APPENDIX A

GEOTECHNICAL INVESTIGATION REPORTS

DYREGROV CONSULTANTS
CONSULTING GEOTECHNICAL ENGINEERS

GEOTECHNICAL REPORT

SOUTH END WATER POLLUTION CONTROL CENTRE

PROPOSED EXPANSION

Prepared for

STANTEC CONSULTING LIMITED

on behalf of

THE CITY OF WINNIPEG

February 2008 **Project No. 272939**

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1.0 INTRODUCTION

This report summarizes the results of a geotechnical investigation undertaken by Dyregrov Consultants for the proposed expansion of the South End Water Pollution Control Centre. The area and extent of the proposed expansion is illustrated on Figure 1. The work was done at the request of Stantec Consulting Ltd. on behalf of the City of Winnipeg and was authorized by letter of July 19, 2007 under the signature of Mr. Cameron Dyck., P.Eng. Manager, Environmental Infrastructure.

2.0 PROPOSED EXPANSION

The long term expansion of the South End Water Pollution Control Centre is illustrated on Figure 1. It involves large concrete structures including Fermenters, Primary Clarifiers, Bioreactors, Secondary Clarifiers, Support Facilities and several lessor facilities. Also included is a parallel outfall discharge line to the Red River. Details of these facilities are provided in Section 8.1 of the Discussion and Recommendations Section 8.0. It is understood that not all of these facilities are planned to be constructed in the short term.

3.0 SITE DESCRIPTION

The site of the proposed expansion is south of the existing South End Water Pollution Centre (SEWPCC) with lesser works on the east side. The major portion of the site is flat lying with remnants of a snow dump area covering the easterly half of the site. Immediately to the west of the snow dump area is a spoil bank from excavations from the previous construction and is visually estimated to be about 4 to 5 metres in height. An area of dense bush and trees covers the westerly portion of the proposed development area. A number of drainage ditches are in the general area.

4.0 BACKGROUND

The original SEWPCC was constructed in the early 1970's. A major expansion was undertaken circa 1990 and a Disinfection Facility constructed in 1998.

Geotechnical studies were undertaken for the foregoing projects. The test holes and laboratory studies which were undertaken in these studies are included in the attached Appendix A. The reports which were referenced include the following:

* Ripley, Klohn & Leonoff International Ltd.
  Report on Subsoil Investigation
  Proposed South End Pollution Control Centre
  Winnipeg, Manitoba
  W - 580, March 8, 1971

* Ripley, Klohn & Leonoff International Ltd.
  Report on Installation of Test Caissons
  at South End Pollution Control Centre
  Winnipeg, Manitoba
  W - 619, March 24, 1971

* Ripley, Klohn & Leonoff International Ltd.
  Test Holes Drilled at Outfall Stage
  Associated with South End Pollution Control Centre
  Winnipeg, Manitoba
  W - 623, April 14, 1971

* Dyregrov and Burgess
  Geotechnical Engineering Report
  South End Water Pollution Control Centre
  88528, April 15, 1988

* Dyregrov Consultants
  Geotechnical Report
  Proposed Disinfection Building
  South End Water Pollution Control Centre
  City of Winnipeg
  981754, February 1998

5.0 FIELD INVESTIGATION

Between September 12 and 19, 2007, eighteen test holes were drilled in an area which covered the future plant expansion. The locations of the test holes are illustrated on Figure 1.

The test holes were advanced using truck-mounted drilling equipment which is owned and operated by Subterranean (Manitoba) Ltd. The test holes were either 450 mm or 125 mm in diameter. The deep test holes were carried to auger refusal in the glacial till which underlies the site. Shallow test holes were drilled to approximately 3 metres. Standpipe piezometers were installed in the 125 mm test holes which were carried to auger refusal. The soil profile was examined and classified on a continuous basis as the drilling progressed and sampled on a frequent basis. Disturbed samples were recovered from the auger cuttings and undisturbed samples were obtained in 75 mm Shelby tube samplers for laboratory testing.

Observations were made during the drilling with respect to groundwater, seepage and caving conditions encountered in the test holes. The sealed standpipe piezometers were installed in Test Holes 2007-02, 2007-08, 2007-09, 2007-11, 2007-15 and 2007-16A.

All of the test holes in which the piezometers were not installed were backfilled with excavated materials on completion.

The locations of the test holes were determined by Stantec Consulting Ltd. as well as the ground elevations at the test holes.

Test Holes 2007-12, 2007-13, 2007-14, 2007-20 and 2007-24 were not drilled for reasons of site access problems. Test Holes 2007-16 and 2007-18 could not be drilled at their respective locations due to access and were replaced by Test Hole 2007-16A.

6.0 THE SOIL PROFILE

Based on this investigation, the following describes the general soil profile at the site of the currently proposed development. The data from this investigation is generally consistent with the data from previous investigations.

A thick deposit of highly plastic Lake Agassiz lacustrine silty clay is the predominant component of the soil profile which extends from the ground surface to depths varying from 12.5 to 16.0 metres. The average thickness is approximately 14.3 metres. The clay is common to the Winnipeg area and can be described as firm to stiff in relative consistency. Moisture contents are typically within the 40 to 60 percent range and are relatively uniform with depth. Moisture depletion appears to be restricted to about the upper 3 metres of the soil profile. Plastic and Liquid Limits for the clays are in the order of 30 and 100 percent, respectively, and the Liquidity Indices at this location are estimated to be in the range of 0.3 to 0.4. It should be noted that specific tests were not performed for the determination of these index properties from samples recovered in this recent investigation.

Undrained shear strengths were determined from unconfined compression tests, pocket penetrometer and Torvane tests in the laboratory. A plot of the undrained shear strength profile versus depth is provided as Figure 20. The lower strengths from the unconfined compression tests within the upper 3.6 metres of the profile are probably related to secondary defects (fissuring) that has accompanied moisture depletion within these depths. There is a trend in decreasing strengths with depth.

Covering the site are variable thicknesses of fill, remnant debris from the snow dumps and topsoil. The thickness of these materials, which generally consists of silt, sand and gravel, were as

thick as 1.22 metres. This is exclusive of the stockpile of excavated materials from the earlier developments. Also, the area of trees and brush will contain organic topsoil and roots.

Near the upper part of the clay profile, in 8 of the 18 test holes, was a silt layer of variable thicknesses up to 1.22 metres and depths between 0.3 and 1.98 metres. It was tan in color, moist to wet and loose to firm in consistency.

The silty clays are underlain by a glacial silt till deposit. The glacial till is known to be a heterogeneous mixture of sand, gravel, cobble and boulder size materials within a predominately silt matrix. The relative density of the glacial till has been evaluated on the basis of its moisture content and visual examination of the auger cuttings. The elevation of the surface of the glacial till varies from about 214.62 to 220.33 metres. The average elevation is 218.72 metres. The glacial till is typically loose or soft near its surface and becomes more dense with depth, however, caving conditions were encountered within the glacial till deposit which prevented recovery of suitable samples for evaluation. The test holes were advanced by screwing the auger until it met refusal on very dense glacial till or boulders in the till. The action of the drill rig did not suggest the presence of the bedrock, but it could be present. The materials through which the augers were drilled are believed to be layered deposits of fine sand and glacial deposits. Some fine sands were actually recovered. Auger refusal was reached between elevations 208.45 and 213.98 metres.

A detailed description of the soil profile and the results of the field and laboratory testing are summarized on the test hole logs, Figures 2 to 19. The logs from previous studies are included in the Appendix.

7.0 GROUNDWATER CONDITIONS

The groundwater conditions at the site consist essentially of groundwater perched within the relatively pervious silt strata that are within the upper part of the soil profile and a subartesion condition within the underlying glacial till and bedrock.

Groundwater conditions in the upper silt deposits are likely to vary over short distances, since they are not contiguous across the site. Seasonal precipitation will influence the groundwater conditions in the silt.

Piezometric pressures within the glacial till deposit originate in the underlying limestone bedrock, which is the carbonate aquifer that is common to Winnipeg, and these are the most relevant to the construction of relatively deep or large excavations. The standpipe piezometers were installed in Test Holes 2007-02, 2007-08, 2007-09, 2007-11, 2007-12, 2007-15 and 2007-16A with their tips sealed into the glacial till. These were installed to determine the elevation of the piezometric surface within the glacial till deposit. The following table shows the groundwater levels which were taken at the time of installation and 8 days later. The piezometric elevations about one week after installation were between 223.79 and 224.41 metres.

Groundwater Elevations (m)			
Piezometer	September 18, 2007	September 19, 2007	September 26, 2007
2007-2	-	223.18	224.33
2007-8	-	224.38	224.15
2007-9	-	223.83	224.41
2007-11	222.99	223.90	224.13
2007-15	221.66	223.49	223.79
2007-16A	221.55	223.92	224.30

Attached as Figures 21 and 22 are the test hole log and hydrograph from the Provincial Groundwater Monitoring Well G05OC0097 which is located in the basement of the SEWPCC. It is noteworthy from the hydrograph that there has been a trend toward higher groundwater levels since the time of the initial construction in 1970 and since the major expansion about 1990. The annual peaks, which are frequent, are apparently associated with Floodway events. As indicated on the hydrograph, the only time in the last 10 years that the bedrock groundwater pressures have risen above 225.0 metres was during the major Floodway operation events of 1997 and 2006.

8.0 DISCUSSION AND RECOMMENDATIONS

8.1 General

The long term additions which are proposed are illustrated on Figure 1. Some of the additions are expected to be similar to some of those that presently exist. The proposed facilities include:

- Preliminary Treatment Expansion will include grit removal tanks which will be comparable to those that presently exist and will be approximately 6.0 metres deep below finished grade at approximately elevation 228.0 metres. They will always contain fluids except when taken out of service for cleaning.

- Standby Power Building will be on grade and will house one or more generators.

- Primary Clarifiers, one of which will be constructed initially, will have a footprint of 45 by 15.6 metres and 5.0 metres in depth (approx. elev. 228.9 metres with a sludge hopper that extends 3.4 metres deeper (elev. 225.5 metres). The clarifiers will maintain fluid except when taken out of service for cleaning.

- Bioreactors will be constructed adjacent to the existing bioreactor and it is anticipated that the floor of the reactors will be at the same elevation as the existing which is 228.1 metres. The four new bioreactors will be 44.1 by 33.9 metres by 6.7 deep. They will be full of fluid at all times except when taken out of service for cleaning.

- Blower/Electrical/Workshop/Odour Control/Alum/Chlorine Rooms will be adjacent to the Bioreactor tanks. These rooms will be at grade, some of which may contain heavy equipment/storage tanks.

- Secondary Clarifiers, two of which are proposed to be constructed initially, will have diameters of 45.7 and 33.5 metres. The depths of the clarifiers will be about 5.1 metres with a central core to a depth of 7.6 metres (elev. 225.0). The clarifiers will be maintained full except for when taken out of service for cleaning.

- The U/V Disinfection Facility will be twinned with the existing facility. It will be 25 metres in length, 5.4 metres in width and to a depth of 3.9 metres (elev.229.0).

- Fermenters will each be 21.3 meters in diameter and will be partially buried. Adjacent to the fermenters will be a DAF Room/truck Bay/Electrical Room/Odour Control Room/ Sludge Holding Tank all of which will be at grade. The DAF room will include four above ground process tanks, each tank approximately 8.1 by 2.6 metres and 2.5 metres high. The sludge holding tank room will contain three above ground sludge tanks, each being about 20 by 9 metres and 2.5 metres high.

8.2 Foundations

The geotechnical conditions are best suited to the use of hexagonal, prestressed, precast concrete piles that are driven to practical refusal in the underlying glacial till. These have been the type of pile which has been used to support the majority of the structures for the existing plant. The variable condition of the glacial till deposit and the potential problems related to water seepage and bell instability are factors that render the site unsuitable for widespread use of high capacity cast-in-place concrete caissons and this type of foundation is not recommended.

The driven end bearing precast concrete piles can be assigned conventional capacities of 445, 625 and 800 kN for 305, 356 and 406 mm sizes respectively if driven to practical refusal with diesel hammers with a rated energy of not less than 40, 000 Joules. Practical refusal can be defined as final penetration resistance values of 5, 8 and 12 blows per 25 mm or less for 305, 356 and 406 mm diameters respectively for the final 3 sets of pile penetration for hammers with driving energies of 40,000 Joules. If higher energies or other types of hammers are used, they should be evaluated to ensure that the piles are not overstressed and a suitable refusal criteria determined.

Construction practice in Winnipeg normally includes preboring at all driven pile locations usually to diameters that are 50 mm greater than the pile size and to depths of about 3 metres. The preboring is effective in reducing ground vibrations, pile heave and contributes positively to pile verticality. No reduction in individual pile capacity is necessary for reasons related to group action provided that pile heave is monitored, measures are taken to minimize it (preboring) and redriving is done, as necessary, in pile groups. Redriving of all piles in groups should be specified. Piles should not be spaced closer than 2.5 pile diameters centre to centre. Full time pile inspection is recommended for the driven pile installations.

The age of the precast pile concrete should be specified to be at least seven days old prior to driving.

Lightly loaded structures can be supported on cast-in-place concrete friction piles which can be designed on the basis of an allowable shaft adhesion value of 19.2 kPa. The top 3.0 metres of shaft support should be discounted due to potential soil shrinkage away from the pile. A minimum pile diameter of 405 mm should be specified. Temporary casings should be used on an as-required basis, to prevent caving and seepage into the pile borings.

A mixture of friction piles and end bearing piles is not recommended for the support of important structures, nor should groups of friction piles be used for large loads.

Any foundations which might be affected by freezing conditions should be protected from frost heave effects. The use of flat lying rigid insulation, such as Styrofoam HI, can be used to prevent frost penetration into the soil around the piles. Alternatively, the pile lengths should be a minimum of 7.6 metres and should contain full length reinforcement regardless of the design loads.

8.3 Excavations and Shoring

Deep excavations will be required for most of the major structures which may be in open areas and others adjacent to existing facilities. In the open areas, it may be possible to use sloped excavations. Adjacent to the existing facilities, shoring may be required. Because these options will impact on the construction activities and schedules, it is recommended that the successful contractor be required to submit an excavation and shoring plan which should be prepared by or endorsed by a registered Professional Engineer who is skilled in these matters.

The excavation and shoring plan should consider the potential for bottom heave of the deeper excavations due to hydrostatic pressures within the underlying glacial till deposit and bedrock. As noted in Section 7.0, the highest groundwater elevations which have been recorded at the site occurred during the Floodway events which, in 2006, were as high as 226.8 metres. With this groundwater elevation, the maximum depth of excavation to elevation 224.5 metres and the highest elevation of the glacial till (or bottom of the clay deposit), the Factor of Safety against bottom heave is too low. It should be appreciated that all of the foregoing are the extremes of the limits which could be used for the analyses. In general, exclusive of the periods of the Floodway events, the Factors of Safety appear to be adequate, however, the development of the excavation and shoring plan should assess the base heave potential for the deeper excavations.

The design of the excavation slopes should consider the soil stratigraphy and piezometric conditions which might prevail at the time of construction. The presence of the silt deposit should be recognized as sloughing and seepage should be expected during periods of heavy rainfall. The excavation slopes should be immediately protected from drying by covering with suitable materials. Particular attention should be paid to excavation slopes where the new excavations will encroach upon or expose the existing structures.

Temporary shoring should be provided where excavations will encroach on structures that have to be protected. The shoring can be designed on the basis of the earth pressure distribution shown on Figure 23. Ground movement behind the shoring will occur and is largely unavoidable. The amount that will occur cannot be predicted with much accuracy, mainly because the movement is as much a function of excavation procedures and workmanship as it is a function of theoretical considerations.

8.4 Below Grade Walls

Below grade walls including the tanks and any retaining walls should be designed to resist lateral earth pressures that are derived on the basis of the following conventional relationship which produces a triangular pressure distribution:

$$P = K \lambda D$$

where P = lateral earth pressure at depth D (kPa)
K = earth pressure coefficient (0.5)
λ = soil/backfill unit weight (17.3 kN/m^3)
D = depth from surface to point of pressure calculation

The base of the wall should be provided with a filter protected drainage system to prevent the buildup of hydrostatic pressures against the wall. Where drainage is not provided, the hydrostatic pressure should be included assuming a water table to be at the ground surface. The selection of backfill materials should be reviewed during the design and their impact on the foregoing pressures reassessed.

An allowance for surface live loads should be included if a significant load is applied within a distance from the wall equal to the height of the wall. The lateral earth pressure due to the live load should be presumed to be equal to 50 percent of the vertical pressure due to the live load.

8.5 Floor Slabs

Structurally supported floor slabs, generally, should be used throughout. These slabs should be separated from the underlying subgrade by a void of at least 200 mm. It is presumed that the slabs will not be provided with underdrainage and that water can collect beneath them. This is conducive to swelling and heave and a generous allowance for this is recommended.

8.6 Seismic Site Classification

On the basis of a weighted undrained shear strength of the clay profile of 55 kPa, the site falls into Site Class D of the Site Classification for Seismic Site Response of the 2005 NBCC.

8.7 Pavements

Pavement structures should be placed on a prepared subgrade. The silty clay which is below the topsoil and fill (which should be removed and stockpiled or wasted) is a suitable subgrade material. It should be reworked until the moisture content is near its optimum value. It would then be compacted to a uniform density of at least 95 percent of Standard Proctor Density. Any "soft spots" which develop during the subgrade preparation should be subcut and replaced with suitably compacted clay materials. Where silt is encountered, it should be subcut by 750 mm and bridged with a granular fill. A woven geotextile should be placed between the native soil and the granular fill to provide a separation and reinforcement.

On the prepared subgrade the pavement areas for parking and light duty traffic should consist of 50 mm of asphaltic concrete placed on 210 mm of crushed granular base course and for heavy duty traffic for trucking, it should consist of 76 mm of asphaltic concrete on 460 mm of crushed granular base course, or equivalent sections. Concrete pavements would entail 205 mm of reinforced concrete on 75 mm of crushed granular base course.

The materials selection and construction requirements should be to the standards of road construction as set out in the City of Winnipeg Standard Specifications.

8.8 Other

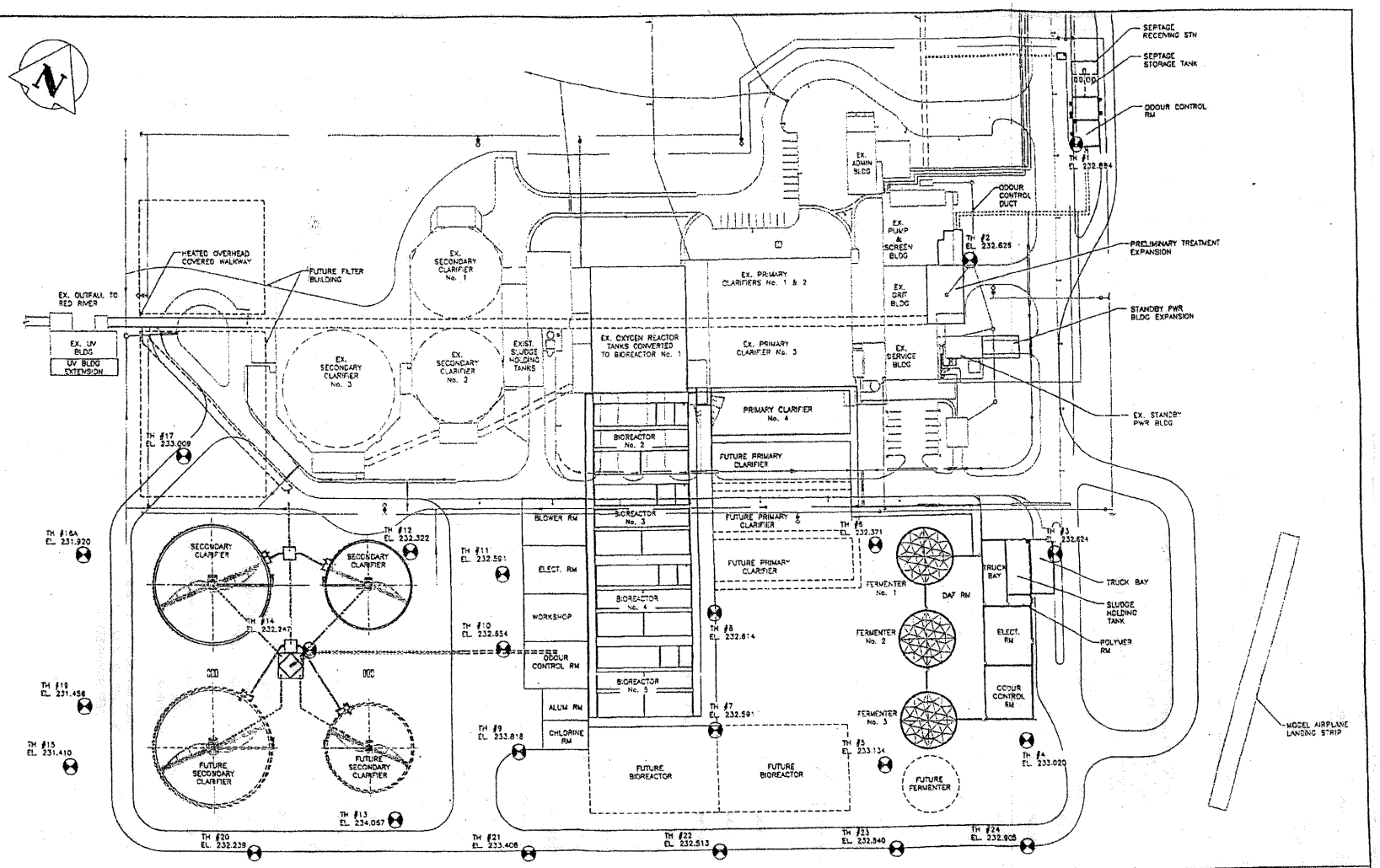
All concrete in contact with the soil should be manufactured with sulphate resistant cement and should be of high quality.

Respectfully submitted,

DYREGROV CONSULTANTS

Per:

A.O. Dyregrov, P.Eng.



APEGM
Certificate of Authorization
Stantec Consulting Ltd.
No. 1301 Expiry: April 30, 2008

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.

S.W. ELEV.

NO. | REVISIONS | DATE | BY

Stantec Consulting Ltd.
905 Waverley Street, Winnipeg, Manitoba
Tel 204-489-5900 Fax 204-453-9012

DESIGNED BY		CHECKED BY	C.D.
DRAWN BY	K.R.	APPROVED BY	C.D.
HOR. SCALE:	1:1500	RELEASED FOR CONSTRUCTION:	
VERTICAL			
DATE	Nov. 15, 2007	DATE	

ENGINEER'S SEAL

TENDER NO. 2007-

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT
Winnipeg

SOUTH END WATER POLLUTION CONTROL CENTRE
UPGRADING / EXPANSION

TEST HOLES LOCATION

CITY DRAWING NUMBER: 1-0102A-D-G0001-001-00B

SHEET OF

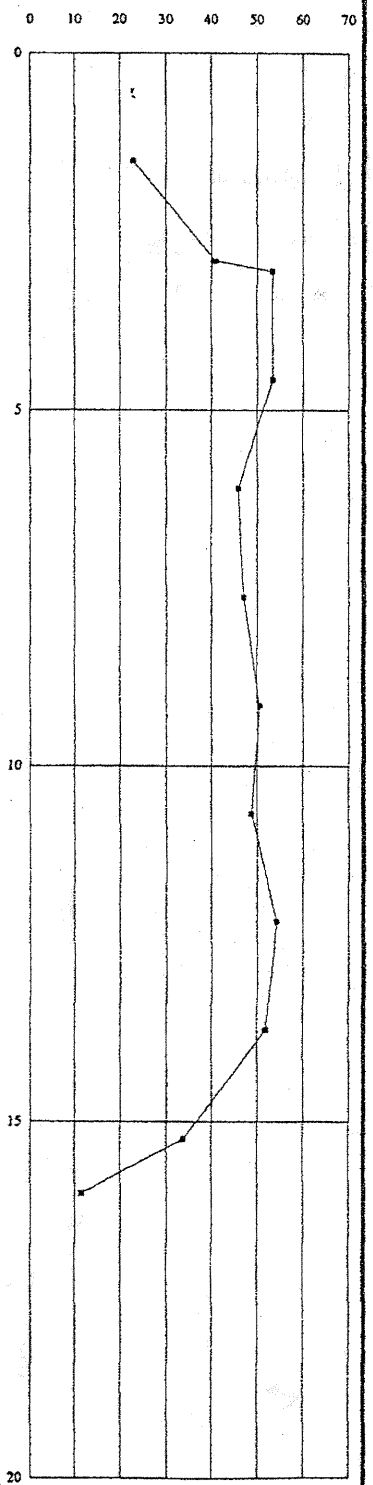
81/000

FIGURE 1

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-01	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 13, 2007 DRILL : SUBTERRANEAN 460 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	232.88		
	0.50	232.38		0.00-0.91FILL, CLAY, TRACE TO SOME SILT AND GRAVEL
	1.00	231.88		0.91-1.06 CLAY, BROWN ,STIFF
	1.50	231.38		1.06-1.68 SILT, TAN, CLAYEY
	2.00	230.88		1.68- 15.39 CLAY SILTY, STIFF BROWN AT 2.13 HIGHLY PLASTIC GYPSUM INCLUSIONS
	2.50	230.38		
	3.00	229.88		Pp-34.3 kPa Tv-45.1 kPa
	3.50	229.38		
	4.00	228.88		
	4.50	228.38		
	5.00	227.88		
	5.50	227.38		
	6.00	226.88		
	6.50	226.38		
	7.00	225.88		
	7.50	225.38		
	8.00	224.88		GREY AT 8.23
	8.50	224.38		
	9.00	223.88		
	9.50	223.38		
	10.00	222.88		
	10.50	222.38		
	11.00	221.88		
	11.50	221.38		
	12.00	220.88		
	12.50	220.38		
	13.00	219.88		
	13.50	219.38		FIRM
	14.00	218.88		
	14.50	218.38		TILL INCLUSIONS
	15.00	217.88		15.39-21.9 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT
	15.50	217.38		
	16.00	216.88		
	16.50	216.38		COBBLES AND BOULDERS @ 16.45 SANDY SEEPAGE
	17.00	215.88		
	17.50	215.38		HOLE SLOUGHED TO 13.8 DRILLED TO 17.37 AUGER SCREWED TO 21.9
	18.00	214.88		
	18.50	214.38		
	19.00	213.88		
	19.50	213.38		
	20.00	212.88		

MOISTURE CONTENT (%)



NOTES

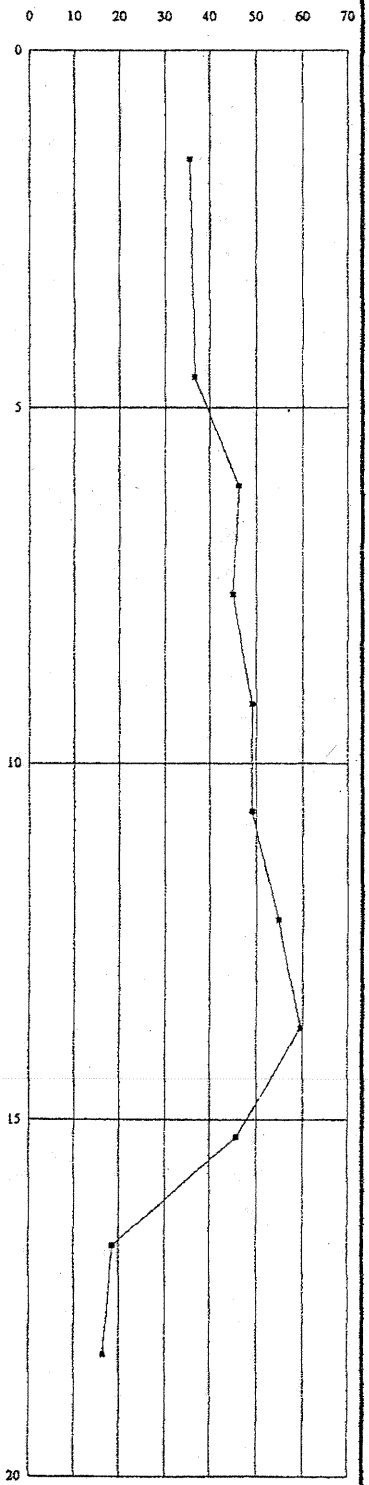
END OF TEST HOLE AT 21.9 AT
AUGER REFUSAL
WATER LEVEL AT 13.4 IN 10 MINUTES

FIGURE 2

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-02	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 19, 2007 DRILL : SUBTERRANEAN 125 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	S Y M	SOIL DESCRIPTION	
	0.00	232.63		0.00-0.30 FILL - SAND, GRAVEL SOME CLAY	
	0.50	232.13		0.30-16.00 CLAY SILTY, STIFF HIGHLY PLASTIC MOTTLED BROWN GYPSUM INCLUSIONS	
	1.00	231.63			
	1.50	231.13			
	2.00	230.63			
	2.50	230.13			
	3.00	229.63			
	3.50	229.13			
	4.00	228.63			
	4.50	228.13			
	5.00	227.63		MOTTLED BROWN, SILTY, HIGH PLASTIC STIFF	
	5.50	227.13			
	6.00	226.63			
	6.50	226.13			
	7.00	225.63			
	7.50	225.13			
	8.00	224.63			
	8.50	224.13		GREY AT 8.53	
	9.00	223.63			Cu-38.7 kPa Pp-39.2 kPa Tv-44.1 kPa W -17.9 kN/M
	9.50	223.13		GREY, SILTY, FIRM TO STIFF, HIGH PLASTIC,	
	10.00	222.63			
	10.50	222.13			
	11.00	221.63			
	11.50	221.13			
	12.00	220.63		GREY. FIRM, HIGH PLASTIC TRACE SILT INCLUSIONS	Cu-29.8 kPa Pp-17.1 kPa TV-49.0 kPa W -16.9 kN/M
	12.50	220.13			
	13.00	219.63			
	13.50	219.13			
	14.00	218.63			
	14.50	218.13			
	15.00	217.63			
	15.50	217.13			
	16.00	216.63		16.00-19.05 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS AT 17.0 HOLE SQUEEZING SAND, FINE GRAINED, SOME SILT GREY, SATURATED	
	16.50	216.13			
	17.00	215.63			
	17.50	215.13			
	18.00	214.63		SCREWED AUGERS TO REFUSAL	
	18.50	214.13		COBBLY AND BOULDERY AND VERY DENSE AT 18.6	
	19.00	213.63			
	19.50	213.13			
	20.00	212.63			

