7%), Clay (65.3%) at 13.11 m.	S	S9	
	14			**SILTY TILL** - Tan, moist, compact, with medium to coarse grained sand, some fine grained gravel, trace coarse grained gravel.			
	15	50		- Loose, reduced coarse grained sand, reduced fine to coarse grained gravel below 14.63 m.	S	S10	
	16				S	S11	
		55		- Auger refusal at 18.76 m on bedrock. Switched over to core below 16.76 m.			
	17			**LIMESTONE BEDROCK** - White, fractured with vertical and horizontal fractures.	R	R1	85
	18	60			R	R2	98
	19				R	R3	100
		65		- Clay seam at 19.69 m.			
	20			- Clay between 20.12 and 20.19 m.			
	21	70			R	R4	100
				- Yellow fractured limestone between 21.41 and 22.25 m.			

SPT (N) blows/0.15 m ▲
DYNAMIC CONE (N) blows/ft △
20 40 60

Cu POCKET PEN (kPa) ★
Cu TORVANE (kPa) ◆
20 40 60 80
PL MC LL
%
20 40 60 80

SAMPLE TYPE: Auger Grab | Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL - SOIL LOG P:\PROJECTS\2012\12-0107-018\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-01**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ✱ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
	22			- Reduced fractures below 22.25 m.		R5	100		
	23	75							
	24	80				R6	100		
	25			- Increased fractures below 24.69 m.					
	26	85				R7	100		
				END OF TEST HOLE AT 25.91 m					
	27	90		Notes: 1. Water level measured at 15.70 m below grade after drilling. 2. Backfilled test hole with a thick bentonite grout mixture and bentonite chips.					
	28								
	29	95							
	30	100							
	31								
	32	105							
	33	110							

SAMPLE TYPE [R] Auger Grab [H] Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-02B**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

PROJECT Chief Peguis Bridge Sewer Replacement

SITE East of Red River and South of Chief Peguis Trail

LOCATION ~3 m West of TH12-02

DRILLING METHOD Acker Track Drill Rig, 125 mm ø Solid Stem

JOB NO. 12-0107-018
GROUND ELEV.
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 11/9/2012
UTM (m) N
E

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
	0			**SILTY CLAY FILL** - Brown, moist, stiff, intermediate to high plasticity, some medium to coarse grained sand, some fine grained gravel, trace coarse grained gravel, trace rootlets.							
	1	5		**SILTY CLAY** - Brown, moist, stiff, high plasticity, trace fine to medium grained sand.							
	2			- Increased sand content below 1.83 m.							
				SAND - Brown, moist, compact, fine to medium grained, trace coarse grained sand, trace silt, trace clay.							
	3	10		**SILTY SAND** - Brown, moist, loose, fine to medium grained, with silt, trace clay.							
	4			**SAND** - Brown, moist, compact, fine to medium grained, trace silt.							
		15		- Water noticed on sample at ~ 5.49 m.							
	5			**SANDY SILT** - Brown, moist, firm, intermediate to high plasticity, trace oxidation.							
	6	20		**SILTY SAND** - Brown, moist, soft, fine to medium grained, trace oxidation.							
				- Grey, no oxidation below 6.71 m.							
	7			**SAND** - Grey, moist, compact, medium grained, some fine and coarse grained sand.							
		25		**SILTY CLAY** - Grey, moist, firm, high plasticity.							
				- Medium grained sand layer between 7.39 and 7.47 m.							
	8			**SILTY SAND** - Grey, moist, soft, fine to medium grained sand, with silt.							
				- Organic layer between 8.53 and 8.64 m.							
	9	30		**SILTY CLAY** - Grey, moist, firm, high plasticity, trace fine grained sand.							
				- Increased sand between 9.75 and 9.96 m.							

