

G.I.-30 SEPT. 1976

GEOCRES No. 30M15-56DIST. 7 REGION W.P. No. 59-75-12/13CONT. No. W. O. No. STR. SITE No. HWY. No. LOCATION THE C.N.R SUBWAYAT NURSERY ACCESS RDNo of PAGES - 1=====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 59-75-12/13

DIST #7

HWY

STR SITE

The C.N.R. Subway at
Nursery Access Road

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FOUNDATION INVESTIGATION REPORT

For

The C.N.R. Subway at Nursery Access Road
and a 4'x4' Concrete Box Culvert Sta. 14+45
W.P. 59-75-12/13, District #7, Port Hope

INTRODUCTION

This report contains the results of a foundation investigation carried out to provide information for the design and construction of the above listed projects. Fieldwork consisted of 3 sampled boreholes at the site of the Nursery Access Road and 2 sampled boreholes as well as 3 dynamic cone penetration tests at the site of the proposed 4'x4' concrete box culvert. This work was carried out during the period March 13th to 18th, 1980 employing a track mounted auger machine equipped with solid stem augers. Bedrock was proven at one location through the recovery of BXL size rock core.

SITE DESCRIPTION

The site is located between Highway 401 and the existing C.N.R. tracks about 1/3 of a mile east of the Waverly Road Highway 401 interchange. The existing Nursery Access Road crosses a broad valley on an abandoned railway embankment which is approximately 12 to 14 feet in height. It is at this point some 300 feet south of Highway 401 that the proposed spurline will cross the Nursery Access Road. Further to the south adjoining the existing C.N.R. tracks a 4'x4' concrete box culvert will be constructed on the valley floor. The area on either side of the valley is engaged in the production of nursery stock.

Physiographically the area is part of the Iroquois Plain which in this area forms a mosaic of till plains and drumlins intermixed with cohesive lacustrine deposits.

SUBSURFACE CONDITIONS (Nursery Access Road)

Subsoil conditions at this site are relatively uniform. The existing embankment of the abandoned railroad consists of 11 to 14 feet of silty

clay fill of low to intermediate plasticity. It has a very stiff to firm consistency as indicated by the Standard Penetration Test 'N' values which varied from 3 to 30 blows per foot. The larger values are found in the upper 5 feet of material. Moisture contents of samples tested varied from 27 to 32 percent.

Underlying the embankment is a 3 to 6 foot thick layer of very dense sand and gravel. This is in turn underlain by a 10 foot thick deposit of glacial origin consisting of a heterogeneous mixture of sand, silt, gravel and clay. Typical grain size distribution curves for this material are shown in Figure 1 of the Appendix. Standard Penetration Test 'N' values which ranged from 22 to in excess of 100 blows per foot indicate a compact to very dense deposit. This material has very slight or no plasticity and will essentially act as a granular deposit. It is in turn underlain by sound limestone bedrock at approximate elevation 237 some 27 feet below the top of the embankment. Groundwater was encountered at approximate elevation 253 some 10 feet below the top of the embankment.

Reference should be made to the Record of Borehole Sheets which are contained in the Report Appendix. They show the boundaries between soil types encountered as well as a summary of all field and laboratory tests performed. Reference should also be made to Drawing #597512&13-A which shows the locations and elevations of all borings together with an inferred subsoil stratigraphy.

SUBSURFACE CONDITIONS (4'x4' Concrete Box Culvert)

Subsoil consists of approximately 2 feet of black organic silt underlain by 5 feet of compact sand and gravel which in turn is underlain by 2 to 3 feet of very dense silty sand some clay and gravel. Refusal to augering was met at a depth of approximately 10 feet indicating bedrock at approximate elevation 243.

The field investigation was carried out during a period of rain and snowmelt and during this period the groundwater level was at the ground surface.

Reference should be made to the Record of Borehole Sheets which are contained in the Report Appendix. They show the boundaries between the soil types encountered as well as a summary of all field and laboratory tests performed. Reference should also be made to Drawing #597512&13-A which shows the locations and elevations of all borings together with an inferred subsoil stratigraphy.

DISCUSSION AND RECOMMENDATIONS

Discussion

It has been proposed that the Nursery Access Road structure be an open concrete culvert with a 12'x12' opening at the grade of the existing road.