MOISTURE CONTENT (%)



NOTES

END OF TEST HOLE AT 19.05 AT AUGER REFUSAL
ON BOULDERS IN VERY DENSE TILL

HOLE OPEN TO 13.4

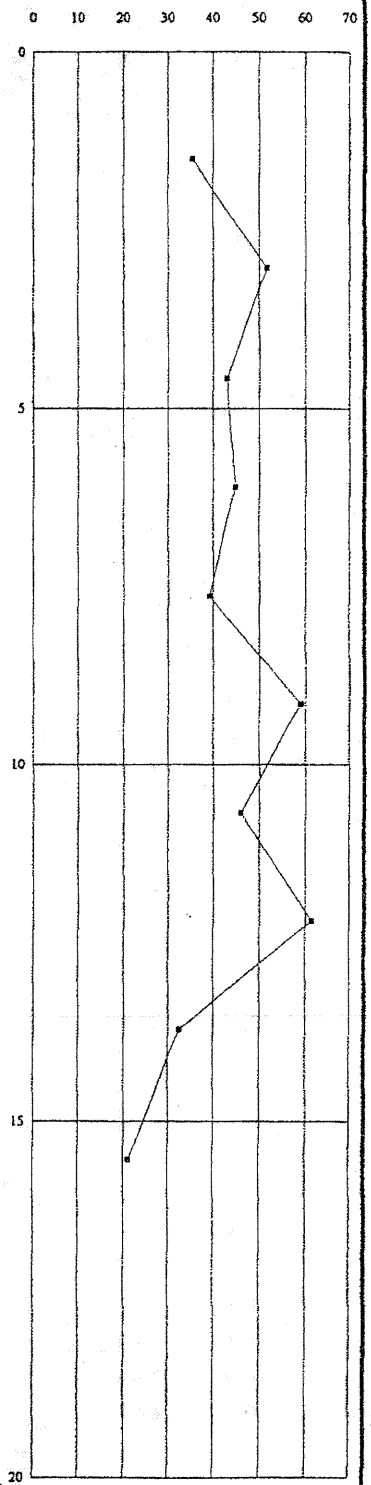
INSTALLED STAND PIPE TO 16.29 WITH BOTTOM 3.05 SLOTTED

FIGURE 3

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-03	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 12 2007 DRILL : SUBTERRANEAN 460 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	232.62		0.00-0.15 FILL, SAND AND CLAY	
	0.50	232.12		0.15-0.76 CLAY, BLACK TO BROWN	
	1.00	231.62		0.76-1.06 SILT, TAN, BROWN	
	1.50	231.12		1.06-14.63 CLAY BROWN, SILTY, STIFF HIGHLY PLASTIC	
	2.00	230.62		0.15 SILT SEAM AT 1.82	
	2.50	230.12			
	3.00	229.62		BROWN, STIFF, SILTY, HIGH PLASTIC, TRACE DECOMPOSED ROOTLETS, TRACE ROOTS	Cu-42.5 kPa Pp-59.8 kPa Tv-73.6 kPa W -16.8 kN/M
	3.50	229.12			
	4.00	228.62			
	4.50	228.12			
	5.00	227.62			
	5.50	227.12			
	6.00	226.62			
	6.50	226.12			
	7.00	225.62			
	7.50	225.12			
	8.00	224.62		GREY AT 8.83	
	8.50	224.12			
	9.00	223.62		GREY, SILTY, FIRM, HIGH PLASTIC TRACE SILT INCLUSIONS	Cu-77.5 kPa Pp-49.1 kPa Tv-44.1 kPa W -17.9 kN/M
	9.50	223.12			
	10.00	222.62			
	10.50	222.12			
	11.00	221.62			
	11.50	221.12			
	12.00	220.62			
	12.50	220.12		GREY, SOFT TO FIRM, HIGH PLASTIC, TRACE SILT INCLUSIONS	Cu-59.7 kPa Pp-34.3 kPa Tv-49.0 kPa W -16.9 kN/M
	13.00	219.62			
	13.50	219.12			
	14.00	218.62			
	14.50	218.12			
	15.00	217.62		14.63-22.10 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT SQUEEZING AT 15.54	
	15.50	217.12			
	16.00	216.62			
	16.50	216.12			
	17.00	215.62			
	17.50	215.12			
	18.00	214.62			
	18.50	214.12			
	19.00	213.62			
	19.50	213.12			
	20.00	212.62			

MOISTURE CONTENT (%)



NOTES

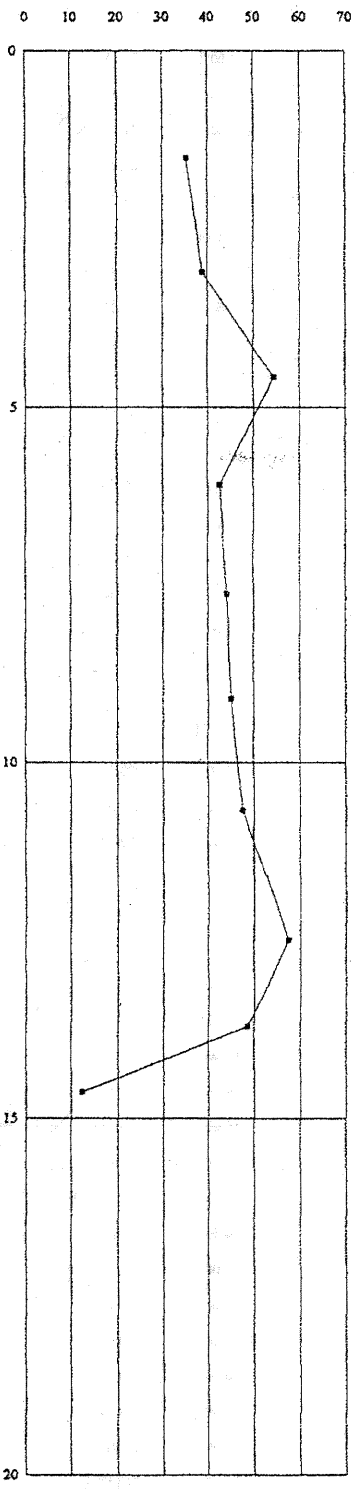
END OF TEST HOLE AT 22.10
AUGER SCREWED TO 22.10
HOLE DRY ON COMPLETION

FIGURE 4

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-04	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 12 2007 DRILL : SUBTERRANEAN 460 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	233.02		0.00-0.61 FILL, SAND, SILT AND CRUSHED LIMESTONE	
	0.50	232.52		0.61-1.21 CLAY, BLACK	
	1.00	232.02		1.21-1.52 SILT, TAN, WET	
	1.50	231.52		1.52-14.32 CLAY SILTY, STIFF HIGHLY PLASTIC MOTTLED BROWN 0.15 SILT SEAM AT 1.98 *GYPSUM INCLUSIONS*	
	2.00	231.02			
	2.50	230.52			
	3.00	230.02			
	3.50	229.52			
	4.00	229.02			
	4.50	228.52		DARK BROWN TO BROWN, SILTY, STIFF, HIGH PLASTIC, TRACE SULPHATES, TRACE SILT INCLUSIONS, LAMINATED	Cu-47.5 kPa Pp-58.9 kPa Tv-65.7 kPa W -17.1 kN/M
	5.00	228.02			
	5.50	227.52			
	6.00	227.02			
	6.50	226.52			
	7.00	226.02			
	7.50	225.52		BROWN TO LIGHT BROWN, SILTY, TRACE SILT, AND GRAVEL INCLUSIONS, STIFF, HIGH PLASTIC	Cu-75.3 kPa Pp-98.1 kPa Tv-88.3 kPa W -17.5 kN/M
	8.00	225.02			
	8.50	224.52		GREY AT 8.23	
	9.00	224.02			
	9.50	223.52			
	10.00	223.02			
	10.50	222.52		GREY, SILTY, FIRM TO STIFF, HIGH PLASTIC, TRACE SILT INCLUSIONS	Cu-49.6 kPa Pp-36.8 kPa Tv-59.8 kPa W -16.8 kN/M
	11.00	222.02			
	11.50	221.52			
	12.00	221.02			
	12.50	220.52			
	13.00	220.02			
	13.50	219.52			
	14.00	219.02			
	14.50	218.52		14.32-21.03 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS	
	15.00	218.02			
	15.50	217.52			
	16.00	217.02		SQUEESING AT 15.84	
	16.50	216.52			
	17.00	216.02			
	17.50	215.52			
	18.00	215.02			
	18.50	214.52			
	19.00	214.02			
	19.50	213.52			
	20.00	213.02			

MOISTURE CONTENT (%)



NOTES

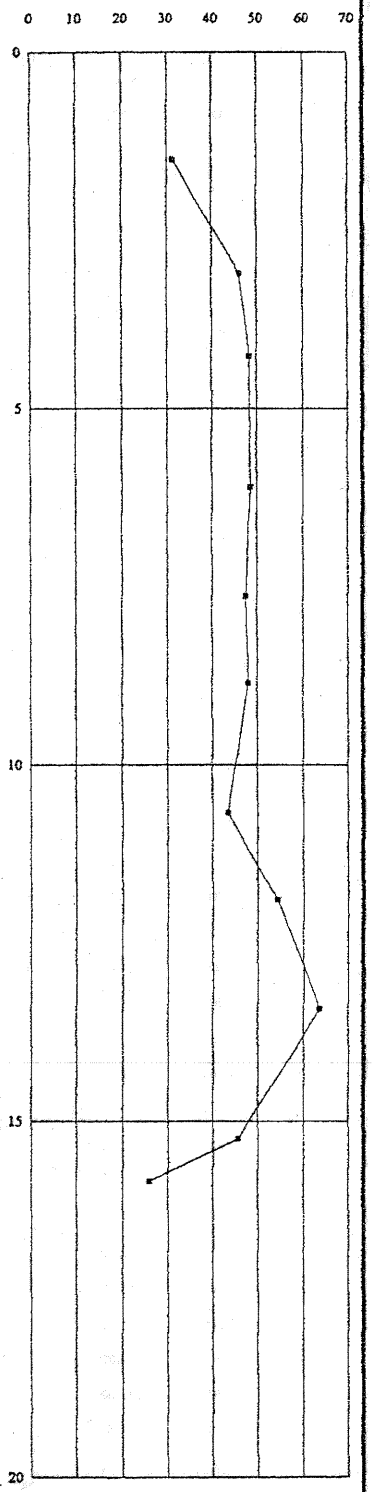
END OF TEST HOLE AT 21.3
AUGER REFUSAL
WATER LEVEL AT 14.02 IN 5 MIN

FIGURE 5

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-05	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 14, 2007 DRILL : SUBTERRANEAN 460 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	233.13		0.00-0.76 FILL, SAND, SILT AND GRAVEL	
	0.50	232.63			
	1.00	232.13		0.76- 1.67 CLAY, BLACK TO BROWN	
	1.50	231.63		1.67-1.98 SILT, TAN, WET	
	2.00	231.13		1.98-15.50 CLAY SILTY, STIFF HIGHLY PLASTIC MOTTLED BROWN GYPSUM INCLUSIONS	
	2.50	230.63			
	3.00	230.13			
	3.50	229.63			
	4.00	229.13			
	4.50	228.63			
	5.00	228.13			
	5.50	227.63			
	6.00	227.13		BROWN, STIFF, HIGH PLASTIC, SILTY TRACE SILT INCLUSIONS, LAMINATED	Cu-35.9 kPa Pp-76.5 kPa Tv-63.8 kPa W -17.2 kN/M
	6.50	226.63			
	7.00	226.13			
	7.50	225.63			
	8.00	225.13		GREY AT 8.23 STIFF TO FIRM	
	8.50	224.63			
	9.00	224.13			
	9.50	223.63			
	10.00	223.13			
	10.50	222.63			
	11.00	222.13			
	11.50	221.63			
	12.00	221.13			
	12.50	220.63			
	13.00	220.13		GREY, SILTY, FIRM, HIGH PLASTIC, TRACE SILT INCLUSIONS	Cu-47.9 kPa Pp-29.4 kPa Tv-49.0 kPa W -16.4 kN/M
	13.50	219.63			
	14.00	219.13			
	14.50	218.63			
	15.00	218.13		15.50-24.68 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS	
	15.50	217.63			
	16.00	217.13		SQUEEZING AT 13.10	
	16.50	216.63			
	17.00	216.13			
	17.50	215.63			
	18.00	215.13			
	18.50	214.63		AUGER SCREWED TO REFUSAL	
	19.00	214.13			
	19.50	213.63			
	20.00	213.13			

MOISTURE CONTENT (%)



NOTES

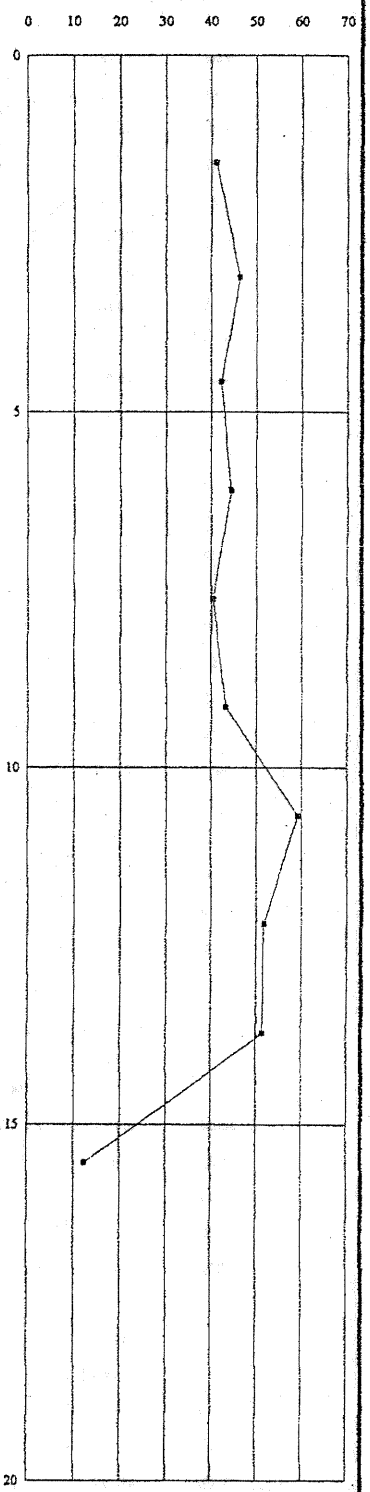
END OF TEST HOLE AT 24.68 AT AUGER REFUSAL
WATER LEVEL AT 15.20 IN 10 MIN

FIGURE 6

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-06	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 13, 2007 DRILL : SUBTERRANEAN 460 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	232.37			
	0.50	231.87		0.00-0.30 FILL, GRAVEL, CLAY, BRICKS AND CONCRETE 0.30- 15.24 CLAY, BLACK TO BROWN HIGH PLASTIC, STIFF,	
	1.00	231.37			
	1.50	230.87		SMALL SILT SEAMS FROM 0.9 TO 1.8	
	2.00	230.37			
	2.50	229.87			
	3.00	229.37			
	3.50	228.87			
	4.00	228.37			
	4.50	227.87			
	5.00	227.37			
	5.50	226.87			
	6.00	226.37		BROWN, STIFF, SILTY, HIGH PLASTIC, TRACE SILT INCLUSIONS SMALL LAMINATIONS	Cu-77.9 kPa Pp-88.3 kPa Tv-68.7 kPa W -17.5 kN/M
	6.50	225.87			
	7.00	225.37			
	7.50	224.87			
	8.00	224.37		GREY AT 7.93 STIFF TO FIRM	
	8.50	223.87			
	9.00	223.37			
	9.50	222.87			
	10.00	222.37			
	10.50	221.87			
	11.00	221.37		GREY, SILTY, FIRM TO STIFF TRACE SILT INCLUSIONS, HIGH PLASTIC	Cu-66.8 kPa Pp-49.1 kPa Tv-52.0 kPa W -16.7 kN/M
	11.50	220.87			
	12.00	220.37			
	12.50	219.87			
	13.00	219.37			
	13.50	218.87			
	14.00	218.37		BELOW 13.7 LARGE GLACIAL TILL INCLUSIONS	
	14.50	217.87			
	15.00	217.37			
	15.50	216.87		15.50-22.86 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, SOFT, LOOSE WET TO SATURATED COBBLES AND BOULDERS	
	16.00	216.37			
	16.50	215.87			
	17.00	215.37			
	17.50	214.87			
	18.00	214.37			
	18.50	213.87		AUGER SCREWED TO REFUSAL	
	19.00	213.37			
	19.50	212.87			
	20.00	212.37			

MOISTURE CONTENT (%)



NOTES

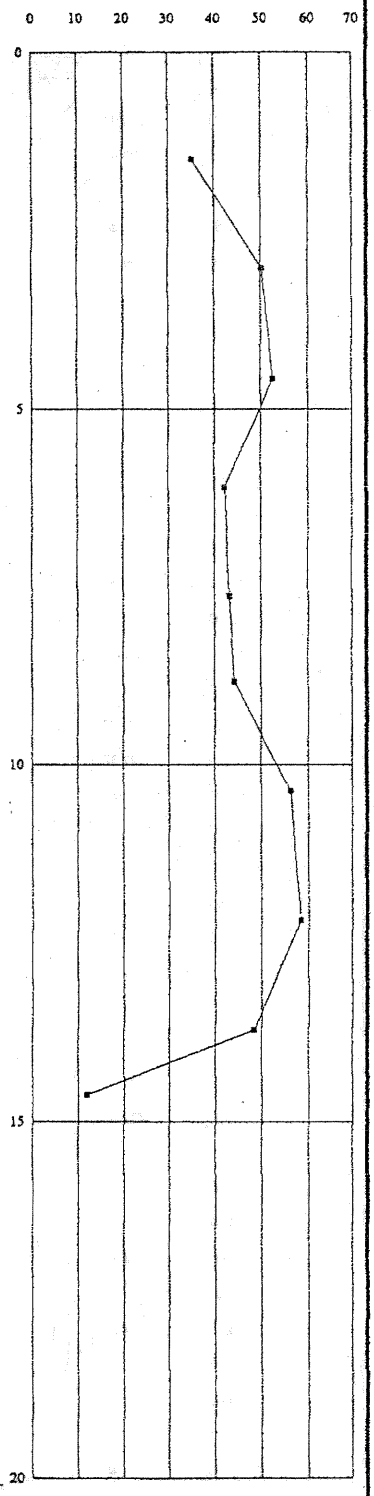
END OF TEST HOLE AT 22.86 AT AUGER REFUSAL
WATER LEVEL AT 17.70 IN 10 MIN

FIGURE 7

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-07	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 14, 2007 DRILL : SUBTERRANEAN 460 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	233.13		0.00-0.30 FILL, SAND, AND GRAVEL	
	0.50	232.63		0.30- 14.33 CLAY, BLACK TO BROWN SILTY, HIGH PLASTIC, VERY STIFF TO STIFF TAN SILT LAYER OF 80mm AT 1.37 MOTTLED BROWN,	
	1.00	232.13			
	1.50	231.63			
	2.00	231.13			
	2.50	230.63			
	3.00	230.13			
	3.50	229.63			
	4.00	229.13			
	4.50	228.63		BROWN, STIFF, SILTY, HIGH PLASTIC, TRACE SULPHATE POCKETS TRACE ROOTLETS, TRACE SILT INCLUSIONS	Cu-40.9 kPa Pp-85.8 kPa Tv-51.0 kPa W -17.6 kN/M
	5.00	228.13			
	5.50	227.63			
	6.00	227.13			
	6.50	226.63			
	7.00	226.13			
	7.50	225.63			
	8.00	225.13			
	8.50	224.63			
	9.00	224.13			
	9.50	223.63		GREY AT 9.15 STIFF TO FIRM	
	10.00	223.13			
	10.50	222.63		GREY, SILTY, FIRM TO STIFF, HIGH PLASTIC, TRACE SILT INCLUSIONS, GRAVEL STONES AT BOTTOM 50 mm DIA	Cu-65.3 kPa Pp-49.1 kPa Tv-59.6 kPa W -16.8 kN/M
	11.00	222.13			
	11.50	221.63			
	12.00	221.13			
	12.50	220.63			
	13.00	220.13			
	13.50	219.63			
	14.00	219.13			
	14.50	218.63		14.33-22.56 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS	
	15.00	218.13			
	15.50	217.63			
	16.00	217.13		SQUEEZING AT 15.24	
	16.50	216.63			
	17.00	216.13			
	17.50	215.63			
	18.00	215.13			
	18.50	214.63			
	19.00	214.13		AUGER SCREWED TO REFUSAL	
	19.50	213.63			
	20.00	213.13			

MOISTURE CONTENT (%)



NOTES

END OF TEST HOLE AT 22.56 AT AUGER REFUSAL

FIGURE 8

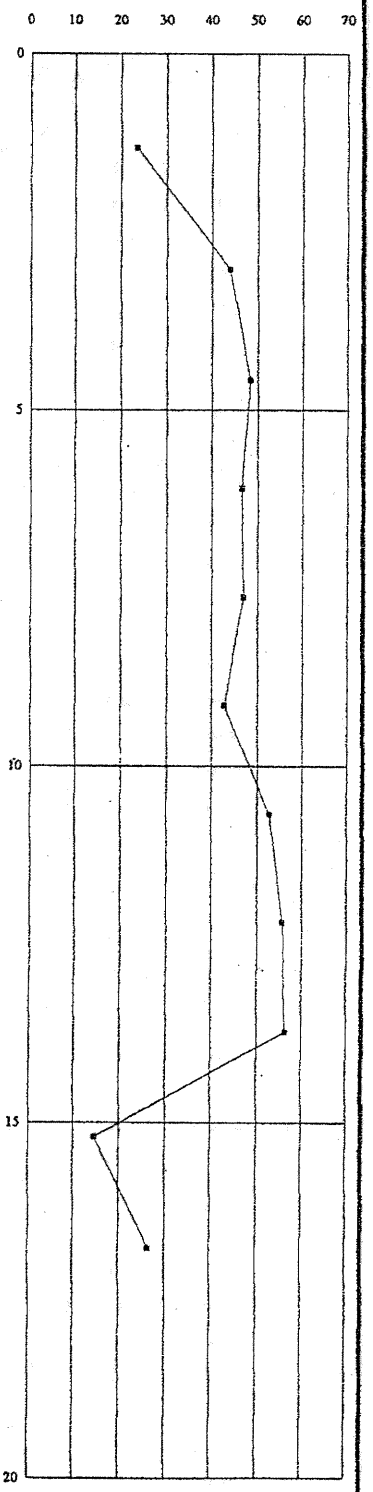
DYREGROV CONSULTANTS | Logged/Drawn: SDG | Checked: AOD | Test Hole No. 2007-08 | Project No. 272939

PROJECT: SEWPCC
CLIENT: STANTEC CONSULTING LTD.

DATE OF INVEST : SEPTEMBER 18, 2007
DRILL : SUBTERRANEAN 460 mm AUGER

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	232.61		0.00-0.30 FILL, SAND, SOME GRAVEL,
	0.50	232.11		0.30- 1.22 CLAY, BLACK TO BROWN SILTY, HIGH PLASTIC
	1.00	231.61		
	1.50	231.11		1.22-1.83 SILT CLAYEY, TAN, FIRM
	2.00	230.61		1.83-14.64 CLAY SILTY, STIFF HIGHLY PLASTIC MOTTLED BROWN
	2.50	230.11		
	3.00	229.61		THIN SILT SEAMS FROM 3.0 TO 4.5
	3.50	229.11		
	4.00	228.61		
	4.50	228.11		
	5.00	227.61		
	5.50	227.11		
	6.00	226.61		BROWN, STIFF, SILTY, HIGH PLASTIC, TRACE SILT INCLUSIONS, TRACE SULPHATE POCKETS, TRACE ROOTLETS Cu-68.7 kPa Pp-98.1 kPa Tv-68.7 kPa W-17.6 kN/M
	6.50	226.11		
	7.00	225.61		
	7.50	225.11		
	8.00	224.61		
	8.50	224.11		
	9.00	223.61		
	9.50	223.11		GREY AT 9.15 STIFF TO FIRM
	10.00	222.61		
	10.50	222.11		
	11.00	221.61		
	11.50	221.11		
	12.00	220.61		
	12.50	220.11		
	13.00	219.61		
	13.50	219.11		
	14.00	218.61		
	14.50	218.11		
	15.00	217.61		14.64-22.56 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL, CLAYEY TAN, LOOSE, SOFT WET TO VERY WET AT 16.7
	15.50	217.11		
	16.00	216.61		EASY DRILLING FROM 16.7 TO 18.3
	16.50	216.11		
	17.00	215.61		
	17.50	215.11		
	18.00	214.61		
	18.50	214.11		AUGER SCREWED TO REFUSAL
	19.00	213.61		COBBLY AND BOULDERY AT 19.2
	19.50	213.11		DIFFICULT DRILLING BELOW 21.3
	20.00	212.61		

MOISTURE CONTENT (%)



NOTES

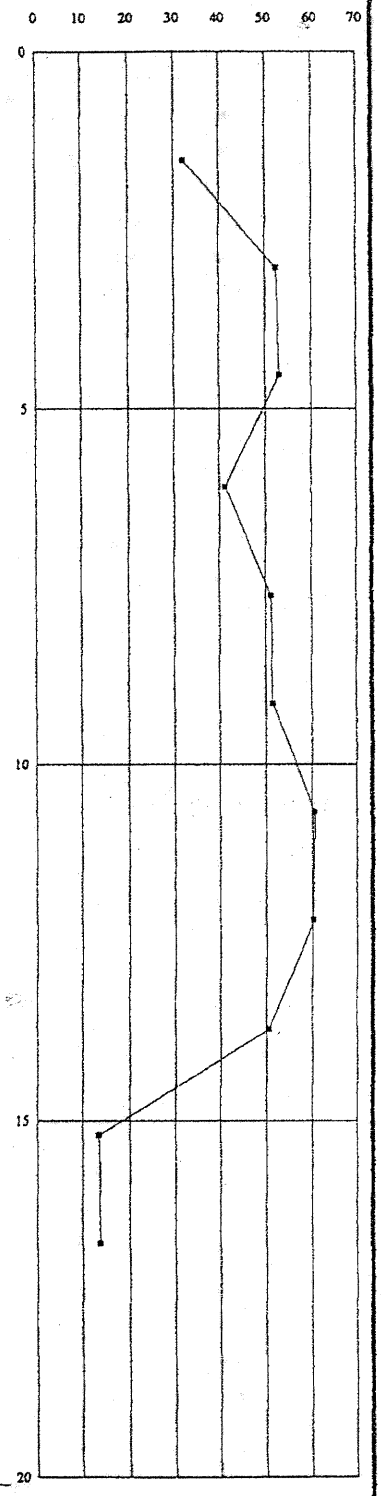
END OF TEST HOLE AT 22.56 AT AUGER REFUSAL
HOLE OPEN TO 11.6

INSTALLED 15.85 PIEZOMETER WITH BOTTOM 3.05 SLOTTED

FIGURE 9

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-09	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 18, 2007 DRILL : SUBTERRANEAN 125 mm SOLID STEM	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	232.82		0.00-0.46 FILL, SANDY GRAVEL WITH SILT	
	0.50	232.32		0.46-14.33 CLAY BLACK TO BROWN, SILTY, VERY STIFF TO STIFF HIGHLY PLASTIC	
	1.00	231.82			
	1.50	231.32			
	2.00	230.82			
	2.50	230.32			
	3.00	229.82			
	3.50	229.32			
	4.00	228.82			
	4.50	228.32		GREY AT 7.6	
	5.00	227.82			
	5.50	227.32			
	6.00	226.82			
	6.50	226.32			
	7.00	225.82			
	7.50	225.32		DARK GREY, SILTY, FIRM, HIGH PLASTIC, TRACE SILT INCLUSIONS	Cu-74.8 kPa Pp-36.8 kPa Tv-49.0 kPa W -17.9 kN/M
	8.00	224.82			
	8.50	224.32			
	9.00	223.82			
	9.50	223.32			
	10.00	222.82			
	10.50	222.32			
	11.00	221.82		GREY, FIRM, SILTY, HIGH PLASTIC TRACE SILT & GRAVEL INCLUSIONS,	Cu-68.3 kPa Pp-36.8 kPa Tv-62.6 kPa
	11.50	221.32			
	12.00	220.82			
	12.50	220.32		HOLE OPEN TO 12.8	
	13.00	219.82			
	13.50	219.32			
	14.00	218.82			
	14.50	218.32		14.33-23.78 GLACIAL SILT TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS	
	15.00	217.82			
	15.50	217.32			
	16.00	216.82		EASY DRILLING FROM 16.7 TO 18.3 FINE GREY SATURATED SAND	
	16.50	216.32			
	17.00	215.82			
	17.50	215.32			
	18.00	214.82			
	18.50	214.32		AUGER SCREWED TO REFUSAL	
	19.00	213.82		COBBLY AND BOULDERY FROM 19.9 TO 23.78	
	19.50	213.32			
	20.00	212.82			