SAMPLE TYPE

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL SOIL LOG P:\PROJECTS\2012\12-0107-01\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-02B**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL % (20 40 60 80)
	11	35		- Increased sand between 10.36 and 10.52 m.							
				SILTY SAND - Grey, moist, compact, medium grained, trace fine grained sand, trace clay.							
				- Test hole squeezing at 10.67 m.	PN	11.4					
						11.6					
	12	40		- 25 mm thick organic layer at 12.50 m.							
	13			- Decreased sand between 12.95 and 13.26 m.							
		45									
	14			SILTY CLAY - Grey, moist, firm, high plasticity, trace coarse grained sand, trace fine grained gravel, trace silt nodules.							
	15	50									
	16			SILT TILL - Tan, moist, compact, with medium to coarse grained sand, some fine grained gravel, trace coarse grained gravel.							
				- Loose, decreased gravel below 16.46 m.		16.8					
	17	55				17.4					
	18					17.7					
		60		AUGER REFUSAL AT 18.34 m		18.3					
	19			Notes: 1. Stratigraphy assumed from TH12-02 drilled ~3 m away. 2. Installed casagrande standpipe at a depth of 17.68 m with a stick-up of 0.91 m. 3. Installed PN 034983 at a depth of 11.58 m. below grade. 4. Backfilled test hole with silica sand between 17.68 and 16.76 m and bentonite chips from 16.76 m to grade.							
	20	65									
	21	70									

SAMPLE TYPE

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-03**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

PROJECT Chief Peguis Bridge Sewer Replacement

SITE West of Red River and South of Chief Peguis Trail

LOCATION North of Existing Sewermain on the Upper Bank

DRILLING METHOD CME Track Drill Rig, 125 mm ø Solid Stem and HQ Core Barrel

JOB NO. 12-0107-018

GROUND ELEV. 230.84

TOP OF PVC ELEV.

WATER ELEV.

DATE DRILLED 11/13/2012

UTM (m) N 5,534,926 E 636,265

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ / PL MC LL / %
	0			**SILTY CLAY FILL** - Black, moist, stiff, high plasticity, trace rootlets.						20 40 60	20 40 60 80
				- Trace medium to coarse grained sand, trace fine to coarse grained gravel below 0.23 m.							
				SILTY CLAY - Brown, moist, stiff, high plasticity, trace coarse grained sand.							
	1	5		- No sand below 1.22 m.			S1				
	2			**SILTY SAND TO SANDY SILT** - Light brown, moist, soft/loose, fine grained sand.			S2				
	3	10									
				SILTY CLAY - Brown, moist, stiff, high plasticity, trace silt nodules (~1-3 mm diameter).							
	4			- 10 mm diameter gravel piece at 3.73 m.			S3				
		15									
	5			- Grey below 5.49 m.			S4				
	6	20		- Firm below 6.10 m.							
	7						S5				
		25									
	8						S6				
	9	30		- Slightly increased silt nodules (up to 5 mm diameter) below 9.14 m.							

SAMPLE TYPE ⊞ Auger Grab ⊠ Split Spoon ▮ Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL-SOIL LOG P:\PROJECTS\2012\12-0107-01\8\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-03**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION
	11	35		
	12	40		- Trace silt pockets below 12.19 m. - Trace fine grained gravel below 12.50 m.
	13	45		
	14			
	15	50		- Reduced silt, trace coarse grained sand, no fine grained gravel below 15.24 m.
	16			
	17	55		- Occasional silt pockets/nodules below 16.92 m.
	18			- Grain Size Distribution: Gravel (0.7%), Sand (7.5%), Silt (19.4%), Clay (72.4%) at 17.68 m.
		60		- Trace fine grained gravel below 18.29 m.
	19			
		65		SILT TILL - Tan with grey, moist, compact, fine to coarse grained sand, fine grained gravel, trace clay.
	20			
	21	70		- Auger refusal at 21.03 m on bedrock. Switched over to core below 21.03 m. LIMESTONE BEDROCK - White, competent, horizontal fractures.

PIEZ. LOG

DEPTH (m): 21.0

SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆
S7			
S8			
S9			
S10			
S11			
S12			
S13			
S14	61	▲11 ▲11 ▲13	
S15			
R1	88		

SPT (N) blows/0.15 m ▲
DYNAMIC CONE (N) blows/ft △
20 40 60

Cu POCKET PEN (kPa) ★
Cu TORVANE (kPa) ◆
20 40 60 80
PL MC LL
%
20 40 60 80

SAMPLE TYPE: Auger Grab ☒ Split Spoon ▮ Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-03**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ / PL MC LL %
	22	75		• Thin clay seam at 21.77 m. • Vertical fracture between 21.84 and 22.05 m.				R2	100		
	23					23.9		R3	97		
	24	80									
	25							R4	100		
	26	85									
	27							R5	97		
		90				27.6					
	28							R6	100		
	29	95		• Rubble zone between 28.46 and 28.52 m. • Vertical fracture between 28.52 and 28.70 m.							
						29.7		R7	100		
	30					30.0					
		100		**END OF TEST HOLE AT 30.02 m**							
	31			Notes: 1. Installed casagrande standpipe at a depth of 30.02 m with a stick-up of 0.91 m. 2. Backfilled test hole with silica sand between 30.02 and 27.58 m, bentonite chips from 27.58 to 23.93 m, slough from 23.93 to 21.03 m and bentonite chips from 21.03 m to grade.							
	32	105									
	33										
		110									