RECOMMENDATIONS

H-Piles

The structure may be founded on steel H-piles driven to bedrock at approximate elevation 236. Design loads equal to the allowable structural capacity of the section chosen may be employed. For example, a 12 BP 74 H-section will carry a design load of 130 tons per pile. Pile tips should be reinforced with standard flange plates to prevent damage from boulders in the till layer and to increase contact area between the pile tip and the bedrock. Settlement of a structure supported on H-piles to bedrock will be negligible.

Spread Footings

The structure may be supported on spread footings with a design loading of up to 1 ton per square foot. Resistance to sliding may be calculated assuming a design adhesion value of 1500 p.s.f. Differential settlement in this case will not exceed 1 inch in the length of the structure.

Concrete Box Culvert

As an alternative the structure may be constructed as a concrete box culvert with a design loading of up to 1 ton per square foot. Differential settlement of a box culvert will not exceed 1 inch in the length of the structure.

Earth Pressure

The structure should be designed to resist earth pressures assuming granular backfill weighing 130 lb./cu. ft. and a coefficient of earth pressure at rest k_0 equal to 0.5.

Frost Protection

The base of all footings or pile caps should be protected from frost action by a minimum of 4 feet of cover.

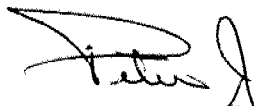
Approach Fills

A shallow organic deposit between the Nursery Access Road and the existing C.N.R. tracks should be removed prior to embankment construction. The irrigation pond located in this same area should be backfilled to 2 feet above water level with free draining granular material. Under these conditions the proposed embankment with slopes of 2 horizontal to 1 vertical will be stable.

4'x4' Concrete Box Culvert Sta. 14+45

This box culvert may be founded in the compact sand and gravel deposit at or below elevation 249 with a design load of up to 1.5 tons per square foot. If the culvert is to be founded above elevation 249 the soil should be excavated to this level and replaced with a pad of compacted granular 'A' to the desired elevation. The pad should extend for at least 1.5 feet on either side of the culvert. Design loading in this case would also be up to 1.5 tons per square foot. Settlement of the culvert would not exceed 1 inch.

If the culvert is founded below the groundwater level prevailing at the time of construction a positive dewatering scheme will be required to prevent loosening of the sand and gravel due to boiling under an unbalanced hydrostatic head.


Peter J. Stuart
Foundations Engineer



April 16, 1980.


M. Devata
Senior Foundations Engineer



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HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W P 59-75-12 LOCATION Co-ords. N 15 950 922; E 1 215 094 ORIGINATED BY PL
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY PJS
DATUM Geodetic DATE March 18, 1980 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							SHEAR STRENGTH		WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE						● QUICK TRIAXIAL	x LAB VANE	10 20 30	
263.7	Ground Surface																	
0.0	Fill		1	SS	22		260						118	5 10 (85)				
	Silty Clay of Low to Intermediate Plasticity		2	SS	7													
	Very Stiff to Firm		3	TW	PH													
250.7							250											
13.0	Sand and Gravel		4	SS	63													
246.7	Very Dense		5	SS	22													
17.0	Silty Sand		6	SS	49													
	Some Gravel and Clay Compact to V. Dense (Glacial Till)						240							12 42 33 13				
237.0			Refusal to augers															
26.7	Probable Bedrock																	
	End of Borehole																	

+3, x5 : Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



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HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W P 59-75-12 LOCATION Co-ords. N 15 950 915; E 1 215 061 ORIGINATED BY PL
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers and B Casing COMPILED BY PJS
DATUM Geodetic DATE March 13, 1980 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
263.4	Ground Surface															GR SA SI CL
0.0	Fill															
	Silty Clay of Low to Intermediate Plasticity		1	SS	24											
			2	SS	12											
			3	SS	7											
	Very Stiff to Firm		4	SS	3											
249.4	Sand and Gravel		5	SS	9											
14.0	Very Dense		6	SS	62											
246.4			7	SS	23											
17.0	Silty Sand		8	SS	38											
	Some Gravel and Clay Compact to V. Dense (Glacial Till)		9	SS	100/7	4"										20 39 28 13
236.5																
26.9	Limestone Bedrock		10	BXL	85%											
232.9	Sound			RC	REC											RQD = 75%
30.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

*3, *5 : Numbers refer to
Sensitivity

20
15 → 5 (%) STRAIN AT FAILURE
10



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RECORD OF BOREHOLE No 3

W P 59-75-12 LOCATION Co-ords. N 15 950 913; E 1 215 022 ORIGINATED BY PL
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY FJS
DATUM Geodetic DATE March 18, 1980 CHECKED BY _____