NOTES

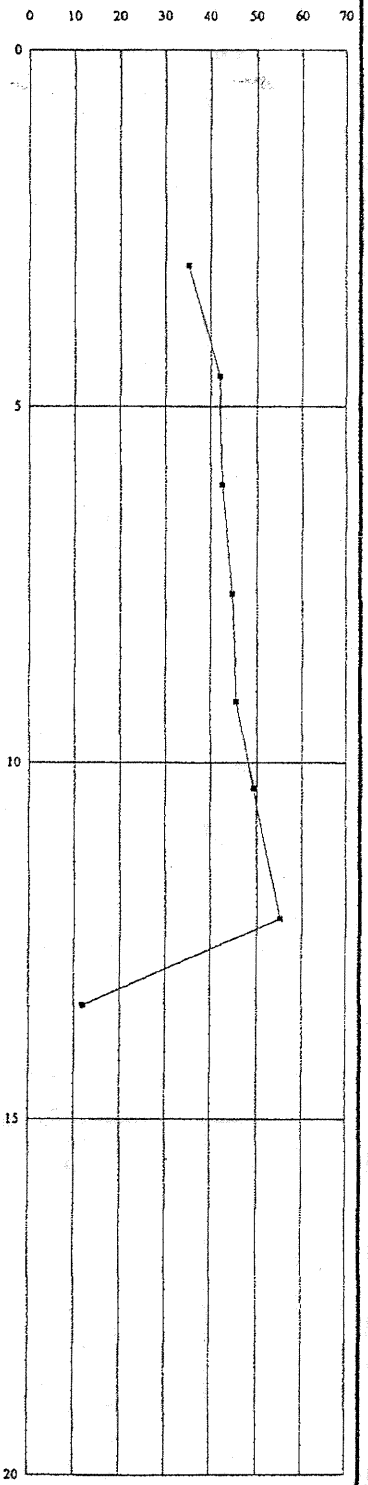
END OF TEST HOLE AT 23.78 AT AUGER REFUSAL

FIGURE 10

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-10	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 14, 2007 DRILL : SUBTERRANEAN 460 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	232.65		0.00-0.76 FILL, SAND, SILT AND GRAVEL	
	0.50	232.15			
	1.00	231.65		0.76- 1.67 CLAY, BLACK TO BROWN	
	1.50	231.15		1.67-1.98 SILT, TAN, WET	
	2.00	230.65		1.98-12.95 CLAY SILTY, STIFF, HIGH PLASTIC, MOTTLED BROWN, GYPSUM INCLUSIONS	
	2.50	230.15			
	3.00	229.65		BROWN, SILTY, FIRM, HIGH PLASTIC, TRACE SILT INCLUSIONS LAMINATIONS	Cu-21.0 kPa Pp-36.8 kPa Tv-62.8 kPa W -16.7 kN/M
	3.50	229.15			
	4.00	228.65			
	4.50	228.15			
	5.00	227.65			
	5.50	227.15			
	6.00	226.65			
	6.50	226.15			
	7.00	225.65			
	7.50	225.15			
	8.00	224.65		GREY AT 8.23 STIFF TO FIRM	
	8.50	224.15			
	9.00	223.65		GREY, SILTY, STIFF, HIGH PLASTIC, TRACE SILT INCLUSIONS	Cu-66.4 kPa Pp-68.7 kPa Tv-87.3 kPa W -16.9 kN/M
	9.50	223.15			
	10.00	222.65			
	10.50	222.15			
	11.00	221.65			
	11.50	221.15			
	12.00	220.65			
	12.50	220.15			
	13.00	219.65		12.95-20.43 GLACIAL SILTY TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS	
	13.50	219.15			
	14.00	218.65		SQUEEZING AT 13.10	
	14.50	218.15			
	15.00	217.65			
	15.50	217.15			
	16.00	216.65			
	16.50	216.15			
	17.00	215.65			
	17.50	215.15			
	18.00	214.65			
	18.50	214.15		AUGER SCREWED TO REFUSAL	
	19.00	213.65			
	19.50	213.15			
	20.00	212.65			

MOISTURE CONTENT (%)



NOTES

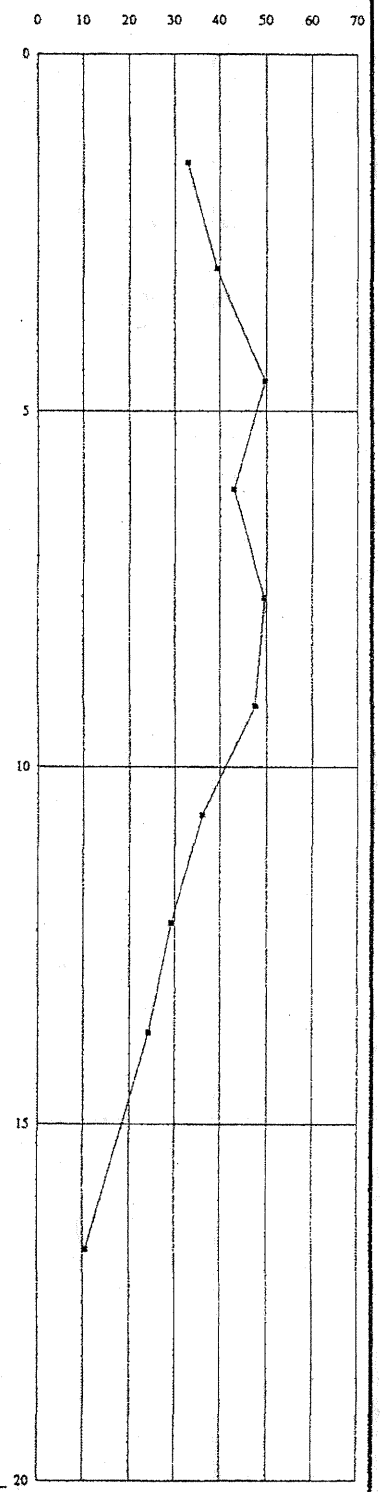
END OF TEST HOLE AT 20.43
AUGER REFUSAL
TEST HOLE DRY UPON COMPLETION

FIGURE 11

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-11	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 18, 2007 DRILL : SUBTERRANEAN 125 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	232.59		0.00-0.30 FILL, CLAY, SOME GRAVEL	
	0.50	232.09		0.30-14.02 CLAY SILTY, DARK GREY, HIGH PLASTIC VERY STIFF TO STIFF,	
	1.00	231.59			
	1.50	231.09			
	2.00	230.59		150 mm SILT LAYER AT 2.28	
	2.50	230.09		MOTTLED BROWN BELOW 2.50	
	3.00	229.59			
	3.50	229.09			
	4.00	228.59			
	4.50	228.09			
	5.00	227.59		BROWN, SILTY, STIFF, HIGH PLASTIC, TRACE SILT AND FINE GRAVEL INCLUSIONS	Cu-57.1 kPa Pp-58.9 kPa Tv-63.8 kPa W -17.4 kN/M
	5.50	227.09			
	6.00	226.59			
	6.50	226.09			
	7.00	225.59			
	7.50	225.09			
	8.00	224.59		GREY AT 7.62 STIFF TO FIRM	
	8.50	224.09			
	9.00	223.59			
	9.50	223.09			
	10.00	222.59			
	10.50	222.09			
	11.00	221.59		GREY, SILTY, FIRM TO SOFT, HIGH PLASTIC, TRACE SILT, SAND AND GRAVEL INCLUSIONS TRACE SULPHATES	Cu-42.2 kPa Pp-49.1 kPa Tv-36.3 kPa
	11.50	221.09			
	12.00	220.59			
	12.50	220.09			
	13.00	219.59			
	13.50	219.09			
	14.00	218.59		14.02-22.26 GLACIAL SILT TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS	
	14.50	218.09			
	15.00	217.59			
	15.50	217.09		SQUEEZING AT 14.32	
	16.00	216.59			
	16.50	216.09			
	17.00	215.59			
	17.50	215.09			
	18.00	214.59		DARK GREY SAND AT 18.3 WATER ENCOUNTERED	
	18.50	214.09			
	19.00	213.59			
	19.50	213.09		COBBLY AND BOULDERY FROM 20.42 TO 21.95	
	20.00	212.59			

MOISTURE CONTENT (%)



NOTES

END OF TEST HOLE AT 22.26 AT AUGER REFUSAL
HOLE OPEN TO 11.3 UPON COMPLETION

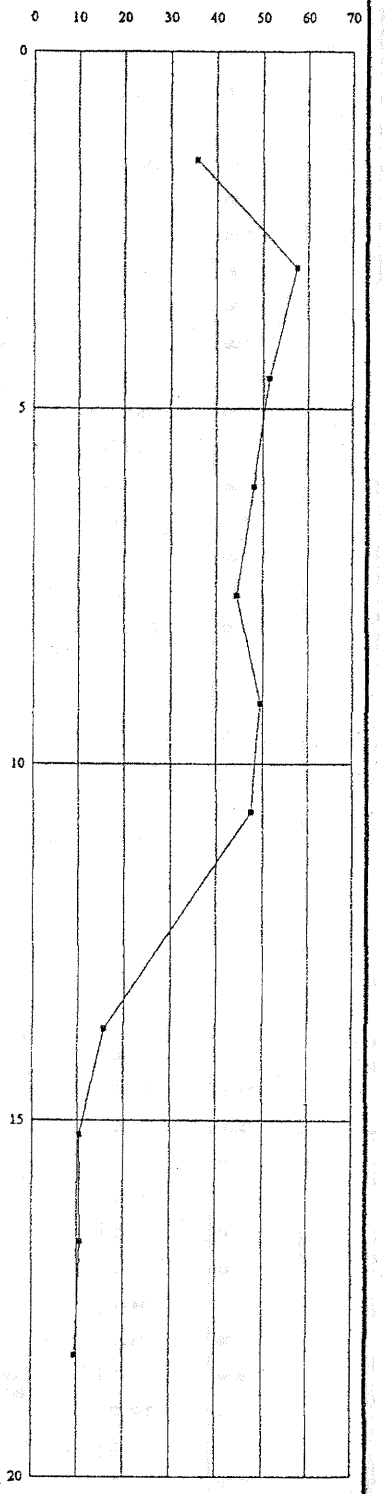
18.29 PIEZO INSTALLED WITH BOTTOM 3.05 SLOTTED

FIGURE 12

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-15	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 17, 2007 DRILL : SUBTERRANEAN 125 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION	
	0.00	231.41		0.00-0.20 TOPSOIL	
	0.50	230.91		0.20-12.80 CLAY DARK GREY TO BROWN, SILTY, STIFF HIGH PLASTIC,	
	1.00	230.41			
	1.50	229.91			
	2.00	229.41			
	2.50	228.91		MOTTLED BROWN AT 2.4	
	3.00	228.41			
	3.50	227.91			
	4.00	227.41			
	4.50	226.91			
	5.00	226.41			
	5.50	225.91			
	6.00	225.41		SILTY, DARK BROWN - GREY MOTTLED FIRM, HIGH PLASTIC	Cu-47.4 kPa Pp-36.8 kPa Tv-68.7 kPa W -17.1 kN/M
	6.50	224.91			
	7.00	224.41			
	7.50	223.91			
	8.00	223.41		GREY AT 8.23 STIFF TO FIRM	
	8.50	222.91			
	9.00	222.41			
	9.50	221.91		GREY, SILTY, FIRM TO STIFF, HIGH PLASTIC, TRACE SILT INCLUSIONS	Cu-71.5 kPa Pp-49.1 kPa Tv-59.8 kPa W -19.3 kN/M
	10.00	221.41			
	10.50	220.91			
	11.00	220.41		FIRM TO SOFT	
	11.50	219.91			
	12.00	219.41			
	12.50	218.91			
	13.00	218.41		12.80-22.25 GLACIAL SILT TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS	
	13.50	217.91			
	14.00	217.41		HOLE SQUEEZING IN AT 14	
	14.50	216.91			
	15.00	216.41		MEDIUM DENSE AT 14.9	
	15.50	215.91		DENSE BELOW 15.8	
	16.00	215.41		SEEPAGE BETWEEN 15.2 AND 16.8	
	16.50	214.91			
	17.00	214.41			
	17.50	213.91			
	18.00	213.41			
	18.50	212.91			
	19.00	212.41		AUGER SCREWED TO REFUSAL	
	19.50	211.91			
	20.00	211.41		COBBLY AND BOULDERY BELOW 20.12	

MOISTURE CONTENT (%)



NOTES

END OF TEST HOLE AT 22.25 ON PROBABLE BOULDERS

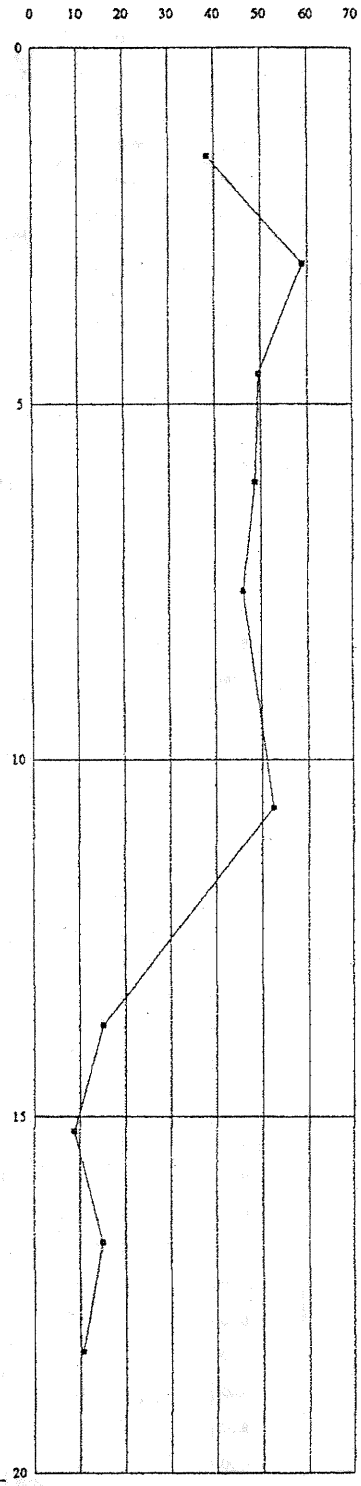
HOLE OPEN TO 11.28 AT COMPLETION OF DRILLING
STANDPIPE 18.3 LONG WAS INSTALLED WITH TIP AT 18.2 BELOW GRADE

FIGURE 13

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-16A	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 17, 2007 DRILL : SUBTERRANEAN 125 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	231.92		0.00-0.15 TOPSOIL
	0.50	231.42		0.15-12.50 CLAY BROWN, SILTY, VERY STIFF TO STIFF HIGH PLASTIC MOTTLED BROWN TRACE SILT INCLUSIONS
	1.00	230.92		
	1.50	230.42		
	2.00	229.92		
	2.50	229.42		
	3.00	228.92		SILTY, STIFF HIGHLY PLASTIC MOTTLED BROWN GYPSUM INCLUSIONS TRACE SILT INCLUSIONS LAMINATION STRUCTURE Cu-22.0 kPa Pp-36.8 kPa Tv-51.0 kPa W-16.5 kN/M
	3.50	228.42		
	4.00	227.92		
	4.50	227.42		
	5.00	226.92		
	5.50	226.42		
	6.00	225.92		
	6.50	225.42		
	7.00	224.92		
	7.50	224.42		
	8.00	223.92		GREY AT 7.93
	8.50	223.42		
	9.00	222.92		
	9.50	222.42		
	10.00	221.92		
	10.50	221.42		
	11.00	220.92		
	11.50	220.42		
	12.00	219.92		
	12.50	219.42		12.50-22.86 GLACIAL SILT TILL SILTY, SANDY, SOME GRAVEL TAN, LOOSE, SOFT COBBLES AND BOULDERS FEW CLAY SEAMS AND INCLUSIONS
	13.00	218.92		
	13.50	218.42		
	14.00	217.92		COBBLY AND BOULDERY, MORE DENSE BELOW 13.7
	14.50	217.42		
	15.00	216.92		
	15.50	216.42		MORE SOFT AND LOOSE BELOW 15.2
	16.00	215.92		
	16.50	215.42		
	17.00	214.92		
	17.50	214.42		
	18.00	213.92		
	16.50	213.42		HARDER DRILLING FROM 18.3 TO 19.8, BOULDERY, WATER ON AUGERS
	19.00	212.92		
	19.50	212.42		
	20.00	211.92		

MOISTURE CONTENT (%)



NOTES

END OF TEST HOLE AT 22.86 AT AUGER REFUSAL

PIEZOMETER INSTALLED TO 18.29 WITH BOTTOM 3.05 SLOTTED

W/L DATE	ELEV
Sept 18/07	221.1
Sept 19/07	223.46

FIGURE 14

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-17	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 18, 2007 DRILL : SUBTERRANEAN 125 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	233.01		
	0.50	232.51		0.00-1.22 FILL CLAY MATRIX, SOME GRAVEL
	1.00	232.01		
	1.50	231.51		1.22-1.83 CLAY BLACK TO DARK GREY, SILTY, HIGH PLASTIC, STIFF TO VERY STIFF
	2.00	231.01		1.83-2.44 SILT, TAN, MOIST, FIRM
	2.50	230.51		2.44-3.05 CLAY BROWN, SILTY, STIFF, HIGH PLASTIC
	3.00	230.01		
	3.50	229.51		END OF TEST HOLE AT 3.05 IN BROWN SILTY CLAY
	4.00	229.01		

MOISTURE CONTENT (%)

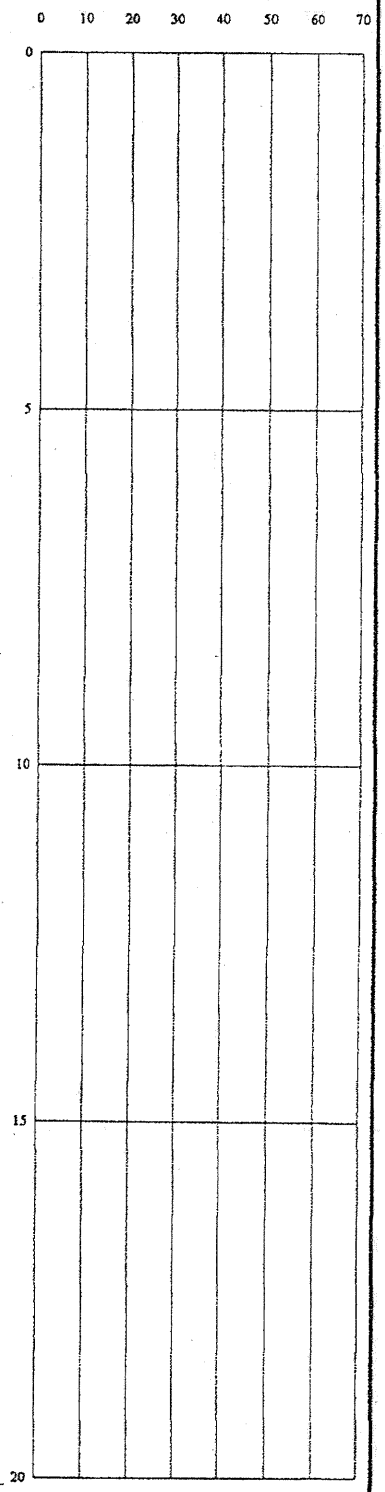


FIGURE 15

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-19	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 17, 2007 DRILL : SUBTERRANEAN 125 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	231.77		
	0.50	231.27		0.00-0.15 TOPSOIL 0.15-3.05 CLAY SILTY, VERY STIFF TO STIFF HIGH PLASTIC,
	1.00	230.77		
	1.50	230.27		MOTTLED BROWN
	2.00	229.77		
	2.50	229.27		
	3.00	228.77		
	3.50	228.27		END OF TEST HOLE AT 3.05 IN BROWN CLAY
	4.00	227.77		

MOISTURE CONTENT (%)

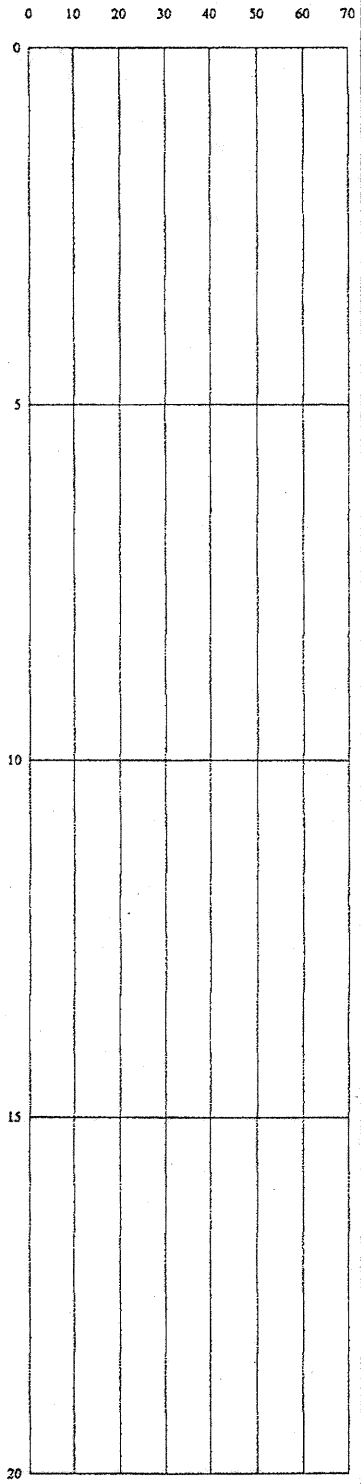


FIGURE 16

DYREGROV CONSULTANTS | Logged/Drawn: SDG | Checked: AOD | Test Hole No. 2007-21 | Project No. 272939

PROJECT: SEWPCC

CLIENT: STANTEC CONSULTING LTD.

DATE OF INVEST : SEPTEMBER 14, 2007

DRILL : SUBTERRANEAN 450 mm AUGER

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	233.41		0.00-0.60 FILL
	0.50	232.91		SANDY, GRAVELLY, CLAYEY, SILTY, PLASTIC, GARBAGE
	1.00	232.41		0.60-3.05 CLAY
	1.50	231.91		BROWN, SILTY, STIFF TO VERY STIFF, HIGH PLASTIC
	2.00	231.41		MOTTLED BROWN AT 1.8
	2.50	230.91		TAN 75 mm SILT SEAM AT 2.2
	3.00	230.41		
	3.50	229.91		END OF TEST HOLE AT 3.05 IN BROWN CLAY
	4.00	229.41		

MOISTURE CONTENT (%)

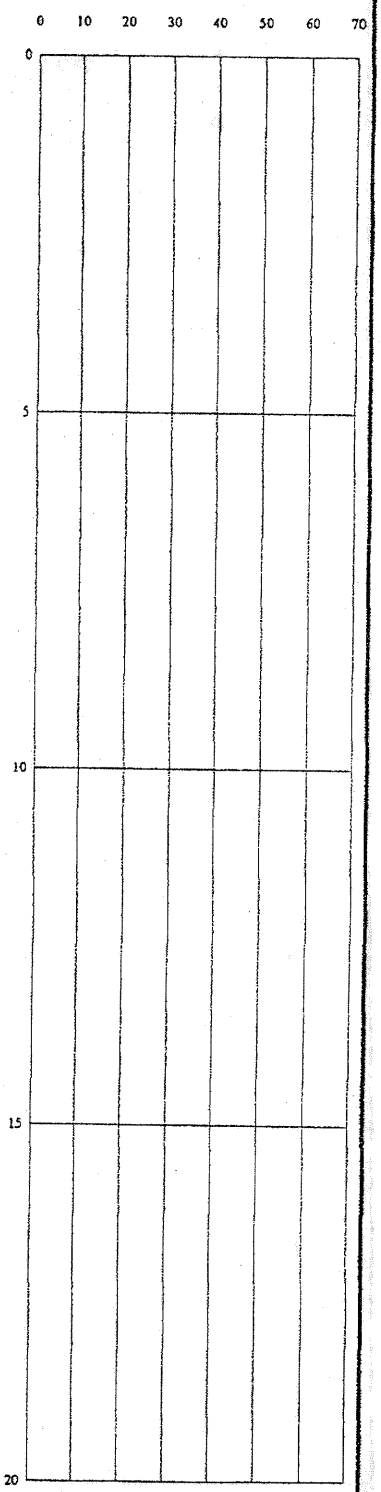


FIGURE 17

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-22	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 14, 2007 DRILL : SUBTERRANEAN 450 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	232.51		
	0.50	232.01		0.00-0.38 FILL SAND, SOME GRAVEL, SILT
	1.00	231.51		0.38-2.74 CLAY BROWN, SILTY, STIFF TO VERY STIFF, HIGH PLASTIC
	1.50	231.01		MOTTLED BROWN AT 1.5
	2.00	230.51		50 TO 75 mm SILT LENSES BETWEEN 1.52 & 1.82
	2.50	230.01		
	3.00	229.51		
	3.50	229.01		END OF TEST HOLE AT 2.74 IN BROWN CLAY

MOISTURE CONTENT (%)

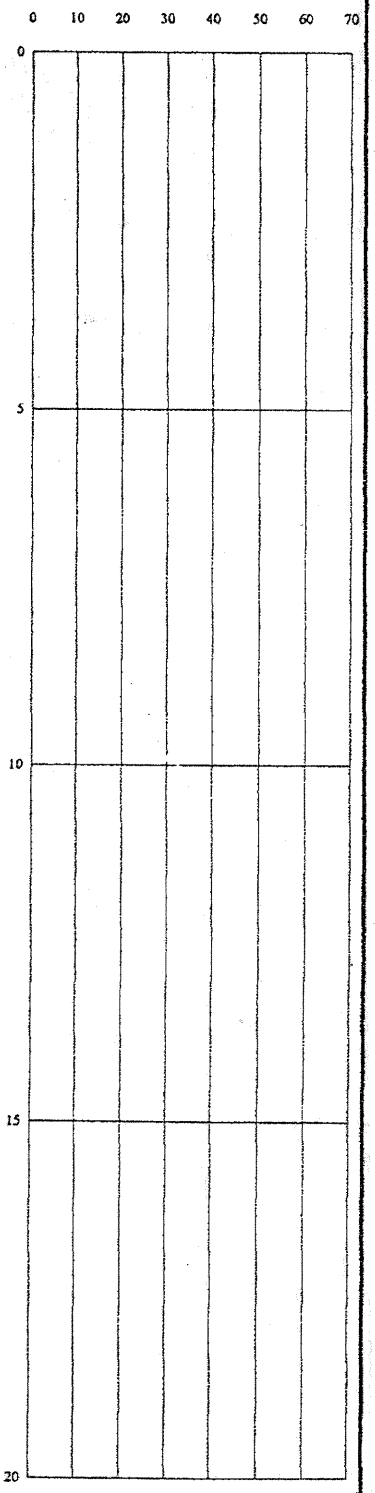


FIGURE 18

DYREGROV CONSULTANTS	Logged/Drawn: SDG Checked: AOD	Test Hole No. 2007-23	Project No. 272939
PROJECT: SEWPCC CLIENT: STANTEC CONSULTING LTD.		DATE OF INVEST : SEPTEMBER 14, 2007 DRILL : SUBTERRANEAN 450 mm AUGER	

SAMPLE NO.	DEPTH (M)	ELEV. (M)	SYM	SOIL DESCRIPTION
	0.00	232.84		
	0.50	232.34		0.00-0.46 FILL SAND, GRAVEL, CLAY
	1.00	231.84		0.46-1.68 CLAY BROWN, SILTY, STIFF TO VERY STIFF, HIGH PLASTIC
	1.50	231.34		
	2.00	230.84		1.68-1.98 SILT TAN, WET, LOW TO NON PLASTIC
	2.50	230.34		1.98-2.74 CLAY BROW, SILT, HIGH PLASTIC STIFF
	3.00	229.84		
	3.50	229.34		END OF TEST HOLE AT 2.74 IN BROWN CLAY

MOISTURE CONTENT (%)