SAMPLE TYPE: Auger Grab ☒ Split Spoon ▮ Core Barrel

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL SOIL LOG P:\PROJECTS\2012\12-0107-01\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-03B**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT

PROJECT Chief Peguis Bridge Sewer Replacement

SITE West of Red River and South of Chief Peguis Trail

LOCATION ~2 m West of TH12-03

DRILLING METHOD CME Track Drill Rig, 125 mm ø Solid Stem

JOB NO. 12-0107-018
GROUND ELEV.
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 11/14/2012
UTM (m) N
E

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION
	0			**SILTY CLAY FILL** - Black, moist, stiff, high plasticity, trace rootlets.
				- Trace medium to coarse grained sand, trace fine to coarse grained gravel below 0.23 m.
	1	5		**SILTY CLAY** - Brown, moist, stiff, high plasticity, trace coarse grained sand.
				- No sand below 1.22 m.
	2			**SILTY SAND TO SANDY SILT** - Light brown, moist, soft/loose, fine grained sand.
	3	10		**SILTY CLAY** - Brown, moist, stiff, high plasticity, trace silt nodules (~1-3 mm diameter).
				- 10 mm diameter gravel piece at 3.73 m.
	4	15		
	5			- Grey below 5.49 m.
	6	20		- Firm below 6.10 m.
	7	25		
	8			
	9	30		- Slightly increased silt nodules (up to 5 mm diameter) below 9.14 m.

PIEZ. LOG | DEPTH (m) | SAMPLE TYPE | NUMBER | RECOVERY %

SPT (N) blows/0.15 m ▲
DYNAMIC CONE (N) blows/ft △
20 40 60

Cu POCKET PEN (kPa) ★
Cu TORVANE (kPa) ◆
20 40 60 80
PL MC LL
%
20 40 60 80

SAMPLE TYPE

CONTRACTOR Paddock Drilling Ltd.
INSPECTOR C. FRIESEN
APPROVED DRAFT
DATE 11/26/12

GEOTECHNICAL-SOIL LOG P:\PROJECTS\2012\12-0107-018\DESIGN\GEOLOGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

HOLE NO. **TH12-03B**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ / PL MC LL %
	11	35			PN	11.6				20 40 60	20 40 60 80
	12	40		- Trace silt pockets below 12.19 m.		11.8					
				- Trace fine grained gravel below 12.50 m.							
	13	45									
	14										
	15	50		- Reduced silt, trace coarse grained sand, no fine grained gravel below 15.24 m.							
	16										
	17	55		- Ocassional silt pockets/nodules below 16.92 m.							
	18	60		- Trace fine grained gravel below 18.29 m.							
	19										
				SILT TILL - Tan with grey, moist, compact, fine to coarse grained sand, fine grained gravel, trace clay.							
	20	65				20.1					
						20.7					
	21					21.0					
		70		AUGER REFUSAL AT 20.98 m							
				Notes: 1. Stratigraphy assumed from TH12-03 drilled ~2 m away.							

SAMPLE TYPE

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

GEOTECHNICAL-SOIL LOG P:\PROJECTS\2012\12-0107-01\6\DESIGN\GEOL\CGS\CHIEF PEGUIS TRAIL SEWERMAIN.GPJ

KGS GROUP

SUMMARY LOG

REFERENCE NO.