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
263.7	Ground Surface															
0.0	Fill		1	SS	30											
	Silty Clay of Low to Intermediate Plasticity		2	SS	9											
252.7	Very Stiff to Firm		3	SS	10											
11.0	Sand and Gravel		4	SS	72											
246.7	Very Dense		5	SS	53											
17.0	Silty Sand Some Gravel and Clay		6	SS	37											
	Compact to V. Dense (Glacial Till)		7	SS	125/	10"										
236.5	Refusal to augers															
27.2	Probable Bedrock End of Borehole															

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



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RECORD OF BOREHOLE No 4

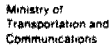
W P 59-75-13 LOCATION Co-ords. N 15 930 762; E 1 214 881 ORIGINATED BY FL
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Auger COMPILED BY FJS
DATUM Geodetic DATE March 17, 1980 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p	W	W _L			
252.7	Ground Level													
250.7	Organic Silt Black	2	1	SS	NA		250	Augered Through Frost						
2.0	Sand and Gravel	2	2	SS	32			Spoon Bouncing						
245.7	Compact	2	3	SS	59									
7.0	Silty Sand, Some Clay													
242.9	and Gravel V. Dense													
9.8	Refusal to Auger Probable Bedrock End of Borehole						240							
	</													

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 5

W P 59-75-13 LOCATION Co-ords. N 15 950 720; E 1 214 898 ORIGINATED BY PL
DIST 7 HWY 401 BOREHOLE TYPE Dynamic Cone Test COMPILED BY PJS
DATUM Geodetic DATE March 17, 1980 CHECKED BY _____

SOIL PROFILE						GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT	PLOT	NUMBER	TYPE			'N' VALUES						20 40 60 80 100
														SHEAR STRENGTH
252.4	Ground Level							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					GR SA SI CL	
0.0							250	Augering Through Frost						
243.2								80/3"						
9.2	Probable Bedrock End of Cone Test						240							

+3, x5: Numbers refer to Sensitivity

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RECORD OF BOREHOLE No 6

W P 59-75-13 LOCATION Co-ords. N 15 950 685; E 1 214 915 ORIGINATED BY PL
DIST 7 HWY 401 BOREHOLE TYPE Solid Stem Auger COMPILED BY PJS
DATUM Geodetic DATE March 17, 1980 CHECKED BY