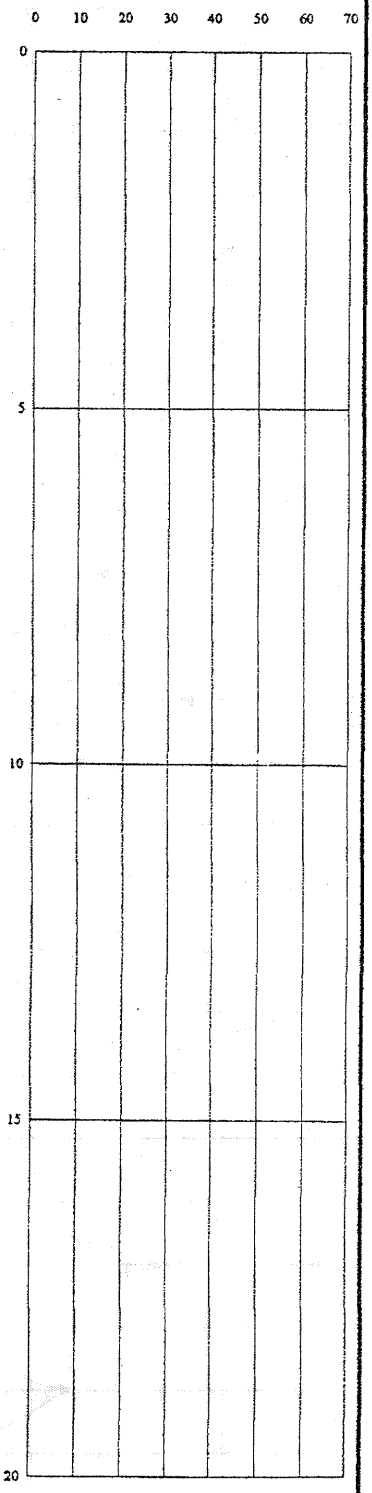
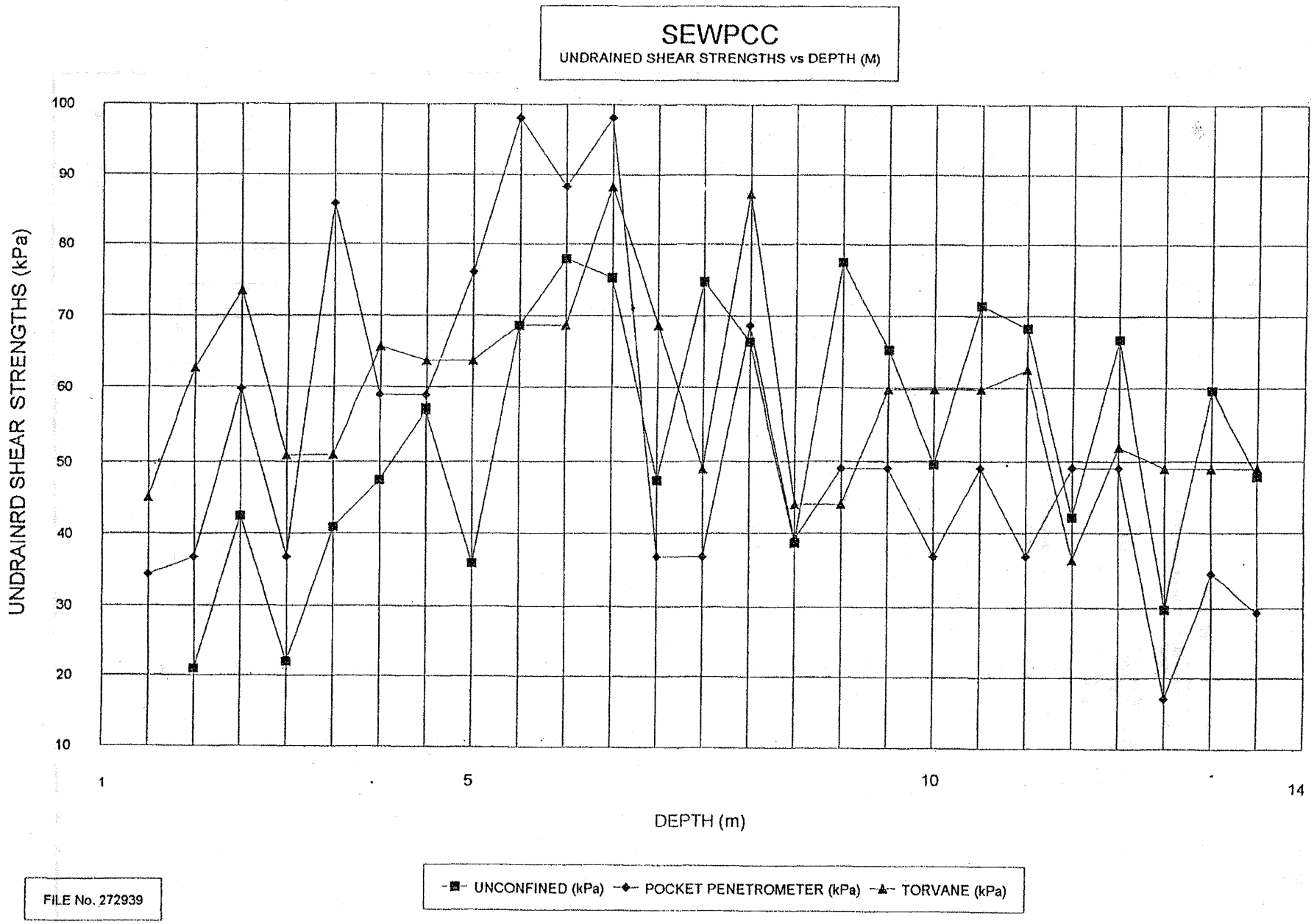


FIGURE 19



FILE No. 272939

FIGURE 20

LOCATION: RIVER LOT 0153 IN PARISH OF St. Norbert

Owner: CITY OF WPG/WRB
Driller: M.R. HALL DRILLING LTD
Well Name: G05OC007 MO-16 SEWPCC
Well Use: OBSERVATION
Water Use:
UTMX: 637014
UTMY: 5517555
Accuracy XY: 1 EXACT [<5M] [GPS]
UTMZ: 233.629
Accuracy Z: 1 EXACT <10CM
Date Completed: 1971 Jan 01

WELL LOG

From (ft.)	To (ft.)	Log
0	5.0	DARK BROWN CLAY
5.0	6.0	SILTY BROWN CLAY
6.0	33.0	BROWN CLAY
33.0	47.0	GREY CLAY
47.0	55.0	SANDY STONY BROWN TILL
55.0	66.5	SILTY FINE SAND, COARSE GRAVEL STREAKS
66.5	71.0	LIMESTONE
71.0	72.0	SHATTERED LIMESTONE
72.0	76.0	LIMESTONE
76.0	77.0	SHATTERED LIMESTONE
77.0	81.9	LIMESTONE
81.9	82.9	SHATTERED LIMESTONE
82.9	99.9	LIMESTONE

WELL CONSTRUCTION

From (ft.)	To (ft.)	Casing Type	Inside Dia.(in)	Outside Dia.(in)	Slot Size(in)	Type	Material
0	67.8	casing	4.00			IRON	
67.8	99.9	open hole	4.00				

Top of Casing: 18.0 ft. below ground

No pump test data for this well.

REMARKS

SOUTH EAST WINNIPEG POLLUTION CONTROL CENTRE, TEST HOLE #3, WELL IN BASEMENT, SE CORNER, DOWN 4 FLIGHTS OF STAIRS, BOILER ROOM, CASING CEMENTED IN PLACE, E-LOGGED TO 98 FT, CHEMICAL ANALYSIS GROUND LEVEL ELEV MEASURED 233.629 M

FIGURE 21

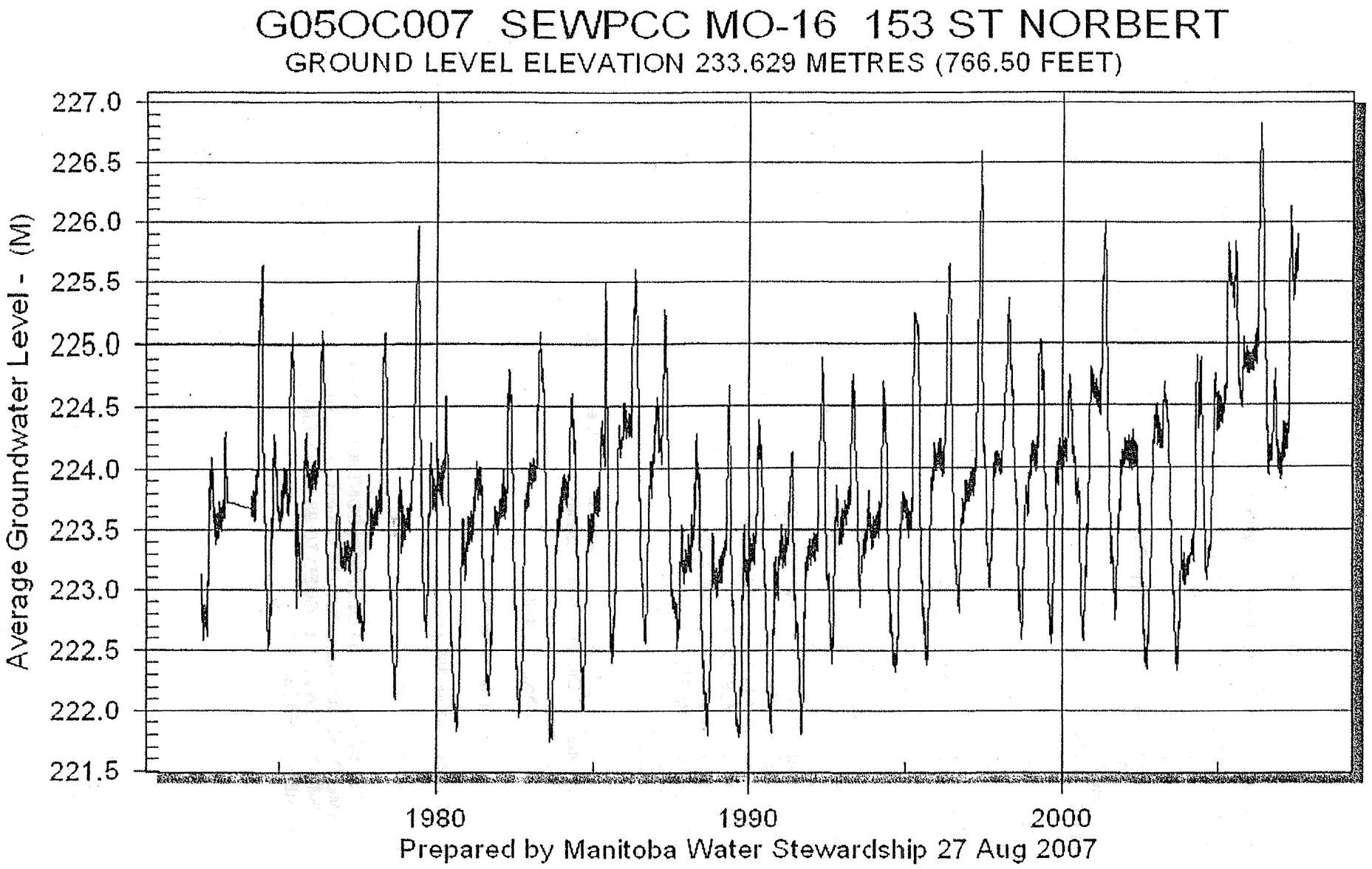
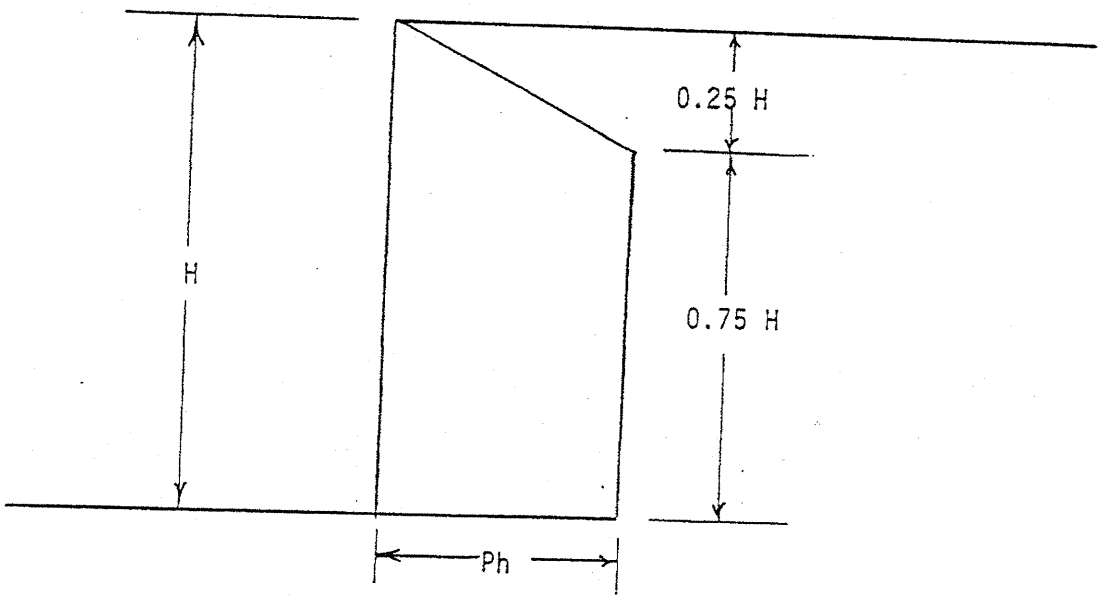

G05OC007 SEWPCC MO-16 153 ST NORBERT
GROUND LEVEL ELEVATION 233.629 METRES (766.50 FEET)
Average Groundwater Level - (M)
227.0
226.5
226.0
225.5
225.0
224.5
224.0
223.5
223.0
222.5
222.0
221.5
1980
1990
2000
Prepared by Manitoba Water Stewardship 27 Aug 2007

FIGURE 22



$Ph = 0.4\gamma H$

Where: Ph = Lateral earth pressure on shoring (kPa)

Y = Soil unit weigth (17.28 kN/M³)

H = Wall height (M)

Note: Add surface load surcharge where applicable

DYREGROV CONSULTANTS CONSULTING GEOTECHNICAL ENGINEERS			**SEWPCC** EARTH PRESSURES TEMPORARY SHORING		
SCALE NTS	DATE 23-11-07	MADE TJH	CHKD AOD	JOB 272939	FIGURE 23

APPENDIX

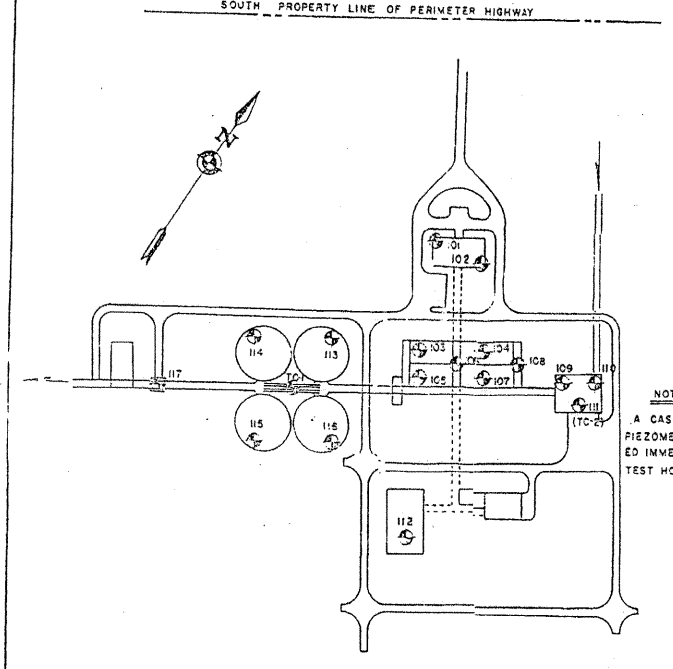
87528

TITLE: REPORT ON SUBSOIL INVESTIGATION
PROPOSED SOUTH END POLLUTION
CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

CLIENT: METROPOLITAN CORPORATION OF
GREATER WINNIPEG
c/o W.L. WARDROP & ASSOCIATES

JOB NO: W-580 DATE: March 8, 1971



NOTE:
A CASEGRANDE TYPE PIEZOMETER WAS INSTALLED IMMEDIATLY EAST OF TEST HOLE NO.111.

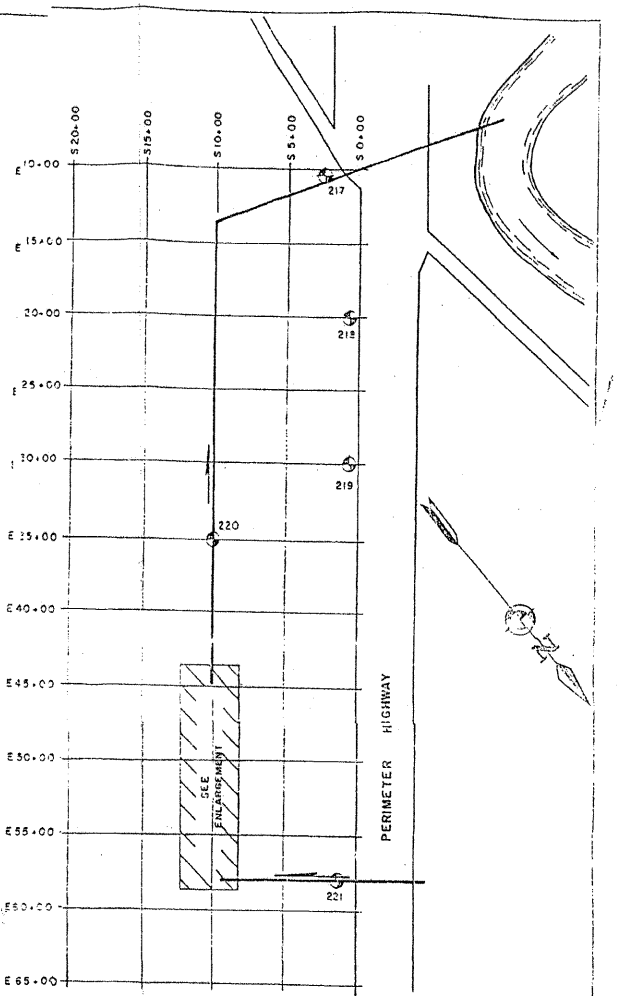
ENLARGEMENT OF TREATMENT PLANT AREA

SCALE: 1in = 200ft

LEGEND:

16"dia. POWER AUGER TEST HOLE

(TC-2) - DENOTES TEST HOLE DRILLED WITH A 4"dia TRI-CONE BIT.



GENERAL SITE LAYOUT AND LOCATION

SCALE: 1in = 500ft.

01	JAN 15.	ADDITION OF TEST HOLE No 221.
	DATE	REVISION DETAILS

DESIGN — DRAWN C J V — TECH — DEC 24/70 — AS SHOWN

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS
VANCOUVER · EDMONTON · CALGARY · WINNIPEG
CANADA

W. L. WARDROP AND ASSOCIATES

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

TITLE: TEST HOLE LOCATION and SITE LAYOUT

DATE OF ISSUE 12/24/70 — PROJECT No. WG0580 — DWG No. C-W-580-01

APPROVED R S

TEST HOLE LOG

DATE November 12, 1970

HOLE NO. 101

SAMPLE DATA				SYMBOL	ELEV. COLLAR	Unconfined Compression Tons Per Sq. Ft.
WEIGHT HAMMER					ELEV. GROUND	1 ● FIELD VANE 2 △ LAB VANE 3 4 ▼UNCONF.
HEIGHT DROP					CO-ORD. LOCATION	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT; X — — — O — — — X; 10 30 50 70 90%
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL	
5	3"Sy		1		1.0' TOPSOIL - black, highly organic	
10	3"Sy		2		CLAY - mottled brown & grey - highly plastic - layered structure - frequent small tan silt lumps - firm to stiff - moist	
15	3"Sy		3			
20 21	3"Sy		4			
26	3"Sy		5		26.0'	
30 31	3"Sy		6		CLAY - dark grey - highly plastic - layered structure - frequent small partings of silt & till-like material - soft to firm - moist to damp	
36	3"Sy		7			
40	3"Sy		8			
45	3"Sy		9		45.0'	
50					GLACIAL TILL - tan--grey color - medium plastic, clayey silt binder, soft, wet At 52' - layer of dark grey clay From 53' - numerous cobbles	
54					54.0'	

NOTES

1. Water at 54.0 ft depth.
2. Slight sloughing of till at 45.0 ft depth.
3. Hole discontinued at 54.0 ft depth in Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 1, 1970

HOLE NO. 102

SAMPLE DATA

WEIGHT HAMMER

HEIGHT DROP

ELEV. COLLAR

ELEV. GROUND

CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. ft.

1 2 3 4

● FIELD VANE Δ LAB VANE ■ UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT

X — — — — O — — — — X

10 30 50 70 90%

DEPTH ELEV	O.D. I.D.	BLOWS FT.	NO.	SYMBOL	DESCRIPTION OF MATERIAL
					1.0' TOPSOIL - black, highly organic
5	Bag		1		CLAY - mottled brown & grey - highly plastic - layered structure
10	2"Sy		2		7' to 8' - firm, moist At 7'-8' - SILT LAYER - tan, medium dense - low plastic, wet
15	Bag		3		At 5' & 15' - occasional silt partings At 15' - occasional inclusions of gypsum crystals
20	2"Sy		4		21.0'
25	Bag		5		CLAY - dark grey - highly plastic - layered structure - firm, moist - occasional partings of silt and till-like material (frequent from 40.0 ft depth on)
30	2"Sy		6		
35	Bag		7		
40	2"Sy		8		
45	Bag		9		47.0'
50			10		GLACIAL TILL - light grey color - low to non-plastic clayey silt binder - soft, wet - pebbles to 3/4"
52	Bag				52.0' At 52' - Till becomes firm to stiff

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 52.0 ft depth. (Maximum Auger Depth).

⊡ Pocket Penetrometer

Ripley, Klein & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT

SOUTH END POLLUTION CONTROL CENTRE

LOCATION

WINNIPEG, MANITOBA

TEST HOLE LOG

DATE November 12, 1970

HOLE NO. 103

SAMPLE DATA | WEIGHT HAMMER | HEIGHT DROP | DEPTH ELEV. | O.D. I.D. | BLOWS FT. | NO. | SYMBOL

ELEV. COLLAR

ELEV. GROUND

CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE Δ LAB VANE ⊕ UNCONF.

PLASTIC LIMIT | WATER CONTENT | LIQUID LIMIT
10 30 50 70 90%

DESCRIPTION OF MATERIAL

			0.6'	TOPSOIL - black, highly organic
5	Bag	1	4'	to 5' SILT LAYER - tan color - medium dense, - low plastic - moist
10				CLAY - mottled brown & grey - highly plastic - layered structure - firm to stiff - moist
13	2"Sy	2		
15	Bag			
20	2"Sy	3	18.5'	- frequent small silt lumps and organic spots
25	Bag	5		CLAY - dark grey - highly plastic - layered structure - firm - moist - frequent small partings of silt & till-like material
30	2"Sy	6		
35	Bag	7		At 22' - inclusions of decayed organic
40	2"Sy	8		
			42.5'	
45	Bag	9		GLACIAL TILL - light grey - low to medium plastic clayey silt binder - stones to 2", soft, wet to saturated
50		10		
52	Bag		52.5'	At 52.5' - becomes hard & moist

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 52.5 ft depth in glacial till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT
SOUTH END POLLUTION CONTROL CENTRE

LOCATION
WINNIPEG, MANITOBA

TEST HOLE LOG

DATE November 12, 1970

HOLE NO. 104

SAMPLE DATA	SYMBOL	
WEIGHT HAMMER		ELEV. COLLAR
HEIGHT DROP		ELEV. GROUND
		CO-ORD. LOCATION

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
				TOPSOIL - black, highly organic
				1.0'
5	Bag		1	3' to 4' SILT LAYER - tan color, low plastic, clayey - wet, soft
10	2"Sy		2	CLAY - mottled brown & grey - highly plastic - layered structure - firm, moist - occasional partings of silt and gypsum crystals
15	Bag		3	
20	2"Sy		4	
				23.0'
25	Bag		5	CLAY - dark grey - highly plastic - soft to firm - damp - occasional partings of non-plastic silt & till-like material - some pebbles to ¼"
30	2"Sy		6	
35	Bag		7	
40	2"Sy		8	
47	Bag		9	46.0'
50			10	GLACIAL TILL - light grey color - low to medium plastic - clayey silt binder - soft, wet - stones to 1½"
52	Bag			52.0'

Unconfined Compressive Tons Per Sq. Ft.

1 2 3 4

● FIELD VANE Δ LAB VANE

PLASTIC LIMIT WATER CONTENT

X — — — — O — — —

10 30 50 70

Pocket Penetrometer

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 52.0 ft depth (maximum auger depth) in soft glacial till.

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 12, 1970

HOLE NO. 105

SAMPLE DATA	SYMBOL	ELEV. COLLAR
WEIGHT HAMMER		ELEV. GROUND
HEIGHT DROP		CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE Δ LAB VANE ▮UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
X — — — — — O — — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
				1.0' TOPSOIL - black, highly organic
5	2"Sy		1	CLAY - mottled brown & grey - highly plastic - layered structure - firm to stiff - moist - occasional partings of silt and of gypsum crystals
10	Bag		2	
15	2"Sy		3	
20	Bag		4	
25	2"Sy		5	At 5' - numerous seams of tan silt
30	Bag		6	30.0'
35	2"Sy		7	CLAY - dark grey - highly plastic - layered structure - soft to firm - damp to wet - occasional small partings of silt & till-like material
40	Bag		8	
45	2"Sy		9	42.5'
50			10	GLACIAL TILL - light grey color, - low to medium plastic clayey silt binder, soft, wet - pebbles to 3/4"
52.5	Bag			At 47' to 48' - till is pinkish in color. 52.5'
				At 52' - till becomes hard, moist

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 52.5 ft in hard Glacial Till.

□ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT
SOUTH END POLLUTION CONTROL CENTRE

LOCATION
WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 1, 1970

HOLE NO. 106

SAMPLE DATA				SYMBOL	ELEV. COLLAR	Unconfined Compression Tons Per Sq. Ft.
WEIGHT HAMMER					ELEV. GROUND	1 2 3 4
HEIGHT DROP					CO-ORD. LOCATION	● FIELD VANE △ LAB VANE ■ UNCONF.
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 30 50 70 90%)

5	Bag	1		TOPSOIL - black, highly organic
				1.0'
				1' to 3.5' SILT LAYER - tan, low plastic
				- medium dense
				- wet, soft,
10	2"Sy	2		CLAY - mottled brown & grey
				- highly plastic
				- layered structure
15	Bag	3		- firm to stiff
				- moist
20	2"Sy	4		From 20' - occasional partings of non-plastic silt.
25	Bag	5		
				26.0'
30	2"Sy	6		CLAY - dark grey
				- highly plastic
				- layered structure
35	Bag	7		- soft to firm
				- moist to damp
40	2"Sy	8		At 40' - frequent partings of non-plastic silt and of till-like material
				41.0'
45	Bag	9		GLACIAL TILL - light grey color
				- medium plastic clayey silt binder, pebbles to 3/4"
50		10		- soft, wet
52	Bag			At 45' - inclusions of dark grey clay as above
				52.0'

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 52.0 ft depth in soft Glacial Till.

□ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

HKL 67.3

PLATE NO. A-W-580-3

TEST HOLE LOG

DATE December 1, 1970

HOLE NO. 107

SAMPLE DATA	SYMBOL	ELEV. COLLAR
WEIGHT HAMMER		ELEV. GROUND
HEIGHT DROP		CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
* FIELD VANE Δ LAB VANE ⊕ UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
X — — — — — O — — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
				1.0' TOPSOIL - black, highly organic
5	2"Sy		1	3' to 5' SILT LAYER - tan, low plastic - soft, damp
10	Bag		2	CLAY - mottled brown & grey - highly plastic - layered structure - firm to stiff - moist At 5' - clay is nuggetty textured At 15' - occasional partings of non-plastic silt & of gypsum crystals
15	2"Sy		3	
20	Bag		4	
25	2"Sy		5	24.0'
30	Bag		6	CLAY - dark grey - highly plastic - layered structure - soft to firm - damp - occasional partings of non-plastic silt
35	2"Sy		7	
40	Bag		8	
45				45.0'
47	Bag		9	GLACIAL TILL - light grey color - medium plastic - clayey, silt binder - soft, wet - stones to 1½"
50	Bag		10	
				52.0'

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 52.0 ft depth in soft Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT
SOUTH END POLLUTION CONTROL CENTRE
LOCATION
WINNIPEG, MANITOBA

PLATE No. A-W-530-9

TEST HOLE LOG

DATE December 1, 1970

HOLE NO. 108

SAMPLE DATA	SYMBOL	ELEV. COLLAR	Unconfined Compressions Per Sq. Ft. 1 2 3 4
WEIGHT HAMMER		ELEV. GROUND	● FIELD VANE Δ LAB VANE ▪ UNCONF.
HEIGHT DROP		CO-ORD. LOCATION	PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT X — — — o — — — X 10 30 50 70 90%
DEPTH ELEV. / O.D. I.D. / BLOWS FT. / NO.		DESCRIPTION OF MATERIAL	

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.
5	2"Sy		1
10	Bag		2
15	2"Sy		3
20	Bag		4
25	2"Sy		5
30	Bag		6
35	2"Sy		7
40	Bag		8
45	2"Sy		9
50	Bag		10

1.0' TOPSOIL - black, highly organic

3' to 5' SILT LAYER - tan, low plastic.
- soft, damp to wet

CLAY - mottled brown & grey
- highly plastic
- layered structure
- firm to stiff
- moist
- occasional partings of non plastic silt

At 5'- clay has nuggetty texture

23.0'

CLAY - dark grey
- highly plastic
- layered structure
- firm
- damp to wet
- occasional partings of non-plastic silt & of till-like material

44.0'

GLACIAL TILL - light grey color
- medium plastic clayey silt binder
- soft, wet
- pebbles to 3/4"

52.0'

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 52.0 ft depth in soft, wet, Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 2, 1970

HOLE NO. 109

SAMPLE DATA				SYMBOL	ELEV. COLLAR	RIG: Power Auger
WEIGHT HAMMER					ELEV. GROUND	TECHNICIAN: J. Adams
HEIGHT DROP					CO-ORD. LOCATION	
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL	

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE Δ LAB VANE ■ UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
X — — — — O — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.
5	2"Sy		1
10	Bag		2
15	2"Sy		3
20	Bag		4
25	2"Sy		5
30	Bag		6
35	2"Sy		7
40	Bag		8
45	Bag		9
50	Bag		10

1.0' TOPSOIL - black, highly organic

3' to 5' SILT LAYER - tan, low plastic
- soft, damp to wet

CLAY - mottled brown & grey
- highly plastic
- layered structure
- firm to stiff
- moist
- frequent small partings of non-plastic silt

27.0'

CLAY - dark grey
- highly plastic
- layered structure
- firm
- damp
- numerous small partings of non-plastic silt & of till like material

47.0'

GLACIAL TILL - light grey color
- medium plastic
- clayey silt binder
- soft, wet

51.5'

NOTES

1. No water.
2. No sloughing of test hole.
3. Refusal on boulder at 51.5 ft depth in soft Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT
SOUTH END POLLUTION CONTROL CENTRE

LOCATION
WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 2, 1970

HOLE NO. 110

SAMPLE DATA	SYMBOL	ELEV. COLLAR
WEIGHT HAMMER		ELEV. GROUND
HEIGHT DROP		CO-ORD. LOCATION

Unconfineg Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE Δ LAB VANE ⁕UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
X — — — — — O — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
				1.0' TOPSOIL - black, highly organic
5	Bag		1	2' to 3' SILT LAYER - tan, low plastic - soft, damp to wet
10	2"Sy		2	CLAY - mottled brown & grey - highly plastic - layered structure - stiff - moist - frequent partings of non-plastic silt & gypsum crystals
15	Bag		3	
20	2"Sy		4	
				At 21' - odd ½" silt seam, tan - non-plastic
25	Bag		5	24.0'
				CLAY - dark grey - highly plastic - layered structure - firm - damp - frequent small partings of till-like material.
30	2"Sy		6	
35	Bag		7	
40	2"Sy		8	
45	Bag		9	
50	Bag		10	50.0'
52	Bag		11	GLACIAL TILL - light grey color - medium plastic clayey-silt binder, soft - wet
				52.0'

NOTES

1. No water.
2. No sloughing of test hole.
3. Refusal on boulder at 52.0 ft depth in soft Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE
LOCATION: WINNIPEG, MANITOBA

DATE December 2, 1970

TEST HOLE LOG

HOLE NO. 111

SAMPLE DATA	SYMBOL	ELEV. COLLAR
WEIGHT HAMMER		ELEV. GROUND
HEIGHT DROP		CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE △ LAB VANE ⊕ UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
X — — — — O — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
				1.0' TOPSOIL - black, highly organic
5	2"Sy		1	5' to 6' SILT LAYER - tan, low to non-plastic - soft, damp
10	Bag		2	CLAY - mottled brown & grey - highly plastic - layered structure - firm to stiff - moist
15	2"Sy		3	
20	Bag		4	
25	2"Sy		5	25.0' - frequent small partings of non-plastic silt and of gypsum crystals
30	Bag		6	
35	2"Sy		7	CLAY - dark grey - highly plastic - layered structure - firm - moist to damp - frequent small partings of till-like material
40	Bag		8	
45	2"Sy		9	
50	Bag		10	
52	Bag			51.0' GLACIAL TILL - light grey, medium plastic, clayey, silt binder, soft, wet At 53' - becomes drier & dense
53	Bag			
			11,12	53.0'
			13	

NOTES

1. No water.
2. No sloughing of test hole.
3. Refusal at 53.0 ft depth on boulder in dense Glacial Till.

□ Pocket Penetrometer

Kilgour, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE
LOCATION: WINNIPEG, MANITOBA

PLATE No. A-W-580-11

TEST HOLE LOG

DATE December 2, 1970

HOLE NO. 112

SAMPLE DATA | WEIGHT HAMMER | HEIGHT DROP | SYMBOL | ELEV. COLLAR | ELEV. GROUND | CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE Δ LAB VANE ✱UNCONF.