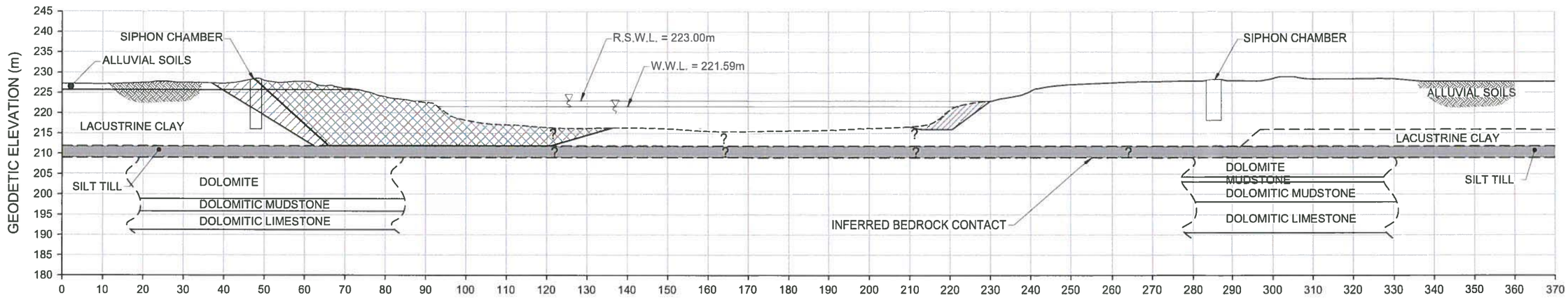
HOLE NO. **TH12-03B**

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ / PL MC LL %
	22	75		2. Installed casagrande standpipe at a depth of 20.98 m with a stick-up of 0.66 m. 3. Installed PN 034985 at a depth of 11.64 m. below grade. 4. Backfilled test hole with silica sand between 20.98 and 20.12 m and bentonite chips from 20.12 m to grade. 5. Test hole squeezing at 8.53 m shortly after drilling.						20 40 60 (SPT/DCP) · 20 40 60 80 (Cu) · 20 40 60 80 (%)
	23										
	24	80									
	25										
	26	85									
	27										
	28	90									
	29	95									
	30										
	31	100									
	32	105									
	33	110									

SAMPLE TYPE

CONTRACTOR	INSPECTOR	APPROVED	DATE
Paddock Drilling Ltd.	C. FRIESEN	DRAFT	11/26/12

CROSS-SECTION A



NOTES :

1. RIVER BOTTOM PROFILE ASSUMED FROM 1970 C.O.W. DRAWING 494.
2. RIVER BOTTOM SOIL STRATIGRAPHY WITHIN RIVER CHANNEL IS UNKNOWN.
3. SOIL AND BEDROCK STRATIGRAPHY BASED ON EXISTING INFORMATION FROM PREVIOUS ENGINEERING REPORTS.

LEGEND :

ZONE OF FACTOR OF SAFETY BETWEEN 1.3 AND 1.5

ZONE OF FACTOR OF SAFETY < 1.3

0 10 20 30 40m
SCALE : 1:1000 (279mm x 432mm)