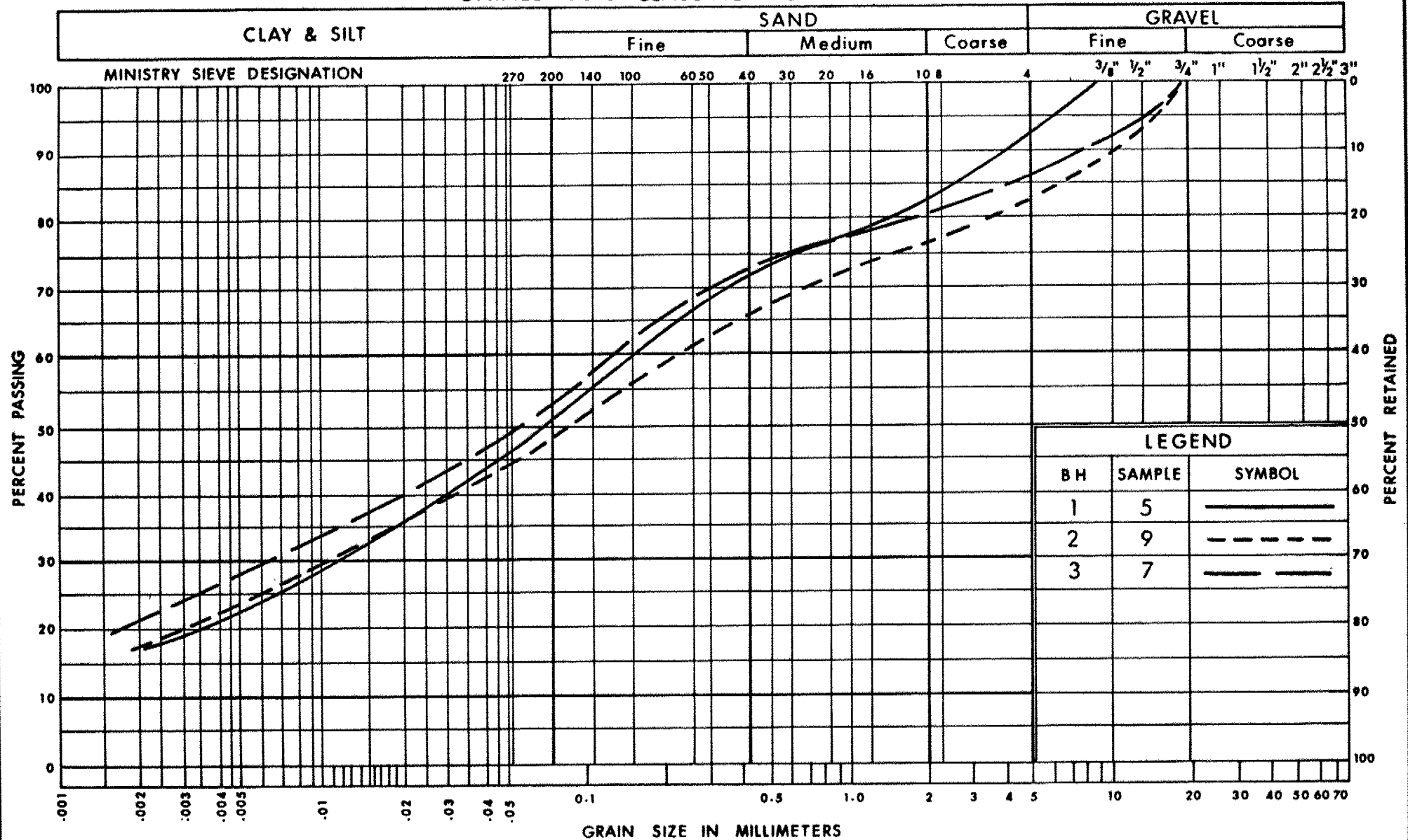
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				NATURAL MOISTURE CONTENT			UNIT WEIGHT %	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p	W	W _L	W _p	W	W _L		
251.9	Ground Level															GR SA SI CL
249.9	Organic Silt Black		1	SS	14		250	Augered Through Frost								
	Sand and Gravel Compact		2	SS	21											45 54 (4)
244.9	Silty Sand, Some Clay		3	SS	537	7"										
243.0	Gravel															
8.9	Refusal to Augering Probable Bedrock End of Borehole						240									

+3, x5: Numbers refer to
Sensitivity

20
15 \div 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



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ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
SILTY SAND
SOME GRAVEL & CLAY (GLACIAL TILL)

FIG No 1

W P 59-75-12

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS N_c .

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL-STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH AS FOLLOWS:

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCK QUALITY: ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4" IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS & SYMBOLS




LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U) ISOTROPICALLY (I) OR NOT (A) AND SHEARED DRAINED (D) OR UNDRAINED (U) WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS) EG. \bar{C}_{IU} = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

S S SPLIT SPOON
W S WASH SAMPLE
S T SLOTTED TUBE SAMPLE
B S BLOCK SAMPLE
C S CHUNK SAMPLE
T W THINWALL OPEN
T P THINWALL PISTON
O S OSTERBERG SAMPLE
F S FOIL SAMPLE
R C ROCK CORE
P H T.W. ADVANCED HYDRAULICALLY
P M T.W. ADVANCED MANUALLY

EARTH PRESSURE TERMS

μ COEFFICIENT OF FRICTION
 δ ANGLE OF WALL FRICTION
 k_o COEFFICIENT OF EARTH PRESSURE AT REST
 k_A COEFFICIENT OF ACTIVE EARTH PRESSURE
 k_P COEFFICIENT OF PASSIVE EARTH PRESSURE
 i ANGLE OF INCLINATION OF SURCHARGE 
 w SLOPE ANGLE-BACKFACE OF WALL 
 β ANGLE OF SLOPE 
 N_q, N_c, N_{γ} BEARING CAPACITY FACTORS
 D_f DEPTH OF FOOTING
 B, L FOOTING DIMENSIONS