PLASTIC LIMIT | WATER CONTENT | LIQUID LIMIT
X — — — — o — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
5	Bag		1	1.0' TOPSOIL - black, highly organic
10	2"Sy		2	CLAY - mottled brown & grey - highly plastic - layered structure - firm to stiff - moist - frequent small partings of non-plastic silt
15	Bag		3	
20	2"Sy		4	
25	Bag		5	
				27.0'
30	2"Sy		6	CLAY - dark grey - highly plastic - layered structure - soft to firm - occasional small partings of non-plastic silt At 40' - numerous ½" seams of light grey Glacial Till pebbles to ¾"
35	Bag		7	
40	2"Sy		8	
				41.0'
45	Bag		9	GLACIAL TILL - light grey color - medium plastic, clayey-silt binder - soft, wet to saturated - pebbles to 3/4"
50				47.0'

NOTES

1. No water.
2. Sloughing experienced in Glacial Till from 41.0 ft depth.
3. Hole discontinued at 47.0 ft depth in Glacial Till (due to drill failure).

⊡ Pocket Penetrometer

Ripley, Klohn & Leinoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE
LOCATION: WINNIPEG MANITOBA

TEST HOLE LOG

DATE November 12, 1970

HOLE NO. 113

SAMPLE DATA | WEIGHT HAMMER | HEIGHT DROP

ELEV. COLLAR

ELEV. GROUND

CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.

1 2 3 4

● FIELD VANE Δ LAB VANE ▮ UNCONF.

PLASTIC LIMIT | WATER CONTENT | LIQUID LIMIT

X — — — — O — — — — X

10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	SYMBOL	DESCRIPTION OF MATERIAL
					0.5' TOPSOIL - black, highly organic
5	Bag		1		1.0' SILT - light grey - moist - loose, organic
10	2"Sy		2		CLAY - mottled brown & grey - highly plastic - layered structure - firm to stiff - moist - occasional small partings of gypsum
15	Bag		3		
20	2"Sy		4		19.0' From 1' to 7' - numerous seams of very fine, tan, silty, sand, wet to sat.
25	Bag		5		
30	2"Sy		6		CLAY - dark grey - highly plastic - layered structure - soft to firm, damp - frequent small partings of of till-like material
35	Bag		7		
40	2"Sy		8		
45	Bag		9		At 45' - traces of organic material
50			10		47.0' GLACIAL TILL - light grey - medium plastic, clayey silt binder, soft, wet to saturated - pebbles to ½"
52.5	Bag				52.5'

NOTES

1. Indication of water at 7.0 ft and at 47.0 ft depths.
2. Some sloughing of sand layer(s) at 7.0 ft depth.
3. Hole discontinued at 47.0 ft depth in soft Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT

SOUTH END POLLUTION CONTROL CENTRE

LOCATION

WINNIPEG MANITOBA

TEST HOLE LOG

DATE November 13, 1970

HOLE NO. 114

SAMPLE DATA | WEIGHT HAMMER | HEIGHT DROP | SYMBOL | ELEV. COLLAR | ELEV. GROUND | CO-ORD. LOCATION

Uncontined Compression Tons Per Sq. Ft.
1 2 3 4
• FIELD VANE Δ LAB VANE ▪ UNCONF.

PLASTIC LIMIT | WATER CONTENT | LIQUID LIMIT
X — — — — O — — — -X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
				2.0' TOPSOIL - black, highly organic
5	2"Sy		1	CLAY - mottled brown & grey
				- highly plastic
10	Bag		2	- layered structure
				- firm to stiff, moist
15	2"Sy		3	- frequent small partings of non-plastic silt & of gypsum crystal
20	Bag		4	- rust stains & organic spots
25	2"Sy		5	At 4' - 5' - layer(s) of tan silt
				26.0'
30	Bag		6	CLAY - dark grey, highly plastic
				- layered structure
35	2"Sy		7	- soft to firm
				- moist to damp
40	Bag		8	- frequent small partings of till-like material
				42.0'
45	2"Sy		9	GLACIAL TILL - light grey, medium plastic, clayey silt binder
				- soft, wet to saturated
			10	At 46' - becomes drier & quite dense
50	Bag			50.0'

NOTES

1. No water.
2. No sloughing of test hole.
3. Refusal at 50.0 ft depth on boulders on dense Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leinoff International Ltd.
CONSULTING ENGINEERS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION

DATE December 18, 1970

TEST HOLE LOG

HOLE NO. 115

SAMPLE DATA	SYMBOL	
WEIGHT HAMMER		ELEV. COLLAR
HEIGHT DROP		ELEV. GROUND
DEPTH ELEV. / O.D. I.D. / BLOWS FT. / NO.		CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE Δ LAB VANE ▮ UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
X — — — — o — — — — X
10 30 50 70 90%

DESCRIPTION OF MATERIAL

5	2"Sy	1	
10	Bag	2	
15	2"Sy	3	
20	Bag	4	
25	2"Sy	5	
30	Bag	6	
35	2"Sy	7	
40	Bag	8	
45	2"Sy	9	
50			
52.5	Bag	10	

1.0' TOPSOIL - black, highly organic

4.0' CLAY - grey, silty, organic
- medium to highly plastic
- firm, nuggetty

CLAY - mottled brown & grey
- highly plastic
- laminated structure
- stiff
- silt lumps
- nuggetty to 10 ft

At 20' - small spots of weathered rock

23.0'

CLAY - grey
- highly plastic
- laminated structure
- firm to stiff
- odd silt lump
- occasional spots of weathered rock

42.0'

GLACIAL TILL - light grey
- medium plastic
- soft to firm to dense
- till becomes dryer & harder at 51.0 ft depth
- pebbles to 3/4"

52.5'

NOTES

1. Hole terminated at 52.5 ft depth in till.
2. No free water encountered.
3. No sloughing.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE
LOCATION: WINNIPEG, MANITOBA

PLATE No. A-W-530-17

TEST HOLE LOG

DATE December 18, 1970

HOLE NO. 116

SAMPLE DATA	SYMBOL	ELEV. COLLAR	Unconfined Compression Tons Per Sq. Ft.
WEIGHT HAMMER		ELEV. GROUND	1 2 3 4
HEIGHT DROP		CO-ORD. LOCATION	● FIELD VANE △ LAB VANE ■ UNCONF.

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL	PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT
				TOPSOIL - black, highly organic medium plastic	10 30 50 70 90%
1.0'					
5	2"Sy		1	CLAY - grey, silty, organic - medium plastic, moist	
4.0'					
				SILT - tan, moist - non-plastic	
5.0'					
10	Bag		2	CLAY - mottled brown & grey - highly plastic - firm to stiff - laminated structure - silt lumps	
15	2"Sy		3	At 10' - large spots of weathered rock	
20	Bag		4	At 20' - rust spots	
25	2"Sy		5		
25.0'					
30	Bag		6	CLAY - grey - highly plastic - laminated structure - silt lumps - occasional small pebbles - firm to soft	
35	2"Sy		7		
40	Bag		8		
44.0'					
45	2"Sy		9	GLACIAL TILL - light grey - medium plastic - soft to firm	
50				At 52' - till becomes stiff to hard	
52.5	Bag		10		
52.5'					

NOTES

1. No water encountered.
2. No sloughing.
3. Hole terminated at 52.5 ft depth in till.

□ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 18, 1970

HOLE NO. 117

SAMPLE DATA | WEIGHT HAMMER | HEIGHT DROP

ELEV. COLLAR

ELEV. GROUND

CO-ORD. LOCATION

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	SYMBOL
5	Bag		1	
10	2"Sy		2	
15	Bag		3	
20	2"Sy		4	
25	Bag		5	
30	2"Sy		6	
35	Bag		7	
40	2"Sy		8	
45	Bag		9	
50				
51.5	Bag		10	

DESCRIPTION OF MATERIAL

1.0' TOPSOIL - black, highly organic wet

CLAY - grey, nuggetty, wet organic

4.0'

SILT - grey & tan mixture
- rust spots
- low to non-plastic

6.0'

CLAY - mottled brown & grey
- highly plastic
- laminated structure
- firm to stiff
- silt lumps
- odd small spots of weathered rock and gypsum at 15.0 ft
- numerous thin silt seams at 21.0 ft depth

26.0'

CLAY - grey
- highly plastic
- laminated structure
- firm to soft
- occasional silt lumps and pebbles

47.0'

GLACIAL TILL - light grey
- medium plastic
- soft to firm

At 51' - till is dryer & more dense
- stones to 4"

52.5'

NOTES

1. No free water.
2. No sloughing.
3. Hole terminated on boulders at 52.5 ft depth.

Unconfined Compression Tons Per Sq. Ft.

1 2 3 4

● FIELD VANE Δ LAB VANE ⊕ UNCONF.

PLASTIC LIMIT | WATER CONTENT | LIQUID LIMIT

X — — — — O — — — — X

10 30 50 70 90%

□ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 9, 1970

HOLE NO. 217

SAMPLE DATA				SYMBOL	ELEV. COLLAR	Unconfined Compression Tons Per Sq. Ft.
WEIGHT HAMMER					ELEV. GROUND	1 2 3 4
HEIGHT DROP					CO-ORD. LOCATION	● FIELD VANE △ LAB VANE ⊗ UNCONF.
DEPTH ELEV	C.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
						X — — — — O — — — -X
						10 30 50 70 90%
5	Bag		1		1.0' TOPSOIL - black, highly organic	
10	Bag		2		CLAY - mottled brown & grey	
15	Bag		3		- highly plastic	
20	Bag		4		- layered structure	
25	Bag		5		- firm to stiff	
30	Bag		6		- moist	
					26.0' CLAY - dark grey, highly plastic	
					- layered structure	
					30.0' - firm	
					- moist to damp	

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 30.0 ft depth in firm grey clay.

□ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE December 13, 1970

HOLE NO. 218

SAMPLE DATA	SYMBOL	ELEV. COLLAR	Unconfined Compressions Per Sq. Ft.
WEIGHT HAMMER		ELEV. GROUND	1 2 3 4
HEIGHT DROP		CO-ORD. LOCATION	● FIELD VANE Δ LAB VANE
DEPTH ELEV. / O.D. I.D. / BLOWS FT. / NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT WATER CONTENT X — — — O — — — 10 30 50 70

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.
5	2"Sy		1
10	Bag		2
15	2"Sy		3
20	Bag		4
25	2"Sy		5
30	Bag		6
35	2"Sy		7
40	Bag		8
45	2"Sy		9
50	Bag		10

1.0 TOPSOIL - black, highly organic

SILT - tan, non-plastic
- loose
- saturated

5.0

CLAY - mottled brown & grey
- highly plastic
- layered structure
- firm to stiff
- moist
- occasional small partings of non-plastic silt

23.0

CLAY - dark grey
- highly plastic
- firm
- damp to wet
- frequent small partings of till-like material

50.0 GLACIAL TILL - light grey
- medium plastic
- clayey silt binder
- soft to firm
- wet

52.5

NOTES

1. Water at 5.0 ft in silt layer.
2. Sloughing of silt from 1.0 ft to 5.0 ft level.
3. Hole discontinued at 52.5 ft dpeth in soft Glacial Till.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CEN
LOCATION: WINNIPEG, MANITOBA

PLATE NO. A-6-1

TEST HOLE LOG

DATE December 21, 1970

HOLE NO. 219

SAMPLE DATA	SYMBOL	ELEV. COLLAR
WEIGHT HAMMER		ELEV. GROUND
HEIGHT DROP		CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE Δ LAB VANE ⊕ UNCONF.

PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
X — — — — — O — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.
5	Bag		1
10	2"Sy		2
15	Bag		3
20	2"Sy		4
25	Bag		5
30	2"Sy		6
35	Bag		7
40			

DESCRIPTION OF MATERIAL

TOPSOIL - black, highly organic

1.0'

SILT - tan, wet to saturated
- non-plastic

4.0'

CLAY - mottled brown & grey
- highly plastic
- laminated structure
- stiff to firm
- silt lumps
- occasional gypsum inclusions

20.0'

CLAY - grey
- highly plastic
- laminated structure
- firm
- silt lumps & inclusions

35.0'

NOTES

1. Hole terminated at 35.0 ft depth in clay.
2. No free water encountered.
3. No sloughing.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE
LOCATION: WINNIPEG, MANITOBA

A-W-589-2

TEST HOLE LOG

DATE December 8, 1970

HOLE NO. 220

SAMPLE DATA				SYMBOL	ELEV. COLLAR	Unconfined Compression Tons Per Sq. Ft.
WEIGHT HAMMER					ELEV. GROUND	1 2 3 4
HEIGHT DROP					CO-ORD. LOCATION	• FIELD VANE Δ LAB VANE ×UNCONF.
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (X — — — O — — — X) 10 30 50 70 90%
					TOPSOIL - black, highly organic	
1.0'						
5	Bag		1		6' to 8' SILT LAYER - tan, low plastic - soft, wet	
10	2"Sy		2		CLAY - mottled brown & grey - highly plastic - layered structure - firm - moist - frequent small partings of non-plastic silt	
15	Bag		3			
20	2"Sy		4			
20.6'					CLAY - dark grey - highly plastic - layered structure - firm, moist - frequent small partings of non-plastic silt & of till-like material	
25	Bag		5			
30	2"Sy		6			
31.5'						

NOTES

1. No water.
2. No sloughing of test hole.
3. Hole discontinued at 31.5 ft depth in grey clay

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE January 15, 1971

HOLE NO. 221

SAMPLE DATA				SYMBOL	ELEV. COLLAR	Unconfined Compression Tons Per Sq. Ft.
WEIGHT HAMMER					ELEV. GROUND	1 2 3 4
HEIGHT DROP					CO-ORD. LOCATION	● FIELD VANE Δ LAB VANE ✱ UNCONF.
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT; X — — — O — — — X; 10 30 50 70 90%
					1.0' TOPSOIL - black, highly organic	
5	Bag		1			
					7'-9' SILT - tan, medium dense, damp	
10	3"Sy		2		CLAY - mottled brown & grey - highly plastic - layered structure - firm to stiff - moist	
15	Bag		3			
20	3"Sy		4		At 18' - partings of white gypsum crystals	
					23.0'	
25	Bag		5		CLAY - dark grey, - highly plastic - layered structure - soft to firm - damp to wet - numerous small partings of light grey till-like material - frequent silt lumps to 1/2 inch	
30	3"Sy		6			
35	Bag		7			
40	3"Sy		8			
45	Bag		9			
					45.0'	

NOTES

1. Hole discontinued at 45.0 ft depth in grey clay.

2. No water. No sloughing.

⊡ Pocket Penetrometer

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

Plate No. A-W-[illegible]-33

TEST HOLE LOG

DATE December 24, 1970

HOLE NO. T.C. 1

SAMPLE DATA	SYMBOL		COHESION – TONS/SQ. FT.
WEIGHT HAMMER		ELEV. COLLAR RIG: Acker	0.2 0.6 1.0 1.4 1.8
HEIGHT DROP		ELEV. GROUND TECHNICIAN: J. Adams	● FIELD VANE Δ LAB VANE ×UNCONF.
DEPTH ELEV. / O.D. I.D. / BLOWS FT. / NO.		CO-ORD. LOCATION	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT; X — — — — O — — — — X; 10 30 50 70 90%
		DESCRIPTION OF MATERIAL	

40

OVERBURDEN

50

49.0'

TILL-LIKE - till
- light grey
- soft

60

60.0'

TILL-LIKE - light grey
- firmer than above

65.0'

GLACIAL TILL - light grey
- hard
- cuttings were mostly light grey fine sands

70

74.0'

LIMESTONE - 74' to 77' very solid
- 77' to 79' softer lime stone, loss of water from pump

80

81.0'

79'-81' - very solid lime-stone

NOTES

1. Auger refusal at 65.0 ft depth
2. Tricone used 65.0 - 81.0 ft depth.
3. Complete water loss below 77 ft depth.

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

PLATE No. A-W-582-2

TEST HOLE LOG

DATE December 24, 1970 — HOLE NO. T.C. 2

SAMPLE DATA				SYMBOL	ELEV. COLLAR	RIG: Acker	COHESION – TONS/SQ. FT.
WEIGHT HAMMER					ELEV. GROUND	TECHNICIAN: J. Adams	0.2 0.6 1.0 1.4 1.8
HEIGHT DROP					CO-ORD. LOCATION		● FIELD VANE Δ LAB VANE ■ UNCONF.
DEPTH FEET	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL		PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT
							X – – – – O – – – – X
							10 30 50 70 90%

40

OVERBURDEN - See Test Bore #111

50

50.0'

TILL-LIKE - light grey

- soft

- auger refusal at 60.5'

60

60.5'

LIMESTONE -

- 60.5' to 62.0' solid limestone
- 62.0' to 63.0' layer of softer broken limestone
- 63.0' to 63.5' solid limestone
- 63.5' to 65.0' broken limestone
- 65.0' to 68.0' solid limestone

68.0'

70

NOTES

1. Water circulated into hole was lost.

2. End of hole. At 68.0 ft was in limestone.

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANIC . & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

87003435

TITLE: REPORT ON INSTALLATION OF TEST CAISSONS AT SOUTH END POLLUTION CONTROL CENTRE T.P.

LOCATION: WINNIPEG, MANITOBA

CLIENT: W. L. WARDROP & ASSOCIATES LTD.

JOB NO: W - 619 DATE: March 24, 1971

PROPERTY
OF THE
Waterworks, Waste & Disposal Department
MAIN OFFICE
RESOURCE CENTRE

TEST HOLE LOG

DATE March 4, 1971

HOLE NO. Test Caisson #1

SAMPLE DATA				SYMBOL	ELEV. COLLAR	TECH: J. Odermatt	Unconfined Compression Tons Per Sq. Ft.
WEIGHT HAMMER					ELEV. GROUND	RIG: Williams Auger	1 2 3 4 ● FIELD VANE Δ LAB VANE ⊠ UNCONF.
HEIGHT DROP					CO-ORD. LOCATION	8+20S & 57+88E	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT X — — — O — — — X 10 30 50 70 90%
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL		

10

CLAY - mottled brown & grey

- highly plastic

20

- layered structure

25.0'

30

CLAY - grey

- highly plastic

40

- layered structure

47.5'

50 Bag 1

TILL-LIKE MATERIAL
- light grey, very sandy
- silt binder
- soft & wet, clayey
- some cobbles & some sand layers or pockets

Bag 2

Bag 3

57.0'

60

GLACIAL TILL - light tan
- very sandy dilates
- soft cobbles
- very little silt binder

Bag 4

60.0'

66.0'

GRAVEL - sandy with angular broken limestone (less than 18 inches dia.)

67.5'

70 Bag 5

71.0'

LIMESTONE - hard, broken
- fractured, sand & gravel inclusions

LIMESTONE - hard, sound rock
- competent rock

Pocket Penetrometer
Disturbed Sample

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT
SOUTH END POLLUTION CONTROL CENTRE

LOCATION
WINNIPEG, MANITOBA

TEST HOLE LOG

DATE: 1971

HOLE NO. Test Caisson #1

SAMPLE DATA				SYMBOL	ELEV. COLLAR / ELEV. GROUND / CO-ORD. LOCATION / DESCRIPTION OF MATERIAL	COHESION – TONS/SQ. FT. (0.2, 0.6, 1.0, 1.4, 1.8; ● FIELD VANE, Δ LAB VANE, ■ UNCONF.) / PLASTIC LIMIT – WATER CONTENT – LIQUID LIMIT (X – – – – O – – – – X; 10, 30, 50, 70, 90%)
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.			

WEIGHT HAMMER

HEIGHT DROP

NOTES

1. Signs of free water at 48.5 ft.
2. Water inflow very rapid at 54.0 ft
3. In five minutes water rose to a depth of 34.0 ft below ground level.
4. Hole caved at 54.0 ft (to a depth of 51.0 ft).
5. End of hole in limestone at 71.0 ft.
6. Water inflow measured at 60 gpm during attempts to dewater the caisson.

PROPERTY
OF THE
Waterworks, Waste & Disposal Department
MAIN OFFICE
RESOURCE CENTRE

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT
SOUTH END POLLUTION CONTROL CENTRE

LOCATION
WINNIPEG, MANITOBA

TEST HOLE LOG

DATE March 5, 1971

HOLE NO. Test Caisson #2

SAMPLE DATA				SYMBOL	ELEV. COLLAR	TECH: J. Odermatt
WEIGHT HAMMER					ELEV. GROUND	RIG: Williams Auger
HEIGHT DROP					CO-ORD. LOCATION	7+90S & 58+39E
DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.		DESCRIPTION OF MATERIAL	

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE △ LAB VANE ● UNCONF

PLASTIC LIMIT — WATER CONTENT — LIQU LIM
X — — — — — O — — — — →
10 30 50 70 90

10
20
25.0'
30
40
50

CLAY - mottled brown & grey
- highly plastic
- layered structure

CLAY - grey
- highly plastic
- layered structure

50	Bag	1	50.0' TILL-LIKE MATERIAL - light grey - silt binder
	Bag	2	54.0' - sandy, clayey, soft SAND - light tan, silty, soft - wet - pebbles to 3/8" diameter
	Bag	3	
60	Bag	4	60.0' GLACIAL TILL - light tan, sandy - soft, very little silt binder, numerous boulders less than 24 inches dia.
	Bag	5	66.0'
	Bag	6	68.0' SAND - light tan, coarse, at 68 ft - till-like, putty whitish-grey, numerous boulders
70			71.0' LIMESTONE - hard - competent rock

☑ Pocket Penetrometer
Disturbed Sample

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENT
LOCATION: WINNIPEG, MANITOBA

TEST HOLE LOG

DATE March 5, 1971

HOLE NO. Test Caisson #2

SAMPLE DATA				SYMBOL	ELEV. COLLAR	COHESION – TONS/SQ. FT. 0.2 0.6 1.0 1.4 1.8 • FIELD VANE Δ LAB VANE ■ UNCONF.
WEIGHT HAMMER					ELEV. GROUND	
HEIGHT DROP					CO-ORD. LOCATION	PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT; X — — — — O — — — — X; 10 30 50 70 90
DEPTH / ELEV.	O.D. / I.D.	BLOWS / FT.	NO.		DESCRIPTION OF MATERIAL	

NOTES

1. Trace of water at 54.0 ft. Hole caving badly.
2. At 57.5 ft water started flowing in. Water rose to a depth of 41.5 ft. below ground surface.
3. Hole was left open overnight and depth to water was 31.0 ft, and depth to soil was 56.0 ft.
4. End of hole was at 71.0 ft in hard solid competent limestone.
5. Water inflow measured at 75 gpm during attempts to dewater caisson.

Ripley, Klohn & Leonoff International Ltd.

CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

PROJECT: SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

REPD TP 711.R46 1971

87003436

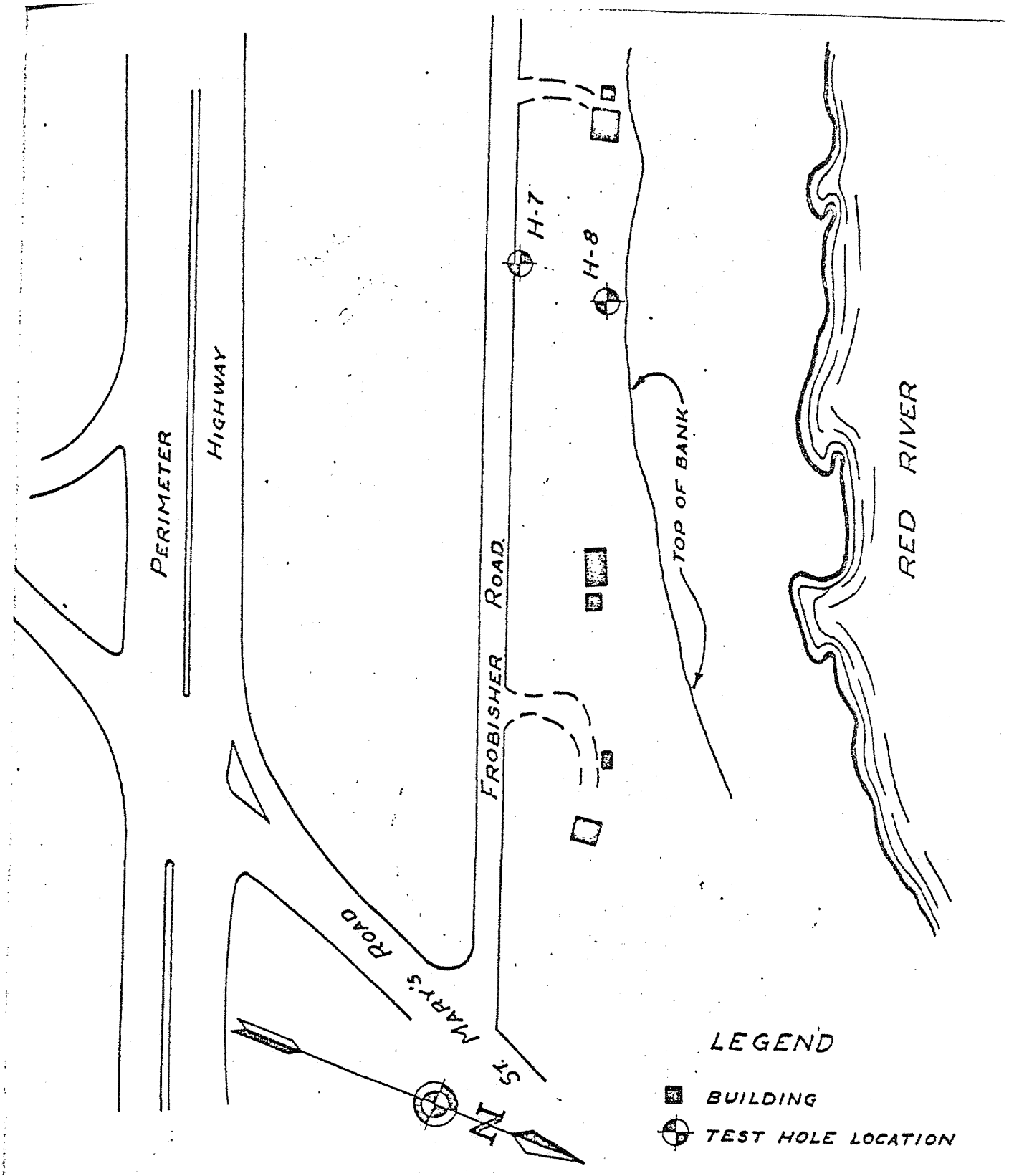
TITLE: TEST HOLES DRILLED AT OUTFALL STAGE ASSOCIATED WITH SOUTH END POLLUTION CONTROL CENTRE

LOCATION: WINNIPEG, MANITOBA

CLIENT: METRO WATERWORKS & WASTE DISPOSAL DIVISION

JOB NO: W-623 DATE: April 14, 1971

PROPERTY
OF THE
Waterworks, Waste & Disposal Department
MAIN OFFICE
RESOURCE CENTRE



SCALE 1"=100'

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS
VANCOUVER — EDMONTON — CALGARY — WINNIPEG CANADA

SUBSOIL INVESTIGATION
SEWAGE OUTFALL LOCATION
TEST-HOLE LOCATION PLAN.

CLIENT: M. C. G. W.

APPROVED R. S.

DATE 25/03/71

A-W-623-01

TEST HOLE LOG

DATE March 24, 1971 HOLE NO. 1

SAMPLE DATA | WEIGHT HAMMER | HEIGHT DROP | DEPTH ELEV. | O.D. I.D. | BLOWS FT. | NO. | SYMBOL

ELEV. COLLAR TECH: C. J. Vann

ELEV. GROUND (759.9) RIG: 16" Power Auger

CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
● FIELD VANE △ LAB VANE ■ UNCONF.