Drawing 02
Inferred Soil and Bedrock Stratigraphy

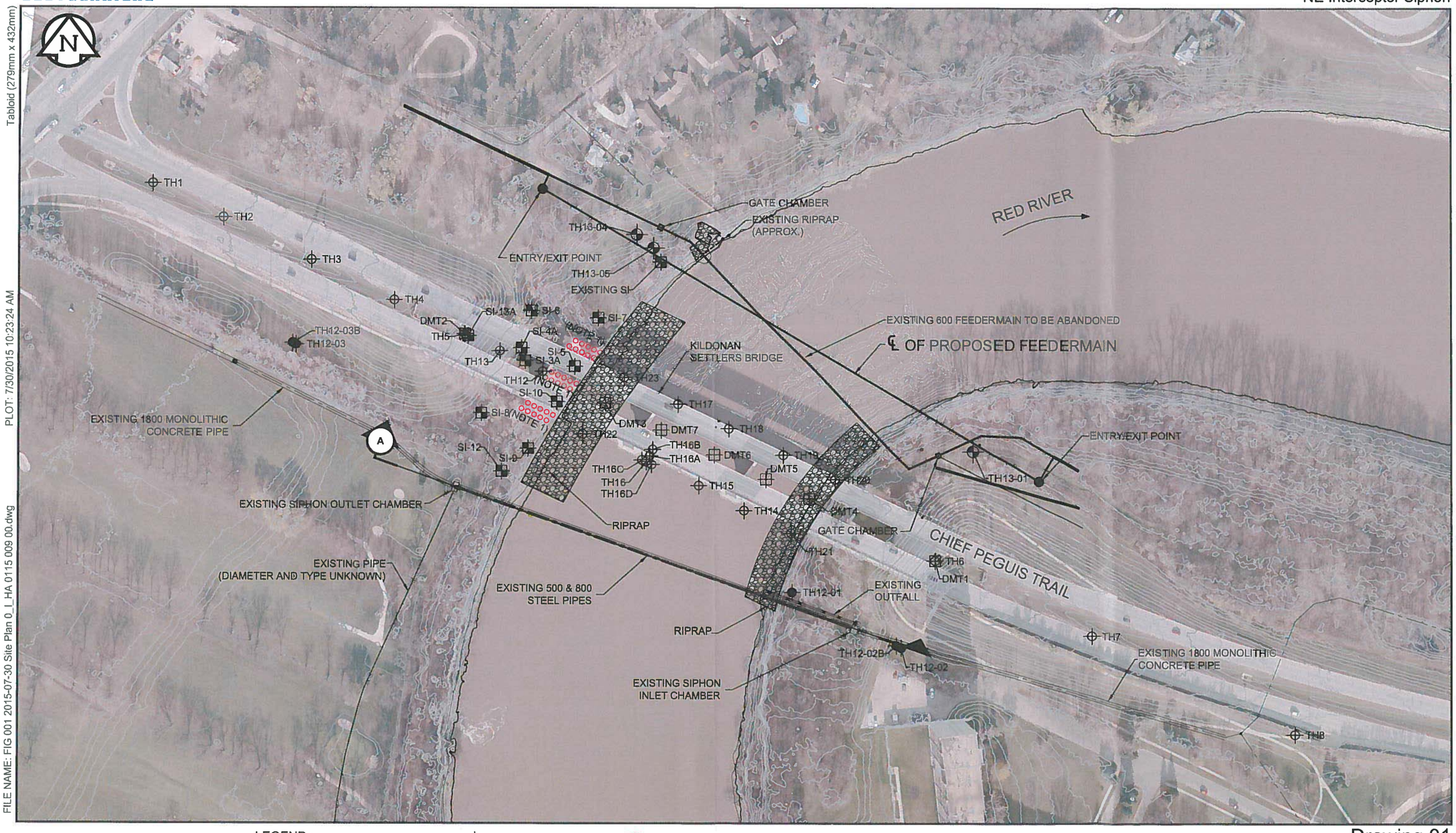
TREK GEOTECHNICAL

0115 009 00
Associated Engineering
NE Interceptor Siphon

Tabloid (279mm x 432mm)

PLOT: 7/30/2015 10:23:24 AM

FILE NAME: FIG 001 2015-07-30 Site Plan 0_I_HA 0115 009 00.dwg



0 20 40 60 80m
SCALE : 1:2000 (279mm x 432mm)

LEGEND :

- TEST HOLE (TREK, 2013)
- TEST HOLE (DYREGROV, 1988)
- TEST HOLE (KGS, 2012)
- SLOPE INDICATORS
- DILATOMETER TESTING (DYREGROV, 1998)
- ROCK COLUMNS

NOTES :

1. ROCK COLUMNS SHOWN ARE NOT TO SCALE
2. 2008 AERIAL IMAGE IN PROVIDED BY CITY OF WINNIPEG
3. SURVEY INFORMATION PROVIDED BY BARNES AND DUNCAN LAND SURVEYERS AND CITY OF WINNIPEG.

Drawing 01
Test Hole Location Plan

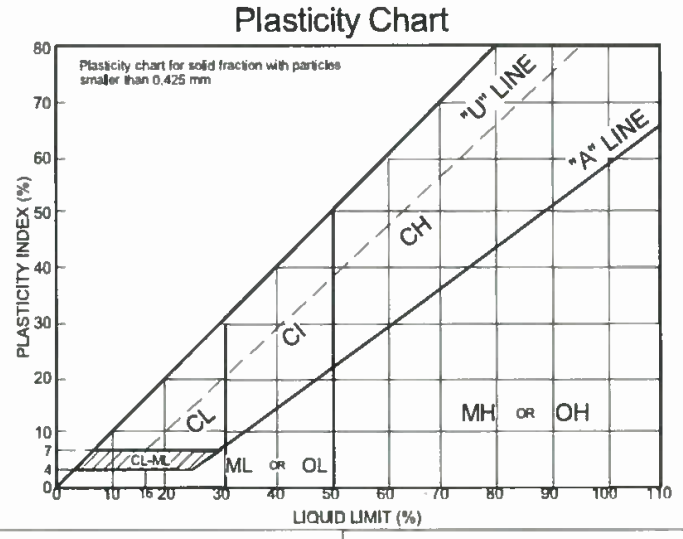
EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
2. Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
3. When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions			USCS Classi-fication	Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline case4s requiring dual symbols*	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GC		Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP		Poorly-graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7	
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and Clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly Organic Soils		Pt		Peat and other highly organic soils	Von Post Classification Limit	Strong colour or odour, and often fibrous texture	