INDEX PROPERTIES

γ UNIT WEIGHT OF SOIL (BULK DENSITY)
 γ_w UNIT WEIGHT OF WATER
 γ_d UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
 γ' UNIT WEIGHT OF SUBMERGED SOIL
 G_s SPECIFIC GRAVITY OF SOLIDS
 e VOIDS RATIO
 e_o INITIAL VOIDS RATIO
 e_{max} e IN LOOSEST STATE
 e_{min} e IN DENSEST STATE
 D_r RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
 n POROSITY
 w WATER CONTENT
 w_L LIQUID LIMIT
 w_P PLASTIC LIMIT
 w_S SHRINKAGE LIMIT
 I_P PLASTICITY INDEX = $w_L - w_P$
 I_L LIQUIDITY INDEX = $\frac{w - w_P}{w_L - w_P}$
 I_c CONSISTENCY INDEX = $\frac{w_L - w}{w_L - w_P}$
 A_c ACTIVITY = $\frac{I_P \text{ of soil}}{I_P \text{ of } 2\mu\text{m Soil Fraction}}$
 O_m ORGANIC MATTER CONTENT
 S_r DEGREE OF SATURATION
 S SENSITIVITY = $\frac{S_u(\text{undisturbed})}{S_u(\text{remoulded})}$