PLASTIC LIMIT | WATER CONTENT | LIQUID LIMIT
X — — — — O — — — — X
10 30 50 70 90%

DESCRIPTION OF MATERIAL	
CLAY - dark brown - sandy, silty - frequent inclusions of gypsum crystals	7.0'
CLAY - mottled brown & grey - highly plastic - laminated structure - gypsum crystals - silt lumps - firm to stiff	24.0'
CLAY - grey - highly plastic - laminated structure - silt lumps - at 45'0" - numerous till-like inclusions and material is wet and soft	50.0'
TILL-LIKE - light tan-grey - clayey, silt binder - firm - damp to wet, cobbles from 54'0"	60.0'

10 20 30 40 50 60

3"Sy 1 | 3"Sy 2 | 3"Sy 3 | 3"Sy 4

NOTES

1. Water at 50'0" in till.
2. Hole discontinued at 60'0", the maximum extent of the auger.

□ Pocket Penetrometer
Undisturbed Sample

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS | FOUNDATIONS

SEWAGE OUTFALL
SOUTH END POLLUTION CONTROL CENTRE
LOCATION
WINNIPEG MANITOBA

TEST HOLE LOG

DATE March 24, 1971 HOLE NO. 2

SAMPLE DATA | WEIGHT HAMMER | HEIGHT DROP | SYMBOL

ELEV. COLLAR TECH: C. J. Vann

ELEV. GROUND (758.8) RIG: 16" Power Auger

CO-ORD. LOCATION

Unconfined Compression Tons Per Sq. Ft.
1 2 3 4
• FIELD VANE △ LAB VANE ▪ UNCONF.

PLASTIC LIMIT | WATER CONTENT | LIQUID LIMIT
X — — — — O — — — — X
10 30 50 70 90%

DEPTH ELEV.	O.D. I.D.	BLOWS FT.	NO.	DESCRIPTION OF MATERIAL
				CLAY - dark brown, sandy, silty - moist - firm to stiff
6.0'				
10	3"Sy		1	CLAY - mottled brown & grey - highly plastic - laminated structure - gypsum inclusions at 10'0" - silt lumps - from 6'0" to 8'0" - numerous layers of tan silt - at 17'0" to 19'0" - layer of grey clay
20	3"Sy		2	
30	3"Sy		3	
30.0'				CLAY - grey, highly plastic - laminated structure - silt lumps, firm to stiff - at 35'0" - frequent inclusions of till-like material, at 46'0" - large seams of soft till-like material
40	3"Sy		4	
50				
50.0'				TILL-LIKE - light tan-grey - soft, damp to wet - cobbles & boulders from 55'0"
	Bag		5	
60				
60.0'				

NOTES

1. Water at 50'0", fifteen minutes after drilling.
2. Hole ended at 60'0", the maximum depth of the auger.

□ Pocket Penetrometer Undisturbed Sample

▨ Pocket Penetrometer Disturbed Sample

Ripley, Klohn & Leonoff International Ltd.
CONSULTING ENGINEERS | SOIL MECHANICS & FOUNDATIONS

SEWAGE OUTFALL
SOUTH END POLLUTION CONTROL CENTRE
LOCATION WINNIPEG, MANITOBA

RKL 67.3

PLATE No. A-W-62

GEOTECHNICAL ENGINEERING REPORT

SOUTH END WATER POLLUTION CONTROL CENTRE

Prepared For

WARDROP ENGINEERING INC.

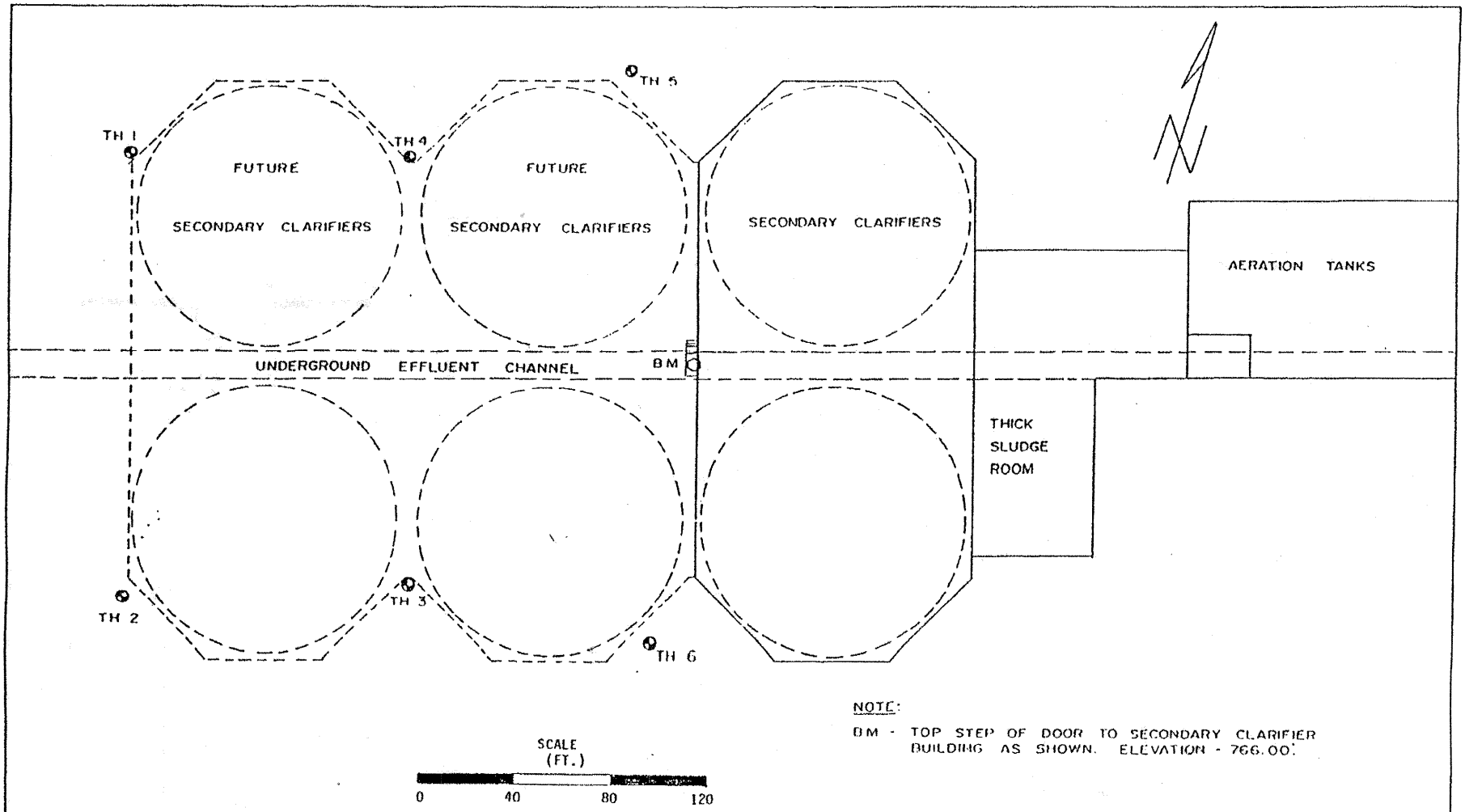
MACLAREN ENGINEERS INC.

On Behalf of

THE CITY OF WINNIPEG

April 15, 1988

Project No. 88528



NOTE:

BM - TOP STEP OF DOOR TO SECONDARY CLARIFIER BUILDING AS SHOWN. ELEVATION - 766.00'

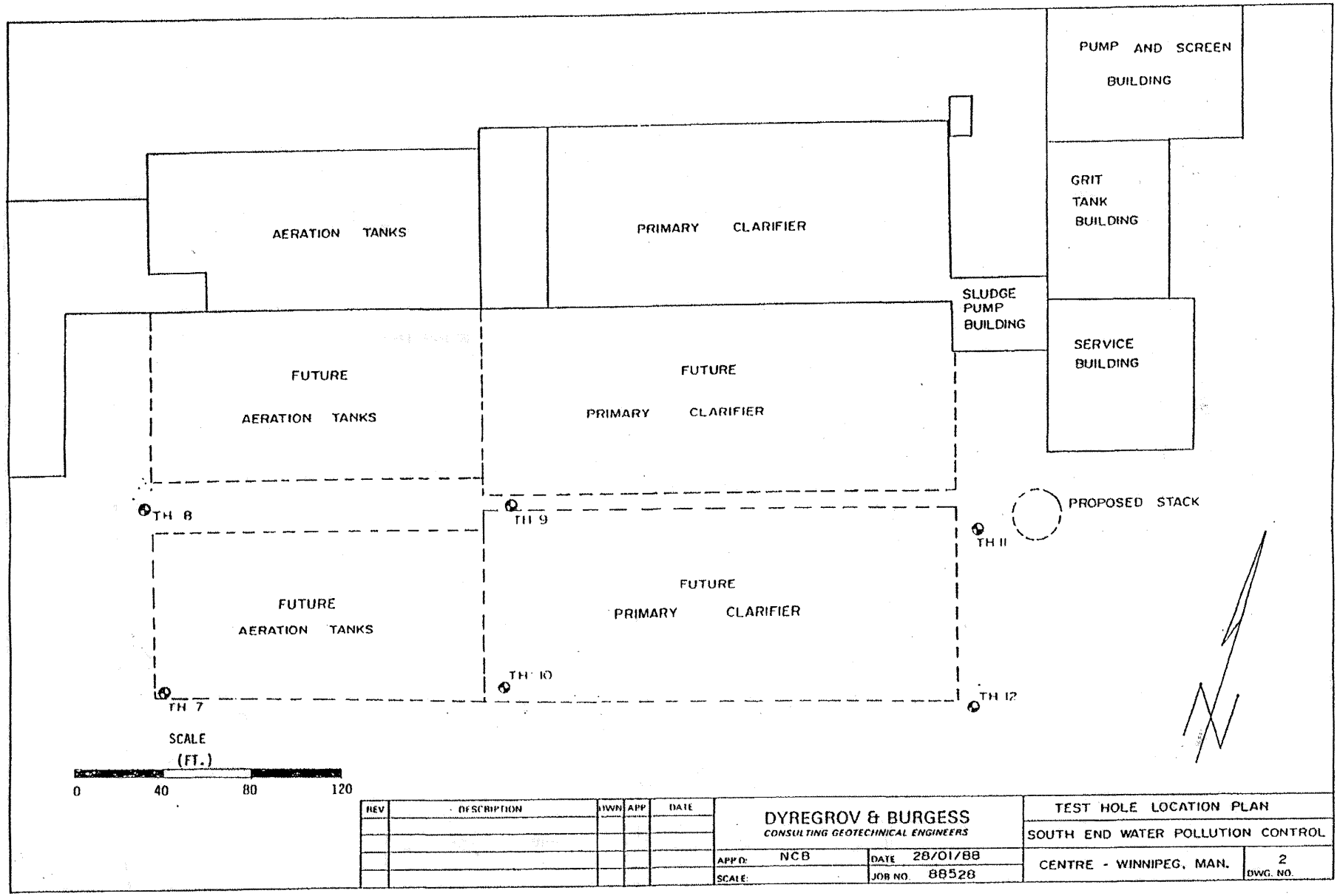
REV	DESCRIPTION	DWN	APP	DATE

DYREGROV & BURGESS
CONSULTING GEOTECHNICAL ENGINEERS

APP'D NCB | DATE 22/01/88
SCALE: | JOB NO. 88528

TEST HOLE LOCATION PLAN
SOUTH END WATER POLLUTION CONTROL
CENTRE - WINNIPEG, MAN.

DWG. NO. 1



REV	DESCRIPTION	DWN	APP	DATE

DYREGROV & BURGESS
CONSULTING GEOTECHNICAL ENGINEERS

APP'D:	NCB	DATE	28/01/88
SCALE:		JOB NO.	88528

TEST HOLE LOCATION PLAN
SOUTH END WATER POLLUTION CONTROL CENTRE - WINNIPEG, MAN.
DWG. NO. 2

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	29/02/88	88528	1

DRILL TYPE: 18" Auger

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

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION (DATUM — SURFACE ELEVATION 762.17')	SOIL SAMPLE: CONDITION / TYPE / PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay, trace gravel		
		Clay -black		
		Clay -silty, brown		
		Silt -tan, moist		
		Clay -mottled brown -highly plastic -stiff to firm -gypsum inclusions to 17'		
10				
			U	qu=2170psf γ_w=105.6pcf pp=3165psf Tv=1620psf
20				
		grey		
30				
			U	qu=855psf γ_w=102.2pcf pp=1750psf Tv=890psf
40				
		Glacial Till -silty, sandy, gravelly -tan, medium dense to soft -wet to saturated -cobbly and/or bouldery -dense to very dense at 51' -slight seepage at 56' -medium dense below 56'		
50				
60				

Notes:
1. Auger refusal at 59'.
2. Installed sealed standpipe at 47'. Bottom 3' of standpipe slotted.
3. Water level at 29.5' from grade on March 16/88.

Plate 3

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	29/02/88	88528	2

DRILL TYPE: 18" Auger

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

DATUM

SURFACE ELEVATION 763.06'

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0	SS	Topsoil				
		Clay -silty -brown				
		Silt -tan -moist to wet				
10		Clay -mottled brown -highly plastic -stiff to firm				
20		— — — grey				
				U		qu=2290psf γ_w=113.3pcf pp=4150psf Tv>2000psf
30						
40				U		qu=1275psf γ_w=105.6pcf pp=1850psf Tv=905psf
50		Glacial Till -silty, sandy, gravelly -tan, soft to medium dense -wet to saturated -dense to very dense at49' -cobbly and bouldery below 52' -medium dense below 59'				
60		Notes: 1.Auger refusal at 67'. 2.Water level at 38' from grade in about 5 minutes.				

Plate 4

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	29/02/88	88528	3

DRILL TYPE: 18" Auger

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

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION (DATUM / SURFACE ELEVATION 763.27')	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0	SS	Topsoil				
		Clay -silty, brown				
		Silt -tan -moist, firm				
10		Clay -mottled brown -highly plastic -stiff to firm		U		qu=1595psf γ_w=106.7pcf pp=2880psf Tv=1660psf
20						
		- - - grey				
30				U		qu=2115psf γ_w=110.5pcf pp=2200psf Tv=1320psf
40						
		Glacial Till -silty, sandy, gravelly -tan, soft -dense to very dense at 52' -bouldery below 54' -medium dense below 56'				
50						
		Notes: 1. Auger refusal at 63'. 2. Water level at 47' from grade in about 5 minutes.				
60						

Plate 5

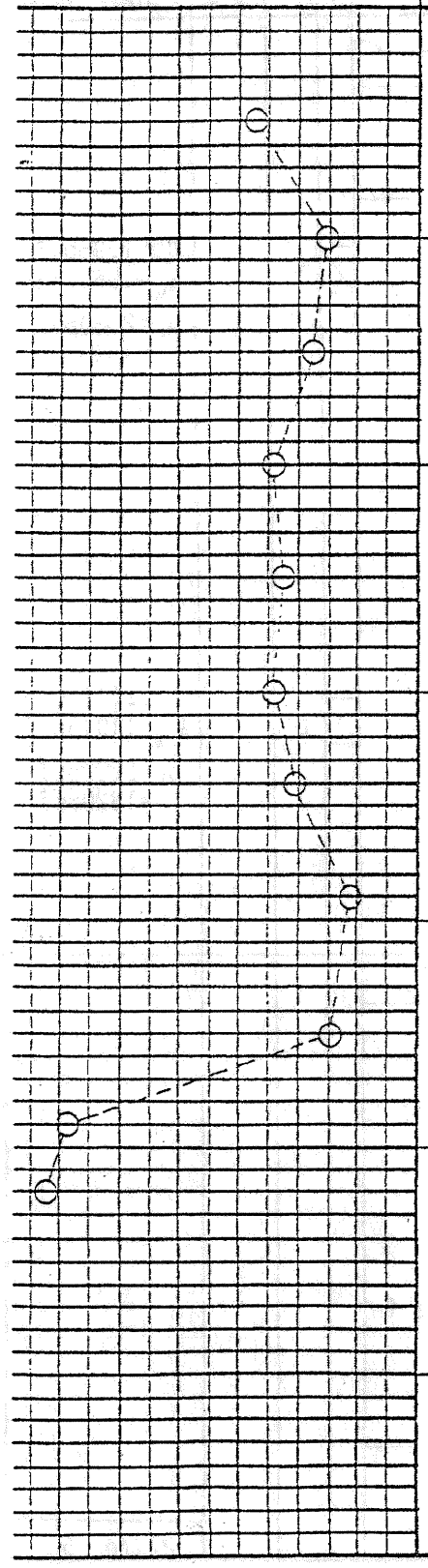
DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 1/03/88 | JOB NO. 88528 | HOLE NO. 4

DRILL TYPE: 18" Auger



DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
		DATUM SURFACE ELEVATION 764.18'				
0		Fill -clay, trace gravel				
		Clay -black				
		Clay -silty, brown				
		Silt -tan, clayey, moist				
		Clay -mottled brown -highly plastic -stiff to firm				
10						
20				U		qu=2865psf γ_w=109.9pcf pp=3750psf Tv=1640psf
		---grey				
30						
40				U		qu=2080psf γ_w=101.0pcf pp=2050psf Tv=1120psf
50		Glacial Till -silty, sandy, gravelly -tan, medium dense -6" thick clay seams to 49' -dense to very dense at 52' -bouldery below 51' -slight seepage upon drilling to 53'				
60						

Notes:
1. Auger refusal at 62.5'
Water level at 44' from grade in about 5 minutes.

Plate 6

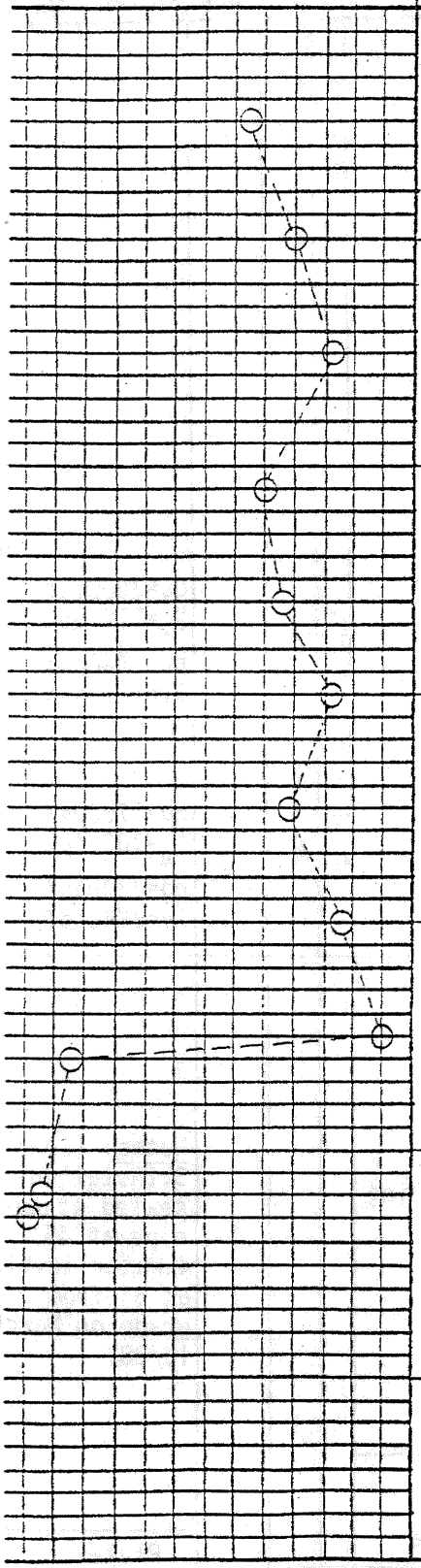
DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End WAter Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	1/03/88	88528	5

DRILL TYPE: 18" Auger



SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
	DATUM SURFACE ELEVATION 763.35'				
	Fill -clay -trace gravel -organic clay				
	Silt -tan, moist, trace sand				
	Clay -mottled brown -highly plastic -stiff to firm				
			U		qu=1450psf γ_w=104.6pcf pp=2850psf Tv=1510psf
	grey				
			U		qu=2530psf γ_w=109.2pcf pp=2100psf Tv=1200psf
	Glacial Till -silty, sandy gravelly -tan, soft to medium dense -dense at 52' -very dense and bouldery at 53' -slight seepage at 56' -medium dense below 57'				
	Notes: 1.Auger refusal at 63.5'. 2. Water level at 42' upon completion of drilling.				

Plate 7

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCR | DATE OF INVEST. 1/03/88 | JOB NO. 88528 | HOLE NO. 6

DRILL TYPE: 18" Auger

DATUM

SURFACE ELEVATION 762.06'

WATER CONTENT (Wp - □ W - ○ W_L - △, PERCENT %, 10 20 30 40 50 60)	DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
	0	X	Fill -clay, some gravel				
			Clay -mottled brown -highly plastic -stiff to firm				
	10						
	20						
			- - - grey		U		qu=3500psf γ_w=112.8pcf pp=3640psf Tv=1870psf
	30						
					U		qu=1700psf γ_w=103.4pcf pp=2300psf Tv=1240psf
	40						
			Glacial Till -silty, sandy , gravelly -tan, soft -wet to saturated -medium dense at 51' dense and bouldery at 52' -slight seepage upon drilling to 54' -medium dense below 55'				
	50						
	60						

Notes:
1. Auger refusal at 63'.
2. Water level at 50' from grade upon completion of drilling.

Notes: (Cont'
3. Installed sealed stand-pipe at 45'.
4. Water level at 6' from grade on March 16/88.

Plate 8

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCR | DATE OF INVEST. 1/03/88 | JOB NO. 88528 | HOLE NO. 7

DRILL TYPE: 18" Auger

WATER CONTENT — W_P - □ W - ○ W_L - △. PERCENT %

10 20 30 40 50 60

DATUM

SURFACE ELEVATION 762.90'

DEPTH (FT)	SOIL DESCRIPTION	SOIL SAMPLE CONDITION	SOIL SAMPLE TYPE	PENETRATION RESISTANCE	OTHER TESTS
0	Fill -clay, some gravel, cobbly				
	Clay -black				
	Clay -silty, brown				
	Silt -tan, moist				
	Clay -mottled brown -highly plastic -stiff to firm				
10			U		qu=2305psf γ_w=106.7pcf pp=3235psf Tv=1720psf
20					
			U		qu=1935psf γ_w=107.5pcf pp=3700psf Tv=1900psf
30	grey				
40					
	Glacial Till -silty, sandy, gravelly -tan, soft to medium dense -bouldery -very sandy at 53' -dense at 53' -seepage at 53' -medium dense below 54'				
50					
	Notes: 1. Auger refusal at 66' on possible bedrock. 2. Water level at 40' from grade upon completion of drilling.				
60					

Plate 9

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 1/03/88 | JOB NO. 88528 | HOLE NO. 8

DRILL TYPE: 18" Auger

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

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION (DATUM — SURFACE ELEVATION 764.81')	SOIL SAMPLE: CONDITION / TYPE / PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay, trace gravel		
10		Clay -mottled brown -highly plastic -stiff to firm		
20			U	qu=2795psf γ_w=110.0pcf pp=4265psf Tv>2000psf
		grey		
30				
40			U	qu=2500psf γ_w=103.8pcf pp=2025psf Tv=1050psf
50		Glacial Till -silty, sandy, gravelly -tan, soft to medium dense -cobbly -dense at 54' -very sandy below 55' -bouldery at 56' -slight seepage at 57'		
60		Notes: 1.Auger refusal at 68' on bedrock. 2.Slight seepage. No measurable amount of water.		

Plate 10

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 2/03/88 | JOB NO. 88528 | HOLE NO. 9

DRILL TYPE: 18" Auger

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

DATUM

SURFACE ELEVATION 763.38'

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -clay, silt, trace gravel				
		Clay -black				
		Clay -silty -brown				
		Silt -tan, moist				
		Clay -mottled brown -highly plastic -stiff to firm				
10				U		qu=1620psf γ_w=105.8pcf pp=2785psf Tv=1490psf
20						
		grey				
30				U		qu=2525psf γ_w=108.0pcf pp=3640psf Tv=1860psf
40						
50		Glacial Till -sitly, sandy, gravelly -tan, clayey to 48' -saturated, soft, cobbly -slight seepage at 54' -bouldery below 56' dense from 56 to 58' -medium dense below 58'				
60		Notes: 1. Auger refusal at 64.5' in broken bedrock. 2. Water level at 43 and hole open to 44' upon completion.				

Plate 11

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	8/03/88	88528	10

DRILL TYPE: 18" Auger

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

DATUM

SURFACE ELEVATION 762.94'

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE CONDITION	SOIL SAMPLE TYPE	SOIL SAMPLE PENETRATION RESISTANCE	OTHER TESTS
0		Fill -gravel, some clay				
		Silt -tan, moist				
		Clay -mottled brown -highly plastic -stiff to firm				
10						
				U		qu=2595psf γ_w=108.7pcf pp=3500psf Tv=1650psf
20						
30		---grey				
				U		qu=2750psf γ_w=108.9pcf pp=2240psf Tv=950psf
40						
50		Glacial Till -silty, sandy, gravelly -tan, saturated, soft -seepage at 52' -dense from 55 to 58' -medium dense below 58'				
60		Notes: 1. Auger refusal at 66.5' on probable bedrock. 2. Water at 39' from grade upon completion of drilling.				

Plate12

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	8/03/88	88528	11

DRILL TYPE: 18" Auger

DATUM

SURFACE ELEVATION: 762.81'

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

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Topsoil -black				
		Clay -mottled brown -highly plastic -stiff to firm -gypsum inclusions				
10						
20				U		qu=3435psf γ_w=110.0pcf pp=4880psf Tv=1940psf
30		---grey				
40				U		qu=1835psf γ_w=113.2pcf pp=1760psf Tv=1000psf
50		Glacial Till -silty, sandy, gravelly -tan, saturated, soft -seepage at 52' -bouldery at 54' -dense from 54 to 56'				Notes:(Cont'd) 4.Water level at 30' from grade on March 16/88.
60		Notes: 1.Auger refusal at 64' on probable bedrock. 2.Hole open to 45' upon completion of drilling. 3.Placed sealed standpipe at 55'.				

Plate 13

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	8/03/88	88528	12

DRILL TYPE: 18" Auger

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

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION (DATUM — SURFACE ELEVATION 762.59')	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -gravel, clay, concrete				
		Clay -mottled brown -highly plastic -stiff to firm				
10				U		qu=1180psf γ_w=106.9pcf pp=3200psf Tv=1640psf
20						
30		grey		U		qu=2390psf γ_w=110.5pcf pp=3080psf Tv=1570psf
40						
50		Glacial Till -silty, sandy, gravelly -tan, soft to medium dense -dense at 55' -very sandy at 56' -seepage at 56'				
60		Notes: 1. Auger refusal at 66' on probable bedrock. 2. Hole open to 48' upon completion				

Plate 14

GEOTECHNICAL REPORT

PROPOSED DISINFECTION BUILDING

SOUTH END WATER POLLUTION CONTROL CENTRE

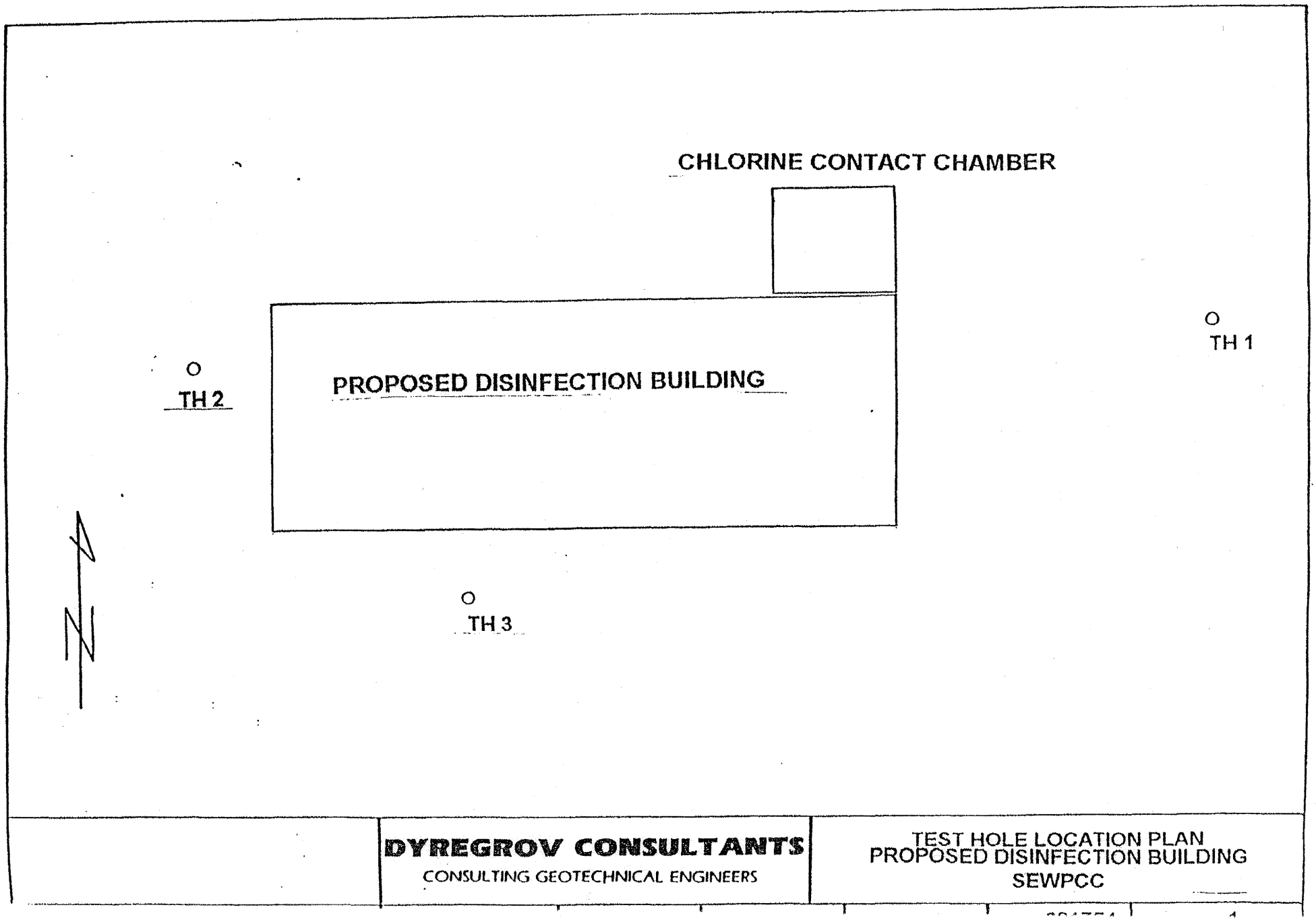
CITY OF WINNIPEG

PREPARED FOR

REID CROWTHER & PARTNERS LTD.