Plasticity Chart



Particle Size	
Material	mm
Sand	2.00 to 4.75
Coarse	0.425 to 2.00
Medium	0.075 to 0.425
Fine	< 0.075
Silt or Clay	

Particle Size	
Material	ASTM Sieve Sizes
Boulders	> 12 in.
Cobbles	3 in. to 12 in.
Gravel	
Coarse	3/4 in. to 3 in.
Fine	#4 to 3/4 in.

ASTM Sieve sizes
#10 to #4
#40 to #10
#200 to #40
< #200

* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

TREK GEOTECHNICAL

EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

Descriptive Terms	SPT (N) (Blows/300 mm)
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

Descriptive Terms	SPT (N) (Blows/300 mm)
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

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

Descriptive Terms	Undrained Shear Strength (kPa)
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200

Sub-Surface Log

Test Hole TH13-01

Client:	Associated Engineering	**Project Number:**	0115 004 00
Project Name:	Detailed Design North Kildonan Feedermain	**Location:**	UTM N-5534866.43, E-636644.43
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	227.36 m
Method:	Acker SS3 Track Mount (see notes for drilling method)	**Date Drilled:**	7 November 2013

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Backfill Legend: Bentonite | Cement | Drill Cuttings | Filter Pack Sand | Grout | Slough

Elevation (m)	Depth (m)	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
225.8	0	CLAY (FILL) - silty, trace gravel (<25mm), trace organics, trace silt inclusions (<20mm) - brown - moist, frozen to 1.1m, stiff when thawed - high plasticity	G	G29		
	1		G	G30		
			G	G31		
	2	CLAY (ALLUVIAL) - silty, some fine to medium grained sand, trace organics (roots) - brown - moist, stiff - intermediate plasticity	G	G32		
224.6						
	3	SILT (ALLUVIAL) - trace clay to clayey, trace fine and medium grained sand, trace organics (roots) - brown - moist, very soft - low to intermediate plasticity	G	G33		
			T	T34		
	4		G	G35		
	5	- sandy and wet below 5.0 m	SB	SB36A		
			SB	SB36B		
	6		SB	SB36C		
			SB	SB37A		
		- soft below 6.6 m	SB	SB37B		
	7		SB	SB37C		
	8		SB	SB38A		
219.0		SAND (ALLUVIAL) - silty, trace to some clay to 10.7m - brown - wet, loose - no plasticity - poorly graded, fine and medium grained sand	SB	SB38B		
	9					
	10		SB	SB39		
		- no clay, some silt below 10.7 m				
	11		SB	SB40		

Bulk Unit Wt (kN/m^3): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 20 40 60 80 100

Test Type: △ Torvane △ | ✿ Pocket Pen. ✿ | ☒ Qu ☒ | ○ Field Vane ○

Logged By: Stephen Renner **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH13-01

Elevation (m)	Depth (m)	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
215.2						
214.6	13	CLAY (ALLUVIAL) - silty, some fine to medium grained sand, trace organics (roots) - brown - moist, stiff - intermediate plasticity		T41		
				SB42A		
	14	SAND (TILL) - trace silt, trace clay - brown - wet, loose - no to low plasticity - poorly graded, fine and medium grained sand		SB42B		
	15	- dense below 14.6 m		SB43		
				SS44		29
	16	- trace till inclusions (<20mm) below 15.7 m		SS45B		
				SS45A		50
	17	- boulder at 16.7 m		CB56		
209.2	18	DOLOMITE (BEDROCK) - beige, vertical and horizontal, rough undulating fractures, slightly altered, clay infilling				
	19			CB57	75	
	20					
	21	- 0.1 m clay (rock flour) seams between 20.7 m and 20.8 m		CB58	30	
	22	- 0.2 m clay (rock flour) seams between 21.6 and 21.8 m - yellowish fractured limestone between 21.8 to 24.3 m		CB59	0	
204.2	23	MUDSTONE (BEDROCK) - beige to brown, layered to varved, highly fractured with clay infill.		CB60	17	
203.0	24	DOLOMITIC MUDSTONE (BEDROCK) - mottled light brown to grey, minor rough undulating sub vertical fractures.		CB61	91	
	25					
	26					