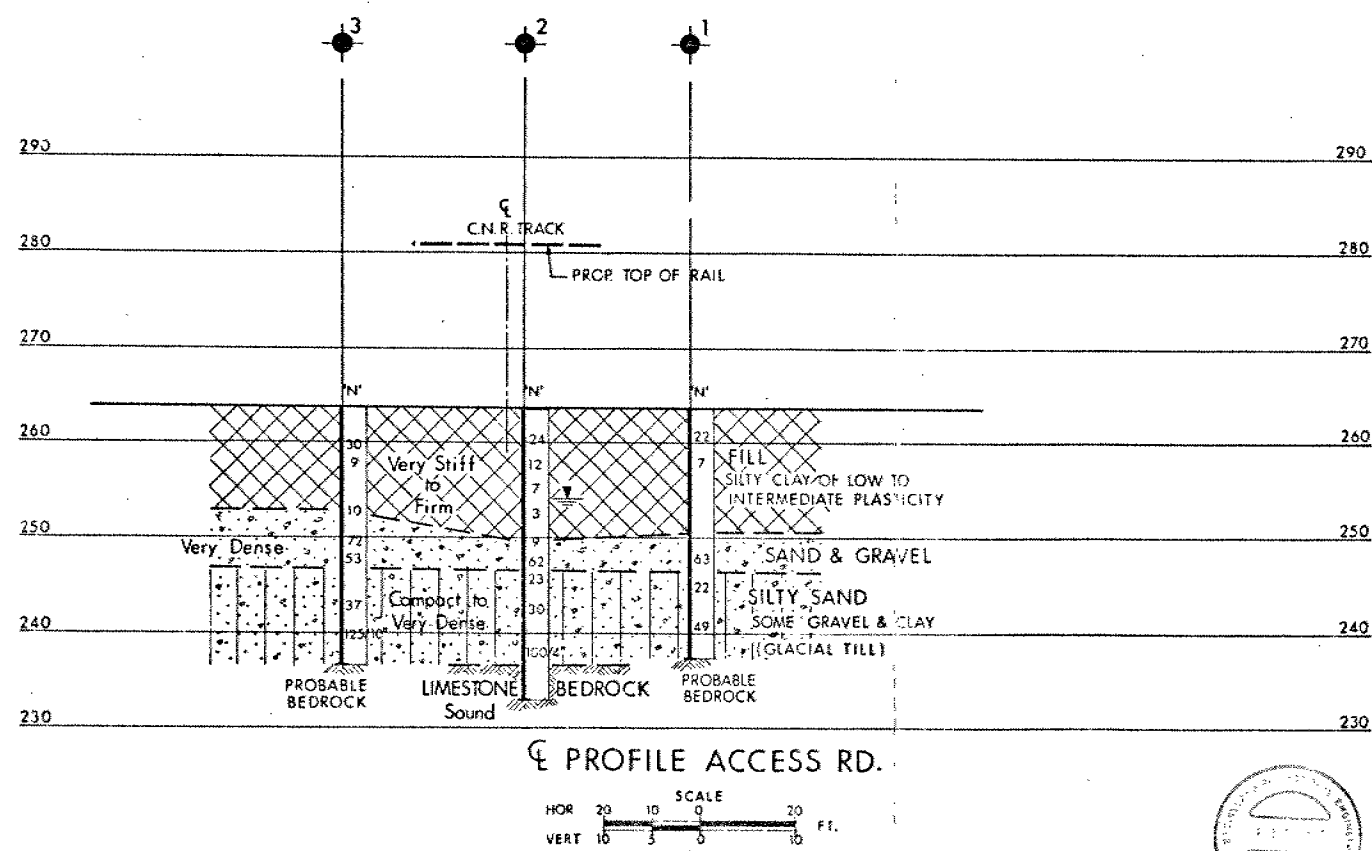
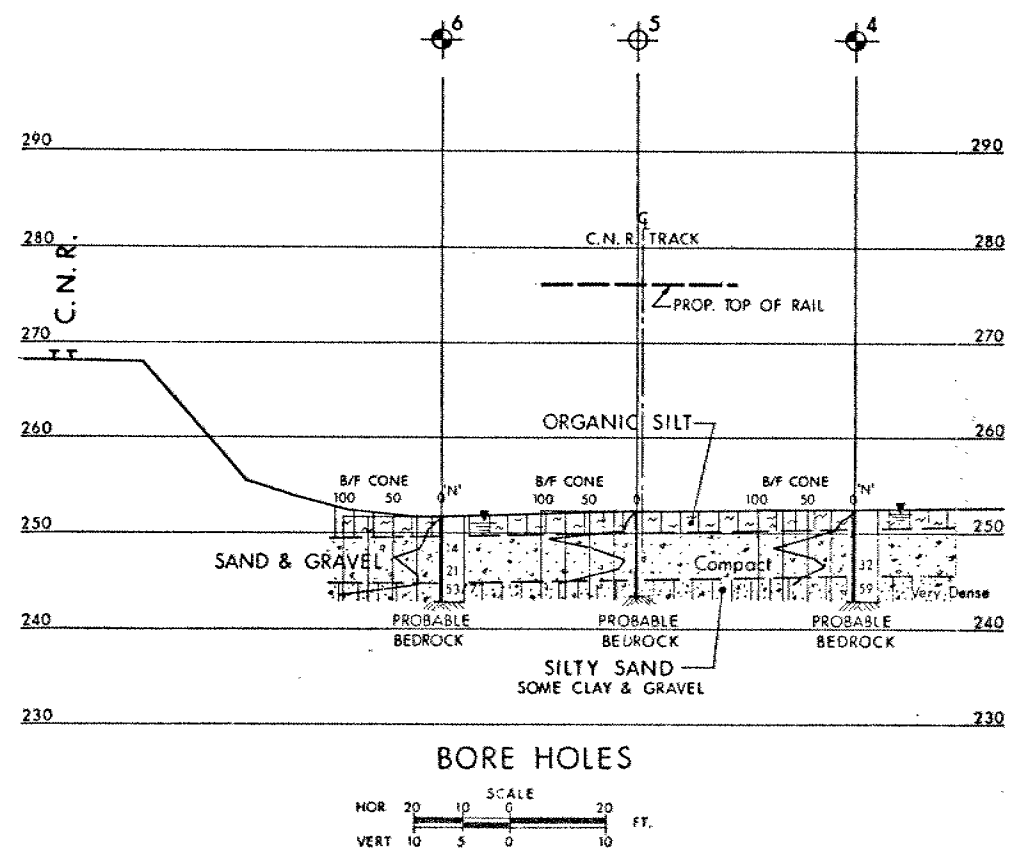