February 1998

Project 981754



DYREGROV CONSULTANTS
CONSULTING GEOTECHNICAL ENGINEERS

TEST HOLE LOCATION PLAN
PROPOSED DISINFECTION BUILDING
SEWPCC

DYREGROV CONSULTANTS	Logged / Dwn. : TH Checked: AOD	Test Hole No. 1	Project No. 981754
PROJECT: SEWPCC DISINFECTION BUILDING		DATE OF INVEST. January 29, 1998	
CLIENT: REID CROWTHER & PARTNERS LTD.		DRILL: Subterranean 400 mm auger	

SAMPLE NO.	DEPTH (m)	ELEV. (m)	SYM	SOIL DESCRIPTION	
	0.00	232.58		0.00-7.32 FILL	
	0.50	232.08		GRANULAR WITH SOME CLAY TO 40	
	1.00	231.58		BELOW .4 IS A MIX OF CLAY WITH SOME TOPSOIL	
	1.50	231.08		AND SILT WITH IN THE MATRIX	Qu-55 kPa Pp-144 kPa Tv-106 kPa W-18.90 Kn/M
	2.00	230.58			
	2.50	230.08		BECOMING SOFTER TOWARDS 2.59	Qu-29.3 KPa
	3.00	229.58		TRACE OF TOPSOIL	Pp-107 kPa Tv-63 kPa
	3.50	229.08			W-16.63 Kn/M
	4.00	228.58			
	4.50	228.08			**Qu-58 kPa** Pp-115 kPa
	5.00	227.58		CLAY WITH A MIX OF SOME SILT	Tv-78 kPa
	5.50	227.08		GRANULAR, STONES TO 100 mm DIA TRACE OF TOPSOIL	W-17.83 Kn/M
	6.00	226.58			
	6.50	226.08			Pp-67 kPa Tv-48 kPa
	7.00	225.58			
	7.50	225.08		7.32-13.72 CLAY GREY, SOME SILT, STIFF TRACE TILL INCLUSIONS (SILT)	
	8.00	224.58			
	8.50	224.08			
	9.00	223.58		TILL INCLUSIONS BECOMING LARGER AND MORE FREQENT WITH DEPTH BECOMING MED TO FIRM	
	9.50	223.08			
	10.00	222.58			
	10.50	222.08			
	11.00	221.58			
	11.50	221.08			
	12.00	220.58			
	12.50	220.08			
	13.00	219.58			
	13.50	219.08			
	14.00	218.58		13.72-18.82 TILL SILT WITH A MIXTURE OF GRANULAR AND A TRACE OF CLAY SOFT	
	14.50	218.08			
	15.00	217.58			
	15.50	217.08		BECOMING DENSE AT 15.5	
	16.00	216.58			
	16.50	216.08			
	17.00	215.58		END OF TEST HOLE AT 16.82 INDENSE TILL	

MOISTURE CONTENT (%)

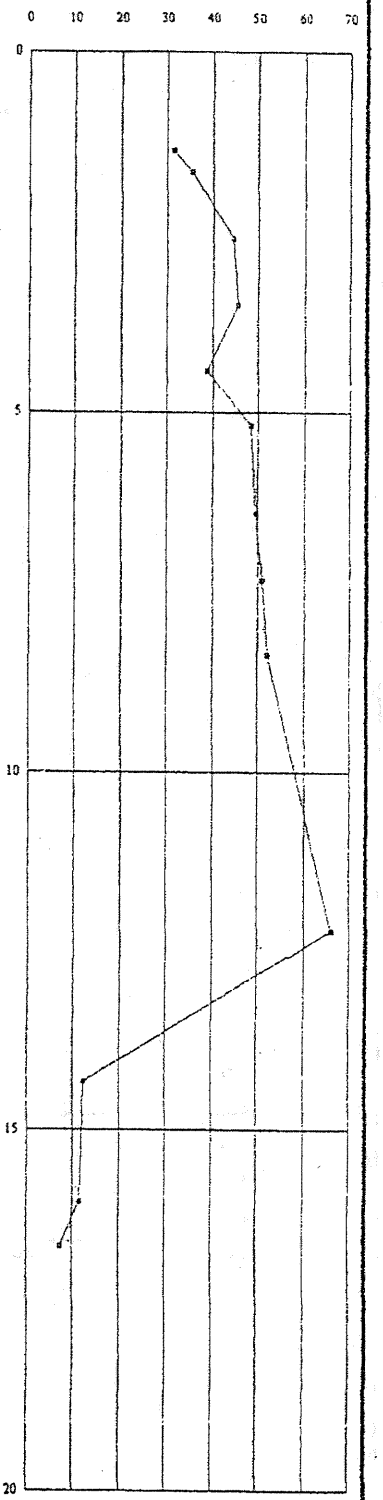


FIGURE 2

DYREGROV CONSULTANTS	Logged / Dwn. : TH Checked: AOD	Test Hole No. 2	Project No. 981754
PROJECT: SEWPCC DISINFECTION BUILDING CLIENT: REID CROWTHER & PARTNERS LTD.		DATE OF INVEST. January 29, 1998 DRILL: Subterranean 400 mm auger	

SAMPLE NO.	DEPTH (m)	ELEV. (m)	SYM	SOIL DESCRIPTION
	0.00	231.91		
	0.50	231.41		0.00-2.90 FILL CLAY WITH A MIXTURE OF SILT, SOME GRANULAR, SOME TOPSOIL
	1.00	230.91		
	1.50	230.41		
	2.00	229.91		
	2.50	229.41		
	3.00	228.91		2.90-13.11 CLAY BROWN, STIFF, SOME SILT TRACE OF SULPHATES (+) Qu-53 kPa Pp-129 kPa Tv-89 kPa W-16.88 Km/M
	3.50	228.41		
	4.00	227.91		
	4.50	227.41		
	5.00	226.91		TILL INCLUSIONS , SILT, BECOMING LARGER WITH DEPTH AND MORE FREQUENT STIFF TO FIRM
	5.50	226.41		
	6.00	225.91		
	6.50	225.41		TRANSITION TO GREY CLAY TILL INCLUSIONS
	7.00	224.91		FIRM
	7.50	224.41		
	8.00	223.91		
	8.50	223.41		
	9.00	222.91		
	9.50	222.41		CLAY BECOMING FIRM TO MED
	10.00	221.91		
	10.50	221.41		
	11.00	220.91		
	11.50	220.41		
	12.00	219.91		
	12.50	219.41		
	13.00	218.91		13.11-16.31 TILL
	13.50	218.41		SILTY, SOME GRANULAR, SOME STONES SOFT, TRACE OF CLAY
	14.00	217.91		
	14.50	217.41		
	15.00	216.91		
	15.50	216.41		BECOMING MORE DENSE WITH DEPTH
	16.00	215.91		
	16.50	215.41		END OF TEST HOLE AT 16.31 IN DENSE TILL
	17.00	214.91		

MOISTURE CONTENT (%)

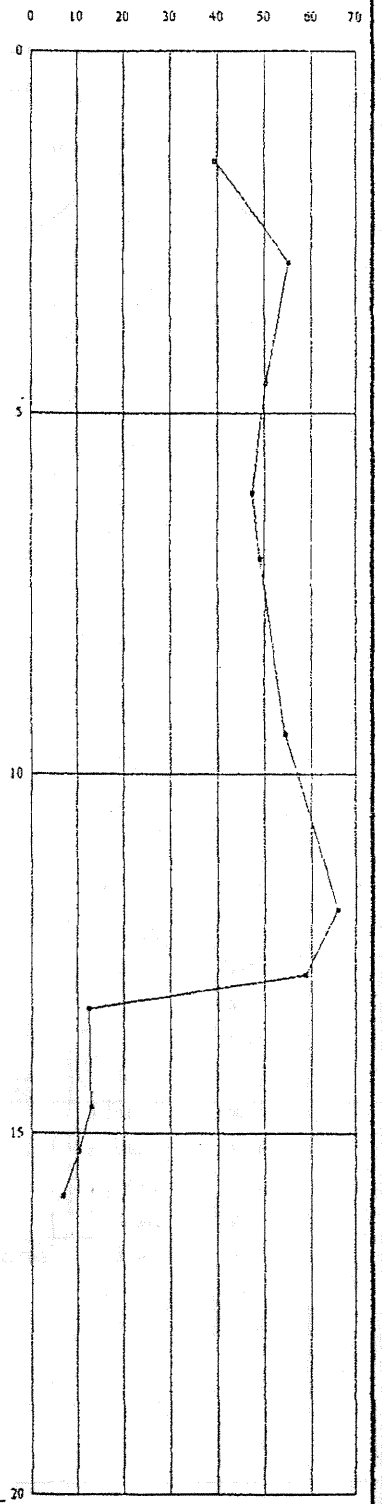
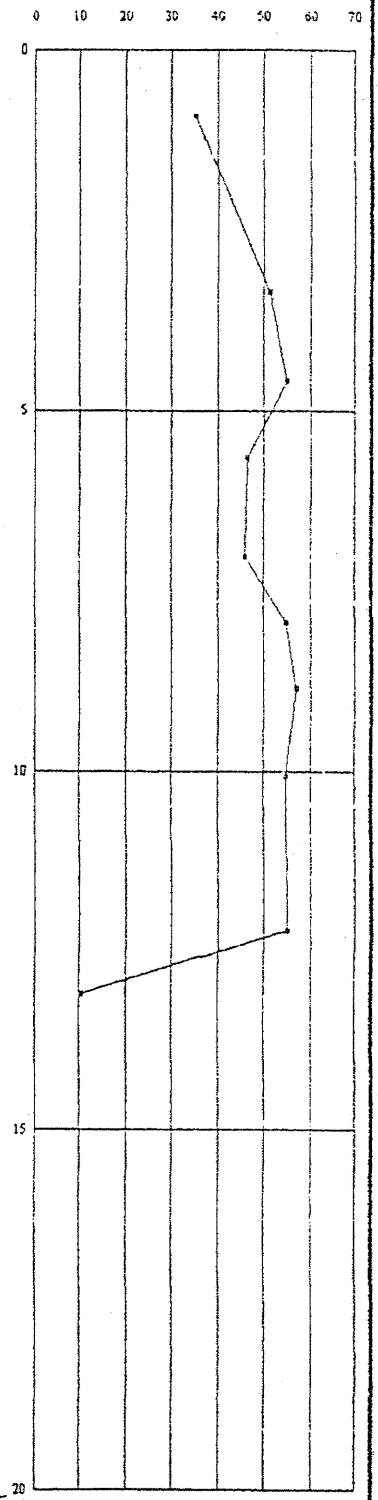


FIGURE 3

DYREGROV CONSULTANTS	Logged / Dwn. : TH Checked: AOD	Test Hole No. 3	Project No. 981754
PROJECT: SEWPCC DISINFECTION BUILDING		DATE OF INVEST. January 29, 1998	
CLIENT: REID CROWTHER & PARTNERS LTD.		DRILL: Subterranean 400 mm auger	

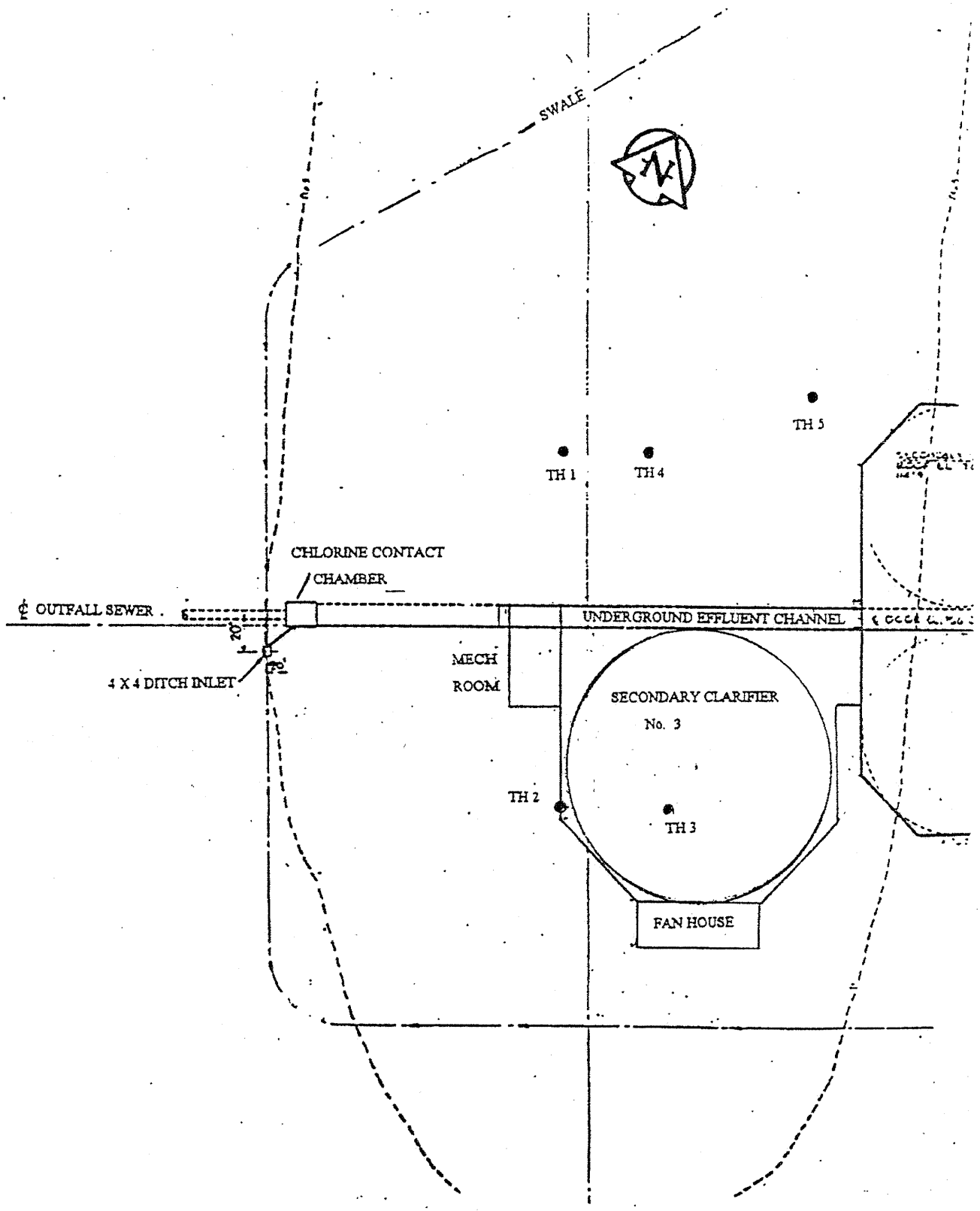
SAMPLE NO.	DEPTH (m)	ELEV. (m)	SYM	SOIL DESCRIPTION
	0.00	232.09		0.00-0.25 TOPSOIL
	0.50	231.59		0.25-1.22 CLAY BLACK TO BROWN, SOME SILT, FROZE
	1.00	231.09		
	1.50	230.59		1.22-1.45 SILT TAN, DAMP TO WET, SLOUGHING
	2.00	230.09		1.45-13.11 CLAY BROWN,STIFF, SOME SILT TRACE OF SULPHATES
	2.50	229.59		
	3.00	229.09		
	3.50	228.59		
	4.00	228.09		LAYERING OF GREY AND BROWN CLAY STIFF, SOME SILT
	4.50	227.59		
	5.00	227.09		
	5.50	226.59		Qu-254 kPa Pp-193 kPa Tv-79 kPa W-17.26 Kn/M
	6.00	226.09		
	6.50	225.59		
	7.00	225.09		TRANSITION TO GREY CLAY
	7.50	224.59		TRACE (+) TILL INCLUSIONS, HIGH PLASTIC
	8.00	224.09		
	8.50	223.59		Qu-59 kPa Pp-124 kPa Tv-85 kPa W-18.48 Kn/M
	9.00	223.09		
	9.50	222.59		
	10.00	222.09		
	10.50	221.59		
	11.00	221.09		
	11.50	220.59		
	12.00	220.09		
	12.50	219.59		
	13.00	219.09		13.11-18.75 TILL SILT WITH SOME GRANULAR AND SAND SILT FIRM AT 13.2 AND BECAME SOFT BELOW NO SAMPLING BELOW 13.1 DUE TO SLOUGHING AUGER WAS SCREWED TO REFUSAL AT 18.75 BELOW GROUND SURFACE
	13.50	218.59		
	14.00	218.09		
	14.50	217.59		
	15.00	217.09		
	15.50	216.59		
	16.00	216.09		
	16.50	215.59		
	17.00	215.09		
	17.50	214.59		
	18.00	214.09		
	18.50	213.59		
	19.00	213.09		END OF TEST HOLE AT 18.75 IN DENSE TO VERY DENSE TILL

MOISTURE CONTENT (%)



NOTE: WATER AT 7.5 BELOW SURFACE AFTER 20 MINUTES

FIGURE 4



DYREGROV CONSULTANTS
CONSULTING GEOTECHNICAL ENGINEERS

CONTROL CENTRE
SITE PLAN

SCALE NTS	DATE 12/02/98	MADE TH	CHKD AOD	JOB 981754	FIGURE 5

GEOTECHNICAL ENGINEERING REPORT

SOUTH END WATER POLLUTION CONTROL CENTRE

Prepared For

WARDROP ENGINEERING INC.

MACLAREN ENGINEERS INC.

On Behalf of

THE CITY OF WINNIPEG

April 15, 1988

Project No. 88528

1.0 INTRODUCTION

This report summarizes the results of a geotechnical investigation undertaken by Dyregrov and Burgess for the proposed expansion of the South End Water Pollution Control Centre. The work was done at the request of Wardrop Engineering Inc. and MacLaren Engineers Inc. as authorized in their letter of January 13, 1988. The work was done in accordance with our proposal of January 6, 1988.

2.0 DESCRIPTION OF THE FIELDWORK

A total of 12 boreholes were put down within the period of February 29 to March 8, 1988 at the locations shown in Figures 1 and 2. Truck mounted caisson drilling equipment (LDH 80) was supplied by Subterranean (Manitoba) Ltd. Eighteen inch diameter augers were used and all borings were taken to auger refusal. The soil profile was examined, classified on a continuous basis as drilling progressed and sampled at regular depth intervals. Disturbed samples from auger cuttings and relatively undisturbed, three inch diameter Shelby tube samples were obtained for laboratory strength and moisture content testing.

Observations were made during drilling concerning groundwater, seepage and caving conditions within the boreholes and the effect these factors may have on foundation selection and design. Sealed standpipe piezometers were installed within the glacial till materials at boreholes 1, 6 and 11.

All boreholes were backfilled on completion and ground elevations were referenced to the benchmark indicated in Drawing No. 1.

3.0 THE SOIL PROFILE

A thick deposit of highly plastic Agassiz clay is the predominant component of the soil profile and extends from about the ground surface to depths varying from 42 to 50 feet. The average thickness is 45 feet. The clay is common to the Winnipeg area and can be described as firm to stiff in terms of its relative consistency. Moisture contents are typically within the range of 40 to 60 percent and are relatively uniform with depth. Moisture depletion appears to be restricted to about the upper 10 feet of the soil profile. Plastic and liquid limits for the clays are typically 30 and 100 percent, respectively, and liquidity indices at this location are estimated to be in the range of 0.3 to 0.4. It should be noted that specific tests were not undertaken for the determination of the above index properties.

Undrained shear strengths were determined from unconfined compression, pocket penetrometer and Torvane tests in the laboratory. The results are shown in Plate 15. The lower strengths from unconfined compression tests within about the upper 12 feet of the profile are probably related to fissuring that has accompanied periodic moisture depletion within these depths.

The clays are underlain by glacial silt till which is a mixture of sand, gravel and boulder sized materials within a predominantly silt matrix. The relative density of the till has been evaluated on the basis of its moisture content and a visual examination of the auger cuttings. The depths at which the till can be described as loose, medium dense, dense and very dense are noted on the logs. Penetration tests for density evaluation in the till are not representative, because of boulders, for

which reason these were not done. The elevation of the till surface varies from about 713 to 720. The average elevation is 717.6. The till is typically loose or soft near its surface and it becomes progressively more dense with depth. This is not always the case, however, and stronger layers are often underlain by weaker ones.

Of primary intest to the design of driven piles are the depths to power auger refusal across the site and these are summarized below:

Hole No.	Ground Elev.	Depth to Refusal (ft.)	Refusal Elev.
1	762.2	59	703.2
2	763.1	67	696.1
3	763.3	63	700.3
4	764.2	62.5	701.7
5	763.4	63.5	699.9
6	762.1	63	699.1
7	762.9	66	696.9
8	764.8	68	696.8
9	763.4	64.5	698.9
10	762.9	66.5	696.4
11	762.8	64	698.8
12	762.6	66	696.6

The mean auger refusal elevation is 698.7. Refusal occurred on boulders within the till in most cases and possibly on bedrock at boreholes 7 to 12. Refusal on bedrock at these locations was suspected primarily on the basis of drill performance and the rapid inflow of groundwater, however, coring was not done and the depth to bedrock was not confirmed.

A detailed description of the soil profile and the results of field and laboratory testing are summarized on the borehole logs, Plates 3 to 14.

4.0 GROUNDWATER CONDITIONS

The groundwater regime at the site consists essentially of groundwater perched within the relatively pervious silt strata that are within the top

10 feet of the soil profile, a nearly hydrostatic condition within the clays and a subartesian condition within the underlying glacial till and bedrock. Groundwater conditions within the upper silt deposits are likely to vary over short horizontal distances, to the extent that the deposits amount to pervious strata that vary in thickness and are not contiguous across the site. Piezometric pressures within the glacial till originate in the underlying bedrock, which is the carbonate aquifer that is common to Winnipeg, and these are the most relevant to the construction of relatively deep or large excavations. Standpipe piezometers were sealed in glacial till at depths of 47, 45 and 55 feet from grade at borings 1, 6 and 11 respectively. These were installed to determine the elevation of the piezometric surface of the till and bedrock. The water table within the piezometers at borings 1, 6 and 11 was at elevations 732.7, 756.1 and 732.8 respectively on March 16, 1988, some two weeks after drilling. The piezometric elevations of 732.7 and 732.8 are considered representative of the head in the till and bedrock. The piezometer at borehole 6 is not completely sealed and is considered to be recording the water table within the upper silt deposits which is probably high, temporarily, because of flooding of the area that occurred this winter (water main break).

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 Foundations

Conditions are best suited to the use of prestressed, precast concrete piles that are driven to refusal. We understand that this has been the primary type of foundation system for the existing plant. The variable condition of the glacial till and the potential for problems related to

water seepage and bell instability are factors that render the site unsuitable for the widespread use of high capacity caissons and this foundation type is not recommended. Precast concrete piles can be assigned capacities of 60, 85 and 110 tons for 12, 14 and 16 inch diameter sizes respectively. The piles must be driven with a diesel hammer rated at 30,000 foot-pounds or more. Link Belt 520 and Delmag D22 hammers are used routinely within Winnipeg and these are rated at 30,000 and 39,000 foot-pounds respectively. Practical refusal can be defined as final penetration resistance values of 5, 8 and 12 blows per inch for 12, 14 and 16 inch pile diameters respectively, for piles driven with a Link Belt 520 hammer. Final penetration resistance can be reduced to 4, 7 and 10 blows per inch for 12, 14 and 16 inch pile sizes driven with a Delmag D22 hammer. Preboring should be done at all pile locations, to minimize heave and vibration and to enhance pile plumbness. All piles in groups must be restruck, to counter the effects of heave, and pile spacing should not be closer than 2.5 diameters, centre to centre. In view of the large number of piles that will be required and the potential for ground heave under these circumstances, heave should be monitored, at least at the start of construction, to determine that this behaviour is counteracted. Precast, prestressed concrete piles driven to practical refusal will derive virtually all of their capacity from end-bearing and no reduction in individual pile capacity within groups is necessary for reasons related to group action. A pile concrete age of at least one week should be specified and piles in large groups or those concentrated within a relatively small area should be driven progressively outwards from the centre.

The depth to power auger refusal varied from about 59 to 68 feet.

This variation is likely to be consistent with the variation in the depth to practical refusal that may occur during pile driving.

Lightly loaded structures can be supported on cast-in-place concrete friction piles and these can be designed on the basis of an allowable skin friction of 400 psf. This value is applicable to piles in compression or tension. The top 5 and 10 feet of pile shaft should be ignored for interior and exterior piles respectively. A minimum pile diameter of 16 inches should be specified. Piles subject to frost action or uplift should contain full depth reinforcing and a minimum length of 20 feet should be specified in these cases, regardless of design loads. Temporary casing should be used on an as-required basis, to prevent caving and seepage into the pile borings. Casing was not required at the time of the test drilling but this condition may not apply at the time of construction. A mixture of friction piles and precast concrete piles is not recommended for the support of important structures, not do we recommend the use of groups of friction piles for large loads.

5.2 Excavations

Excavations will be required for the proposed primary clarifiers, aeration tanks and secondary clarifiers. These are expected to not exceed depths of about 20 feet at the primary clarifiers and aeration tanks and 25 feet at the secondary clarifiers. The piezometric surface within the glacial till and bedrock is nominally 30 feet below average grade at the site and this determines that the factor of safety against bottom heave is at least 2.5 for a 25 foot excavation. An allowance for a ten foot increase in the head in the till reduces the safety factor to about 2.0 and this also is satisfactory.

For the most part, it is expected that the excavations can be open cut. An average undrained shear strength of about 920 psf is required for a safety factor of 2.0 against slope instability for the case of a 25 foot cut with 2:1 side slopes, on the basis of a total stress analysis. This is a minimum safety factor for this condition and we recommend that cut slopes not be steeper than 2:1 (H:V) for excavations that are 20 feet deep or greater. Sloughing and seepage from the upper silt strata may occur, depending on environmental conditions at the time of construction. Sloughing of the silt should be expected during wet periods but it should be of a localized nature and of little significance to construction. Seepage from the clays will be insignificant. Particular care should be paid to excavation slopes where the new excavations will encroach upon or expose the existing structures. The transition in slopes in these areas must ensure that instability is prevented. Significant slides could adversely affect the existing structures or their foundations.

Temporary shoring may be necessary where the excavations will encroach on structures that have to be protected. The shoring can be designed on the basis of the earth pressure distribution shown in Plate 16. Cantilevered shoring can be employed for vertical cuts that are limited to about 13 feet. Bracing or a combination of sloped and shored cuts is necessary for cuts in excess of 13 feet.

5.3 Other

Basement, tank and rigid retaining walls should be designed to resist earth pressures equal to full hydrostatic pressure (equivalent fluid density of 62.4 pcf). This applies to walls that are drained. Where drainage is not provided, the equivalent fluid density should be increased

to 93 pcf. The water table for undrained walls and for buoyancy/uplift calculations should be assumed to be at the ground surface. An allowance for surface live load should be included if significant load is applied within a distance from the wall equal to the height of the wall. The lateral pressure due to live load should be presumed equal to 50 percent of the vertical pressure due to the live load.

The clarifiers and aeration tanks should have structurally supported floors and these should be isolated from the underlying subgrade by a 12 inch void. We presume that these structures are not provided with underdrainage and that water can collect below them. This is conducive to swelling and a generous allowance for this is recommended. A smaller void can be used if it can be justified on the basis of experience with the existing clarifiers and aeration tanks.

The on-site clays are suitable for backfill purposes. The backfill should be free of topsoil and organic materials. The silt soils can be used as backfill provided they are mixed with the clays. The backfill should be compacted in thin lifts to at least 95 percent of Standard Proctor maximum dry density at moisture contents that are within 2 percent of optimum.

All concrete in contact with the soils at this location should be made with sulphate resistant cement.

5.4 Field Inspection

The potential for problems related to ground heave are significant for this project, assuming that a large number of piles will be driven within relatively confined areas. In addition, the piling is likely to penetrate most of the till deposit. These factors are conducive to heave and it may

be necessary to prebore to greater depths than usual or to adopt other measures to counter this problem if it develops. Conditions at this location are amenable to the use of pile capacities that are higher than historical values and we have recommended the use of allowable loads that exceed the historical by about 20 percent. It is essential that the interpretation of practical refusal during pile driving be consistent with good engineering practice and it is important that extra attention be paid to this aspect of the work. Primarily for these reasons we would suggest that the requirement for inspection by geotechnical personnel is pronounced. We recommend that the pile driving be done under the full time inspection of the geotechnical consultant.

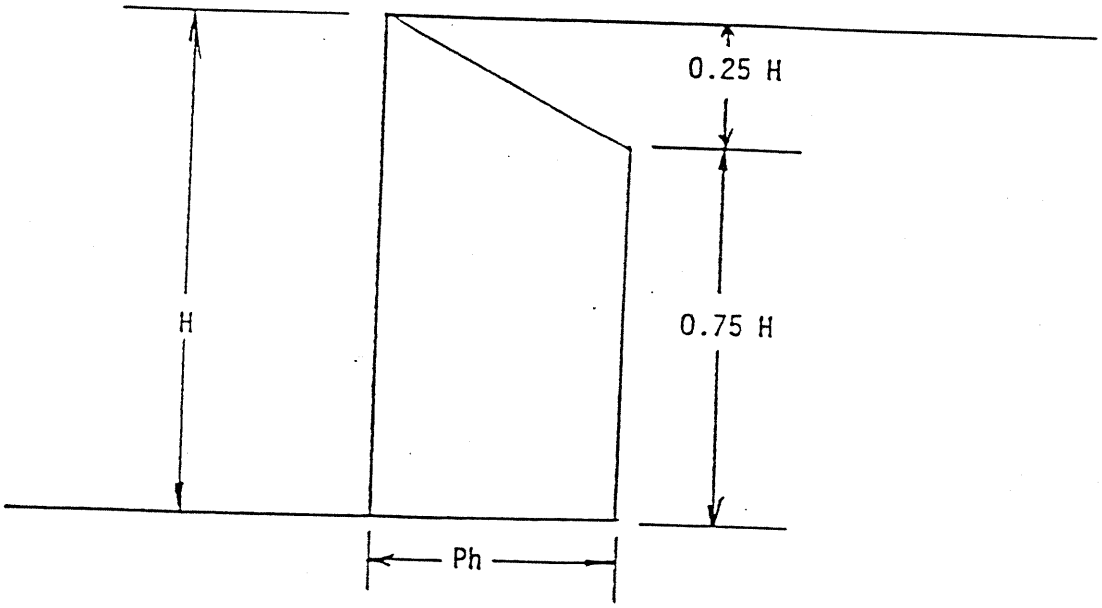
Respectfully submitted,

DYREGROV & BURGESS

Per:

N.C. Burgess, P.Eng.

NCB/pf



$Ph = 0.4 \gamma H$

Where: Ph = Lateral earth pressure on shoring (psf)

γ = Soil unit weight (110 pcf)

H = Wall height (ft.)

Note: Add surface load surcharge where applicable

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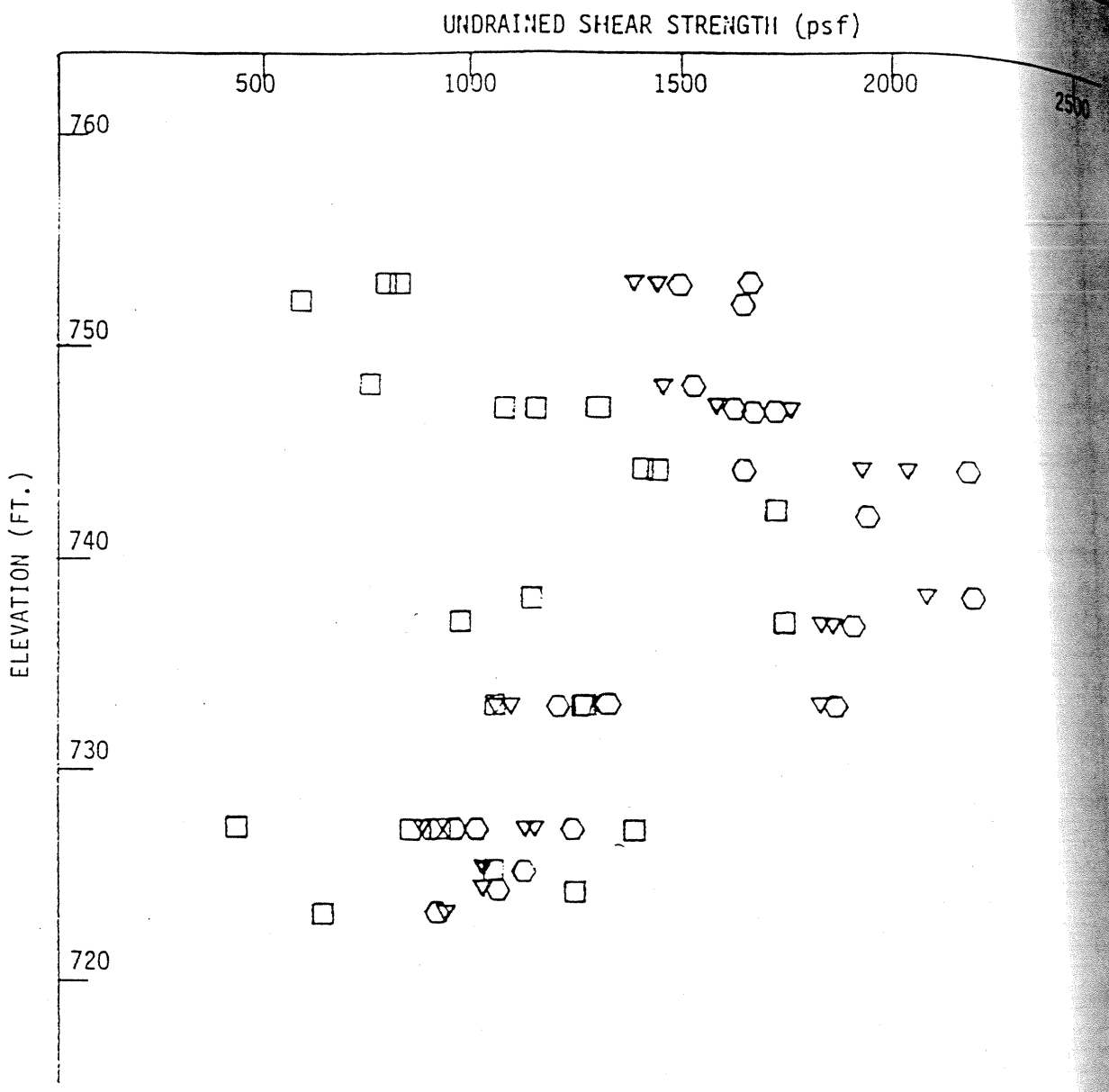
CONSULTING GEOTECHNICAL ENGINEERS

EARTH PRESSURES, TEMPORARY SHORING

SCALE NTS	DATE	MADE	CHKD	JOB 88528	FIGURE 16



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SHEAR STRENGTH DATA

SCALE	DATE	MADE	CHKD	JOB 88528	FIGURE 15

GYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

DRED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	8/03/88	88528	12

DRILL TYPE: 18" Auger

WATER CONTENT — w_P - □ w - ○ w_L - △. PERCENT % (0 20 30 40 50 60)

DATUM

SURFACE ELEVATION 762.59'

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -gravel, clay, concrete				
		Clay -mottled brown -highly plastic -stiff to firm				
10				U		qu=1180psf γ_w=106.9pcf pp=3200psf Tv=1640psf
20						
30		grey		U		qu=2390psf γ_w=110.5pcf pp=3080psf Tv=1570psf
40						
50		Glacial Till -silty, sandy, gravelly -tan, soft to medium dense -dense at 55' -very sandy at 56' -seepage at 56'				
60		Notes: 1.Auger refusal at 66' on probable bedrock. 2.Hole open to 48' upon completion				

Plate 14

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	8/03/88	88528	11

DRILL TYPE: 18" Auger

DATUM

SURFACE ELEVATION: 762.81'

WATER CONTENT — w_p - □ w - ○ w_L - △. PERCENT % (10 20 30 40 50 60)

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Topsoil -black				
		Clay -mottled brown -highly plastic -stiff to firm -gypsum inclusions				
10						
20				U		qu=3435psf γ_w=110.0pcf pp=4880psf Tv=1940psf
30		---grey				
				U		qu=1835psf γ_w=113.2pcf pp=1760psf Tv=1000psf
40						
50		712.8 Refusal Elev. 700.3 Glacial Till -silty, sandy, gravelly -tan, saturated, soft -seepage at 52' -bouldery at 54' -dense from 54 to 56'				
60		Notes: 1. Auger refusal at 64' on probable bedrock. 2. Hole open to 45' upon completion of drilling. 3. Placed sealed standpipe at 55'.				Notes: (Cont'd) 4. Water level at 30' from grade on March 16/88.

Plate 13

BOREHOLE LOG

GREGROV & BURGESS

PROJECT: South End Water Pollution Control Centre

DRAWN. SDG	CKD. NCB	DATE OF INVEST. 8/03/88	JOB NO. 88528	HOLE NO. 10

DRILL TYPE: 18" Auger

WATER CONTENT — □ w - ○ w_L - △ — PERCENT % (20 30 40 50 60)

DATUM

SURFACE ELEVATION 762.94'

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
0		Fill -gravel, some clay				
		Silt -tan, moist				
		Clay -mottled brown -highly plastic -stiff to firm				
10				U		qu=2595psf γ_w=108.7pcf pp=3500psf Tv=1650psf
20						
30		---grey				
				U		qu=2750psf γ_w=108.9pcf pp=2240psf Tv=950psf
40						
50		Glacial Till -silty, sandy, gravelly -tan, saturated, soft -seepage at 52' -dense from 55 to 58' -medium dense below 58'				
60		Notes: 1. Auger refusal at 66.5' on probable bedrock. 2. Water at 39' from grade upon completion of drilling.				

Plate 12

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 2/03/88 | JOB NO. 88528 | HOLE NO. 9

DRILL TYPE: 18" Auger

WATER CONTENT (W_P-□ W-○ W_L-△. PERCENT %)	DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
			DATUM SURFACE ELEVATION 763.38'				
	0		Fill -clay, silt, trace gravel				
			Clay -black				
			Clay -silty -brown				
			Silt -tan, moist				
			Clay -mottled brown -highly plastic -stiff to firm				
	10				U		qu=1620psf γ_w=105.8pcf pp=2785psf Tv=1490psf
	20						
			grey				
	30				U		qu=2525psf γ_w=108.0pcf pp=3640psf Tv=1860psf
	40						
			Glacial Till -sitly, sandy, gravelly -tan, clayey to 48' -saturated, soft, cobbly -slight seepage at 54' -bouldery below 56' dense from 56 to 58' -medium dense below 58'				
	50						
	60		Notes: 1. Auger refusal at 64.5' in broken bedrock. 2. Water level at 43 and hole open to 44' upon completion.				

Plate 11

BOREHOLE LOG

YREGROV & BURGESS

PROJECT: South End Water Pollution Control Centre

DWN. SDG	CKD. NCB	DATE OF INVEST. 1/03/88	JOB NO. 88528	HOLE NO. 8

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

DRILL TYPE: 18" Auger

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
		DATUM SURFACE ELEVATION 764.81'				
0		Fill -clay, trace gravel				
		Clay -mottled brown -highly plastic -stiff to firm				
10						
20				U		qu=2795psf γ_w=110.0pcf pp=4265psf Tv>2000psf
		--- grey				
30						
40				U		qu=2500psf γ_w=103.8pcf pp=2025psf Tv=1050psf
50		Glacial Till -silty, sandy, gravelly -tan, soft to medium dense -cobbly -dense at 54' -very sandy below 55' -bouldery at 56' -slight seepage at 57'				
60		Notes: 1. Auger refusal at 68' on bedrock. 2. Slight seepage. No measurable amount of water.				

Plate 10

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 1/03/88 | JOB NO. 88528 | HOLE NO. 7 | DRILL TYPE 18" Auger

WATER CONTENT — w_p - □ w - ○ w_L - △. PERCENT %

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
		DATUM SURFACE ELEVATION 762.90'				
0		Fill -clay, some gravel, cobbly				
		Clay -black				
		Clay -silty, brown				
		Silt -tan, moist				
		Clay -mottled brown -highly plastic -stiff to firm				
10						
				U		qu=2305psf γ_w=106.7pcf pp=3235psf Tv=1720psf
20						
				U		qu=1935psf γ_w=107.5pcf pp=3700psf Tv=1900psf
30		- - -grey				
40						
		Glacial Till -silty, sandy, gravelly -tan, soft to medium dense -bouldery -very sandy at 53' -dense at 53' -seepage at 53' -medium dense below 54'				
50						
		Notes: 1. Auger refusal at 66' on possible bedrock. 2. Water level at 40' from grade upon completion of drilling.				
60						

Plate 9

BOREHOLE LOG

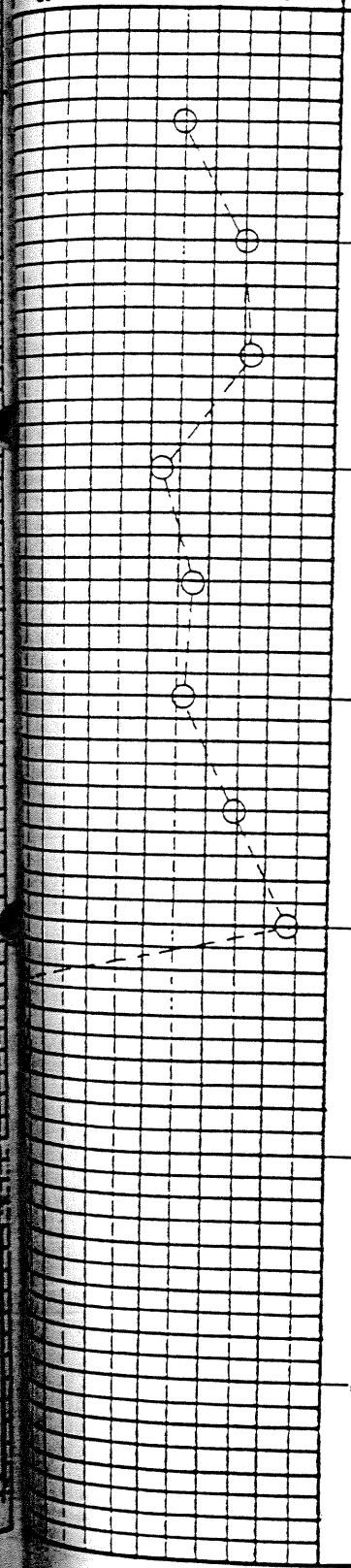
YREGROV & BURGESS

PROJECT: South End Water Pollution Control Centre

LOGGED/DOWN.	CKD.	DATE OF INVEST.	JOB NO.	HOLE NO.
SDG	NCB	1/03/88	88528	6

DRILL TYPE: 18" Auger

OTHER TESTS



SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
DATUM SURFACE ELEVATION 762.06'				
Fill -clay, some gravel				
Clay -mottled brown -highly plastic -stiff to firm				
grey		U		qu=3500psf γ_w=112.8pcf pp=3640psf Tv=1870psf
		U		qu=1700psf γ_w=103.4pcf pp=2300psf Tv=1240psf
Glacial Till -silty, sandy , gravelly -tan, soft -wet to saturated -medium dense at 51' dense and bouldery at 52' -slight seepage upon drilling to 54' -medium dense below 55'				Notes: (Cont'd) 3.Installed sealed standpipe at 45'. 4.Water level at 6' from grade on March 16/88.

Notes:
1. Auger refusal at 63'.
2. Water level at 50' from grade upon completion of drilling.

Plate 8

BOREHOLE LOG

DYREGROV & BURGESS

PROJECT
South End WAter Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 1/03/88 | JOB NO. 88528 | HOLE NO. 5

DRILL TYPE 18" Auger

WATER CONTENT

w_P - □ w - ○ w_L - △

PERCENT %

10 20 30 40 50 60

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
		DATUM SURFACE ELEVATION 763.35'				
0		Fill -clay -trace gravel -organic clay				
		Silt -tan, moist, trace sand				
10		Clay -mottled brown -highly plastic -stiff to firm		U		qu=1450psf γ_w=104.6pcf pp=2850psf Tv=1510psf
20		--- grey				
30				U		qu=2530psf γ_w=109.2pcf pp=2100psf Tv=1200psf
40						
50		Glacial Till -silty, sandy gravelly -tan, soft to medium dense -dense at 52' -very dense and bouldery at 53' -slight seepage at 56' -medium dense below 57'				
60		Notes: 1.Auger refusal at 63.5'. 2. Water level at 42' upon completion of drilling.				

Plate 7

BOREHOLE LOG

YREGROV & BURGESS

PROJECT: South End Water Pollution Control Centre

DRN. SDG | CKD. NCB | DATE OF INVEST. 1/03/88 | JOB NO. 88528 | HOLE NO. 4

DRILL TYPE: 18" Auger

WATER CONTENT: w_P-□ w-○ w_L-△. PERCENT % (20 30 40 50 60)

SOIL DESCRIPTION | SOIL SAMPLE (CONDITION, TYPE, PENETRATION RESISTANCE) | OTHER TESTS

DATUM

SURFACE ELEVATION 764.18'

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE	OTHER TESTS
0		Fill -clay, trace gravel		
		Clay -black		
		Clay -silty, brown		
		Silt -tan, clayey, moist		
		Clay -mottled brown -highly plastic -stiff to firm		
10				
20		---grey	U	qu=2865psf γ_w=109.9pcf pp=3750psf Tv=1640psf
30				
40			U	qu=2080psf γ_w=101.0pcf pp=2050psf Tv=1120psf
50		Glacial Till -silty, sandy, gravelly -tan, medium dense -6" thick clay seams to 49' -dense to very dense at 52' -bouldery below 51' -slight seepage upon drilling to 53'		
60				

Notes:
1. Auger refusal at 62.5'
Water level at 44' from grade in about 5 minutes.

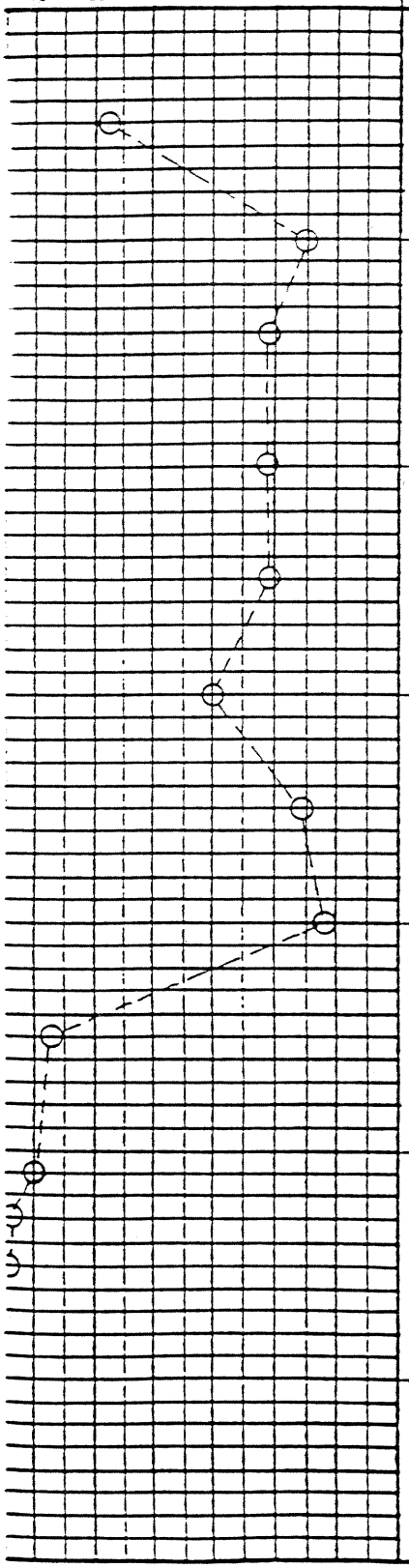
Plate 6

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 29/02/88 | JOB NO. 88528 | HOLE NO. 3 | DRILL TYPE 18" Auger



SOIL DESCRIPTION	CONDITION	TYPE	PENETRATION RESISTANCE	OTHER TESTS
DATUM SURFACE ELEVATION 763.27'				
Topsoil				
Clay -silty, brown				
Silt -tan -moist, firm				
Clay -mottled brown -highly plastic -stiff to firm		U		qu=1595psf γ_w=106.7pcf pp=2880psf Tv=1660psf
- - - grey				
		U		qu=2115psf γ_w=110.5pcf pp=2200psf Tv=1320psf
Glacial Till -silty, sandy, gravelly -tan, soft -dense to very dense at 52' -bouldery below 54' -medium dense below 56'				
Notes: 1. Auger refusal at 63'. 2. Water level at 47' from grade in about 5 minutes.				

Plate 5

DYREGROV & BURGESS

BOREHOLE LOG

PROJECT: South End Water Pollution Control Centre

LOGGED/DWN. SDG | CKD. NCB | DATE OF INVEST. 29/02/88 | JOB NO. 88528 | HOLE NO. 1

DRILL TYPE: 18" Auger

OTHER TESTS

WATER CONTENT

W_o - □ W - ○ W_L - △

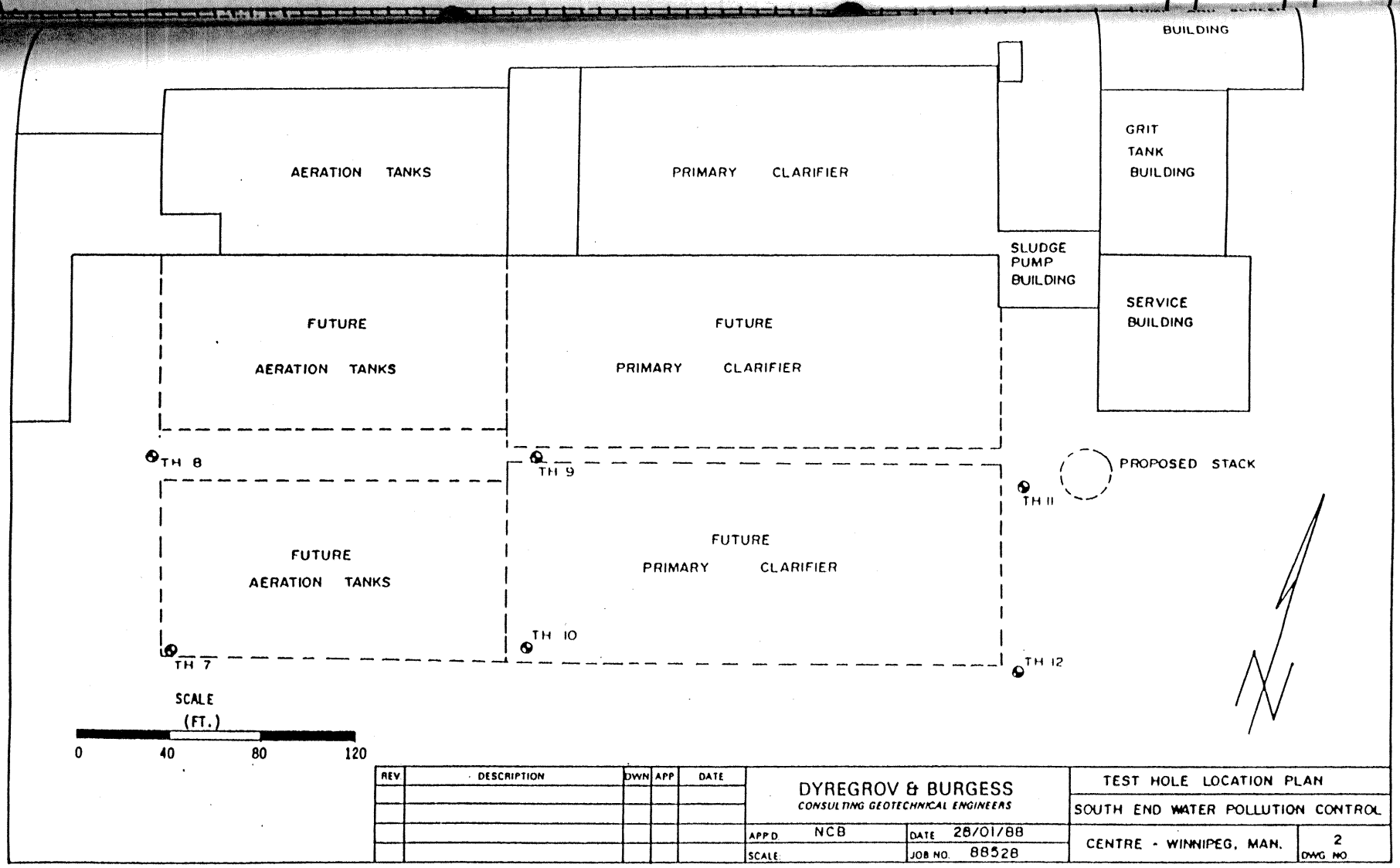
PERCENT %

10 20 30 40 50 60

DEPTH (FT)	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE: CONDITION	SOIL SAMPLE: TYPE	SOIL SAMPLE: PENETRATION RESISTANCE	OTHER TESTS
		DATUM SURFACE ELEVATION 762.17'				
0		Fill -clay, trace gravel				
		Clay -black				
		Clay -silty, brown				
		Silt -tan, moist				
		Clay -mottled brown -highly plastic -stiff to firm -gypsum inclusions to 17'				
10				U		qu=2170psf γ_w=105.6pcf pp=3165psf Tv=1620psf
20						
		grey				
30						
				U		qu=855psf γ_w=102.2pcf pp=1750psf Tv=890psf
40						
		Glacial Till -silty, sandy, gravelly -tan, medium dense to soft -wet to saturated -cobbly and/or bouldery -dense to very dense at 51' -slight seepage at 56' -medium dense below 56'				
50						
60						

Notes:
1. Auger refusal at 59'.
2. Installed sealed standpipe at 47'. Bottom 3' of standpipe slotted.
3. Water level at 29.5' from grade on March 16/88.

Plate 3

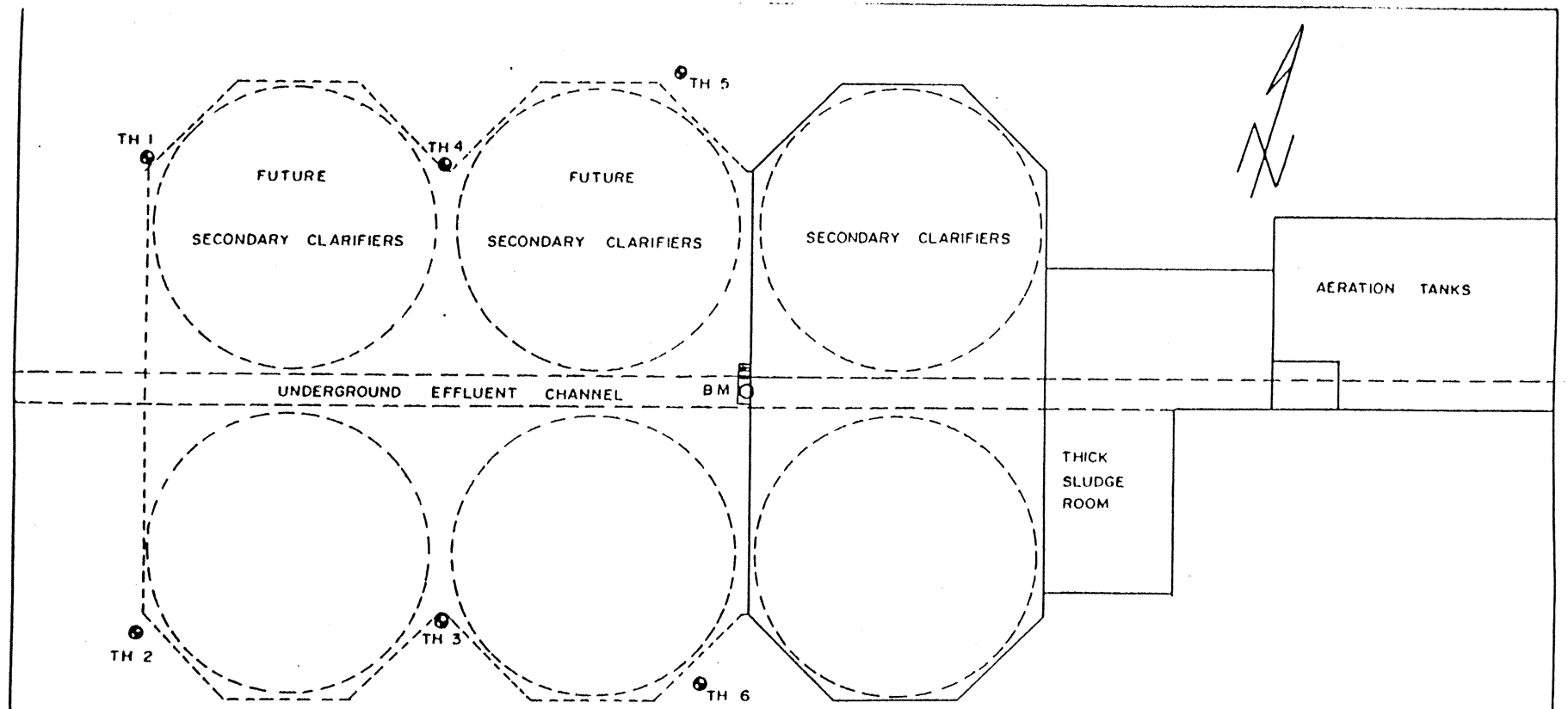


REV	DESCRIPTION	DWN	APP	DATE

DYREGROV & BURGESS
CONSULTING GEOTECHNICAL ENGINEERS

APP'D NCB DATE 28/01/88
SCALE JOB NO. 88528

TEST HOLE LOCATION PLAN
SOUTH END WATER POLLUTION CONTROL CENTRE - WINNIPEG, MAN.
DWG NO. 2



NOTE:

BM - TOP STEP OF DOOR TO SECONDARY CLARIFIER BUILDING AS SHOWN ELEVATION - 766.00'

SCALE (FT.)

0 40 80 120

REV	DESCRIPTION	DWN	APP	DATE

DYREGROV & BURGESS
CONSULTING GEOTECHNICAL ENGINEERS

APP'D NCB DATE 22/01/88

SCALE: JOB NO 88528

TEST HOLE LOCATION PLAN

SOUTH END WATER POLLUTION CONTROL CENTRE - WINNIPEG, MAN.

DWG NO 1