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○

0 20 40 60 80 100

49100 ☒

Logged By: Stephen Renner **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH13-01

Elevation (m)	Depth (m)	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
	27	- chalk nodules at 26.8 m		CB62	96	
	28			CB63	62	
198.1	29	DOLOMITIC LIMESTONE (BEDROCK) - beige to grey mottled, some chert nodules (grey) in a dolomitic limestone matrix (beige), vuggy.		CB64	73	
	30					
	31			CB65	35	
	32					
	33			CB66	31	
	34	- 0.3 m thick highly fractured layer at 33.5 m		CB67	74	
	35	- fractures decreasing below 34.7 m				
	36			CB68	94	
190.5		END OF TEST HOLE At 36.9 m in DOLOMITIC LIMESTONE (BEDROCK)				

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✪ Pocket Pen. ✪ ☒ Qu ☒ ○ Field Vane ○

0 20 40 60 80 100

31200 ☒

21800 ☒

33100 ☒

Notes:
1) Power auger refusal at 16.9 m depth.
2) Seepage observed below 5.3 m
3) Water level at 1.5 m depth immediately after dilling prior to coring.
4) Test hole drilled using solid stem auger up to 4.6 m then switched to hollow stem auger. At power auger refusal, switched to HQ coring.

Logged By: Stephen Renner **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH13-04

Client:	Associated Engineering	**Project Number:**	0115 004 00
Project Name:	Detailed Design North Kildonan Feedermain	**Location:**	UTM N-5534987.21, E-636455.82
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	227.19 m
Method:	Acker SS3 Track Mount (see notes for drilling method)	**Date Drilled:**	6 November 2013

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Backfill Legend: Bentonite | Cement | Drill Cuttings | Filter Pack Sand | Grout | Slough

Elevation (m)	Depth (m)	MATERIAL DESCRIPTION	Sample Type	Sample Number
225.7	0	CLAY (ALLUVIAL) - silty, some gravel, trace fine sand, trace to some organics (roots and rootlets) - dark brown - moist, very stiff - high plasticity	G	G46
	1		G	G47
	1.5	CLAY (LACUSTRINE) - silty to 2.4m, some gravel, trace fine sand, trace organics (roots and rootlets), trace oxidation - dark brown, moist, soft to firm, high plasticity	G	G48
	2		SB	SB01
	2.4	- grey below 2.4 m	SB	SB02
	2.7	- trace silt inclusions (<15mm) and soft below 2.7 m	G	G49
	3		T	T03
	3.7	- firm to stiff, trace to some oxidation below 3.7 m	SB	SB04
	4		SB	SB05
	5		SB	SB06
	5.8	- trace coarse sand below 5.8 m	SB	SB07
	6		T	T08
	7		SB	SB09
	7.3	- trace gravel (<25mm) below 7.3 m	SB	SB10
	7.9	- trace to some silt inclusions (<15mm) below 7.9 m	SB	SB11
	8		SB	SB12
	9		T	T13
	10		SB	SB14
	10.4	- trace till inclusions (<75mm) below 10.4 m	SB	SB15
	11		SB	SB16
			SB	SB17

RQD (%)	SPT (N)	Bulk Unit Wt (kN/m^3) 16 17 18 19 20 21	Particle Size (%) 0 20 40 60 80 100	PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) 0 20 40 60 80 100
					Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

Logged By: Stephen Renner | Reviewed By: Nelson Ferreira | Project Engineer: Nelson Ferreira

SUB-SURFACE LOG 0115 004 00 DETAILED DESIGN NORTH KILDONAN FEEDERMAIN - LOGS.GPJ TREK GEOTECHNICAL.GDT 15/1/14

TREK GEOTECHNICAL

Sub-Surface Log

Test Hole TH13-04

2 of 2

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
	13					SB18		
						SB19		
	14			- trace to some till inclusions below 14.0 m		SB20		
						SB21		
212.2	15			SILT (TILL) - trace clay, trace gravel (<25mm), trace sand - light brown, moist, loose, low plasticity		SB22		
211.8						SS23		
211.3				CLAY - silty, trace gravel - grey, moist, soft to firm, high plasticity				
	16			SILT (TILL) - trace clay, trace gravel (<25mm), trace sand (poorly graded) - light brown, moist, loose, low plasticity - dense below 16.4 m		SB24		
						SB25		
210.1	17			DOLOMITE (BEDROCK) - beige, vertical and horizontal, rough undulating fractures, slightly altered, clay infilling		CB26	86	
	18							
	19					CB27	100	
	20							
						CB28	100	
205.5	21							

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

0 20 40 60 80 100

END OF TEST HOLE at 21.6 m in DOLOMITE (BEDROCK)

Notes:

1) Power auger refusal at 16.7 m.
2) No seepage or sloughing observed.
3) Water level at 4.2 m depth immediately after drilling prior to coring.
4) Test hole drilled using solid stem augers to 16.7 m then drill method switched to HQ coring.

Logged By: Stephen Renner **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG 0115 004 00 DETAILED DESIGN NORTH KILDONAN FEEDERMAIN - LOGS.GPJ TREK GEOTECHNICAL.GDT 15/1/14

TREK GEOTECHNICAL

Sub-Surface Log

Test Hole TH13-05

Client:	Associated Engineering	**Project Number:**	0115 004 00
Project Name:	Detailed Design North Kildonan Feedermain	**Location:**	UTM N-5534979.78, E-636465.14
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	226.26 m
Method:	CME-850 Track Mount (see notes for drilling method)	**Date Drilled:**	15 November 2013

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Backfill Legend: Bentonite | Cement | Drill Cuttings | Filter Pack Sand | Grout | Slough

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)	Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✣ Pocket Pen. ✣ ☒ Qu ☒ ○ Field Vane ○ 0 20 40 60 80 100
	0			- overburden soils not logged - drilling advanced to power auger refusal then drilling method switched to HQ coring						
	1									
	2									
	3									
	4									
	5									
	6									
	7									
	8									
	9									
	10									
	11									

Logged By: Martial Lemoine **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG 0115 004 00 DETAILED DESIGN NORTH KILDONAN FEEDERMAIN - LOGS.GPJ TREK GEOTECHNICAL.GDT 15/1/14

Sub-Surface Log

Test Hole TH13-05

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
210.1	16							
210.0				SILT (TILL) - trace clay, trace sand, trace gravel - light grey, moist, loose, no to low plasticity	SS	SS69		
				DOLOMITE (BEDROCK) - beige, vertical and horizontal, rough undulating fractures, slightly altered, clay infilling	CB	CB70	0	
208.7	17				CB	CB71	38	
				DOLOMITE (BEDROCK) - beige to light grey layering, massive, minor vugs, minor vertical and horizontal tight fractures	CB	CB72	73	
	20				CB	CB73	95	
	22				CB	CB74	83	
	23			- visible hairline fractures between 22.9 m to 24.4 m	CB	CB75	98	
201.9	24							
				DOLOMITE (BEDROCK) - beige layers with light brown mottled and cream coloured layers, massive, minor vertical and horizontal tight fractures	CB	CB76	92	
	26				CB	CB77	75	

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type
△ Torvane △
✤ Pocket Pen. ✤
☒ Qu ☒
○ Field Vane ○

0 20 40 60 80 100

39500

39500

Logged By: Martial Lemoine **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira

TREK GEOTECHNICAL

Sub-Surface Log

Test Hole TH13-05

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)	Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○ 0 20 40 60 80 100
198.8	27									
	28			DOLOMITIC MUDSTONE (BEDROCK) - mottled light brown to grey, light brown mottles are soft calcareous mudstone, grey mottles are hard dolomite, trace chert nodules, vuggy, rough undulating sub vertical fractures 0.1 m thick clay (rock flour) seam at 28.7 m		CB78	69			
	29					CB79	92			11900 ☒
195.8	30			DOLOMITIC LIMESTONE (BEDROCK) - beige to grey mottled, some chert nodules (grey) in a dolomitic limestone matrix (beige), vuggy, minor, very rough, angular, subhorizonal fracturing.		CB80	100			
	31					CB81	100			
	32									
	33					CB82	99			
	34									
191.2	35					CB83	85			

END OF TEST HOLE At 35.1 m in DOLOMITIC LIMESTONE (BEDROCK)

Notes:
1) Power auger refusal at 16.2 m.
2) No seepage or sloughing observed.
3) Water level at 3.7 m depth immediately after dilling prior to coring.
4) Test hole drilled using solid stem augers to 16.2 m then drilling method switched to HQ coring.

Logged By: Martial Lemoine **Reviewed By:** Nelson Ferreira **Project Engineer:** Nelson Ferreira