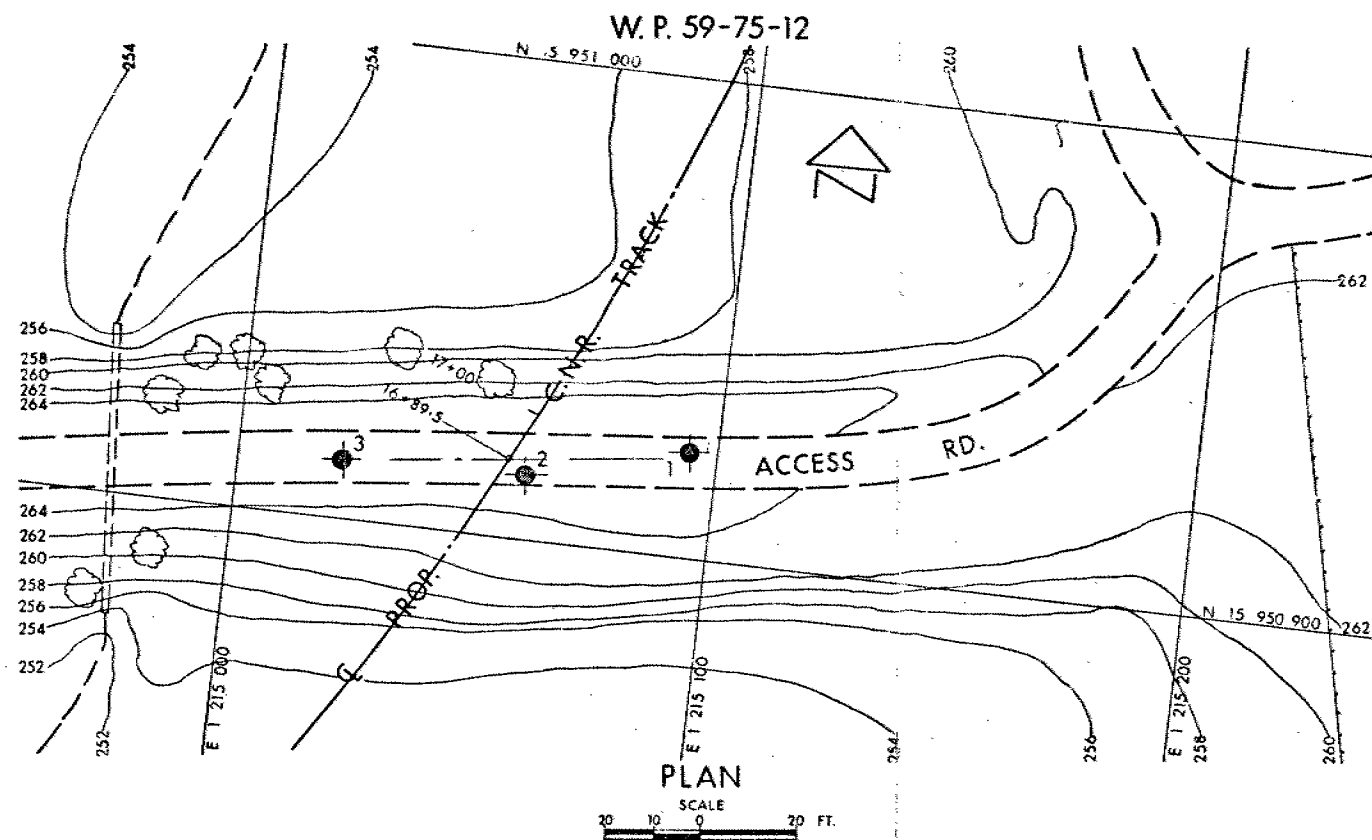
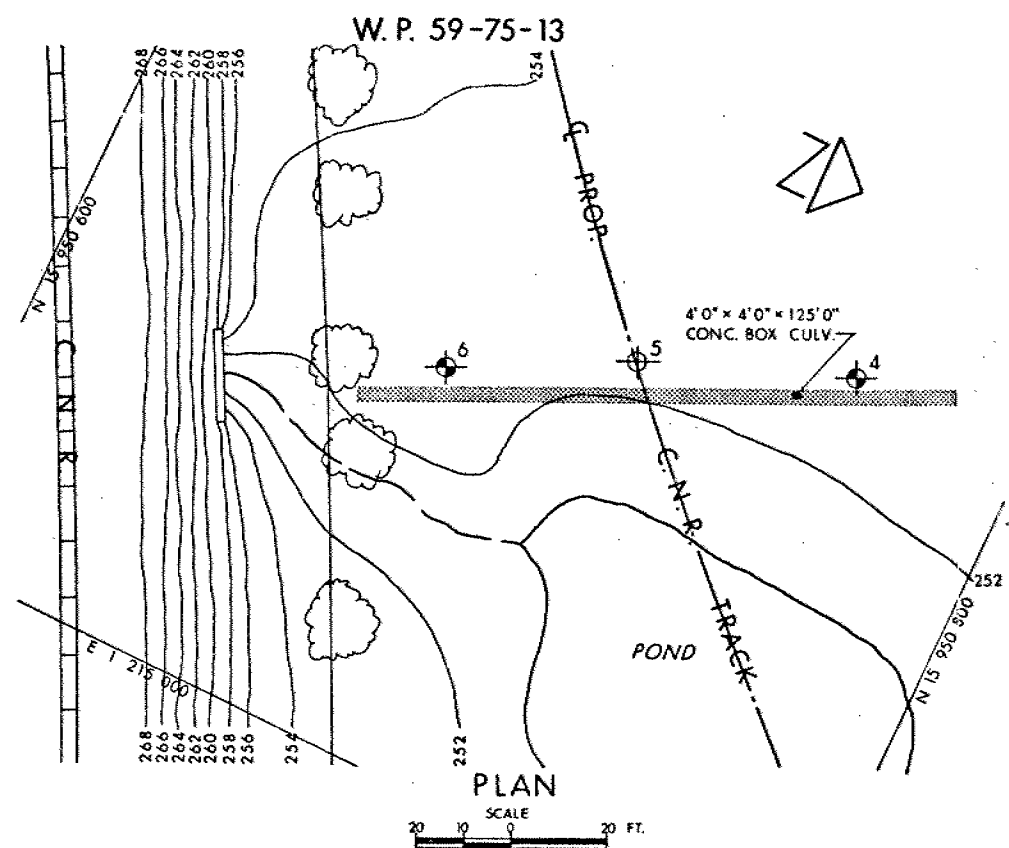
STRENGTH PARAMETERS

ϕ ANGLE OF SHEARING RESISTANCE
 τ_f PEAK SHEAR STRENGTH
 τ_R RESIDUAL SHEAR STRENGTH
 c COHESION INTERCEPT
 $\sigma_1, \sigma_2, \sigma_3$ NORMAL PRINCIPAL STRESSES
 u PORE WATER PRESSURE
 u_e EXCESS u
 r_u PORE PRESSURE RATIO
 q_u UNCONFINED COMPRESSIVE STRENGTH
 s_u UNDRAINED SHEAR STRENGTH
 ϵ LINEAR STRAIN
 γ SHEAR STRAIN
 ν POISSON'S RATIO
 E MODULUS OF ELASTICITY
 G MODULUS OF SHEAR DEFORMATION
 k_s MODULUS OF SUBGRADE REACTION
 m, n STABILITY COEFFICIENTS
 A, B PORE PRESSURE COEFFICIENTS

HYDRAULIC TERMS

h HYDRAULIC HEAD OR POTENTIAL
 q RATE OF DISCHARGE
 v VELOCITY OF FLOW
 i HYDRAULIC GRADIENT
 j SEEPAGE FORCE PER UNIT VOLUME
 η COEFFICIENT OF VISCOSITY
 k COEFFICIENT OF HYDRAULIC CONDUCTIVITY
 k_h k IN HORIZONTAL DIRECTION
 k_v k IN VERTICAL DIRECTION
 m_v COEFFICIENT OF VOLUME CHANGE
 c_v COEFFICIENT OF CONSOLIDATION
 C_c COMPRESSION INDEX
 C_r RECOMPRESSION INDEX
 d DRAINAGE PATH DISTANCE
 T_v TIME FACTOR
 U DEGREE OF CONSOLIDATION
 O_r OVERCONSOLIDATION RATIO (OCR)

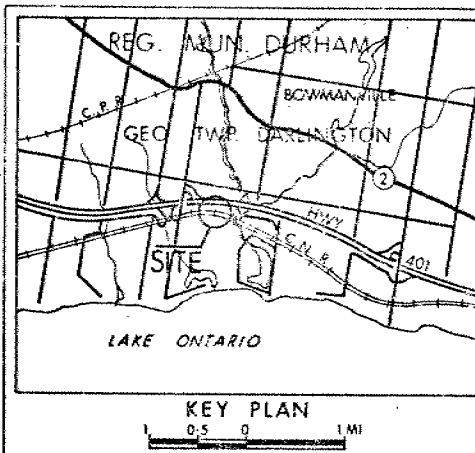
NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
 ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
 σ' = EFFECTIVE NORMAL STRESS



CONT No
WP No 59-75-12 & 13

C.N.R. SPURLINE OVER NURSERY
ACCESS RD. & CONC. BOX CULVERT
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std. Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation 80 03 18
- NO WL Established in BH No 1 & 3

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	263.7	15 950 922	1 215 094
2	263.4	15 950 915	1 215 061
3	263.7	15 950 913	1 215 022
W.P. 59-75-13			
4	252.7	15 950 762	1 214 881
5	252.4	15 950 720	1 214 898
6	251.9	15 950 685	1 214 915

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION