

# CONTRACT 80-44

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NOTE: For purposes of the contract these reports supercede all other foundation reports prepared by or for the Ministry in connection with the above mentioned projects.

'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

$\mu$  COEFFICIENT OF FRICTION  
 $\delta$  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  
 $\beta$  ANGLE OF SLOPE  
 $N, N_q, N_c$  BEARING CAPACITY FACTORS  
 $D_f$  DEPTH OF FOOTING  
 $B, L$  FOOTING DIMENSIONS

##### INDEX PROPERTIES

$\gamma$  UNIT WEIGHT OF SOIL (BULK DENSITY)  
 $\gamma_w$  UNIT WEIGHT OF WATER  
 $\gamma_d$  UNIT DRY WEIGHT OF SOIL (DRY DENSITY)  
 $\gamma'$  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 =  $\frac{I_p \text{ of soil}}{I_p \text{ of } 2\mu m \text{ Soil Fraction}}$   
 $Om$  ORGANIC MATTER CONTENT  
 $S_r$  DEGREE OF SATURATION  
 $S$  SENSITIVITY =  $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

##### STRENGTH PARAMETERS

$\phi$  ANGLE OF SHEARING RESISTANCE  
 $\tau_f$  PEAK SHEAR STRENGTH  
 $\tau_R$  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  
 $\epsilon$  LINEAR STRAIN  
 $\gamma$  SHEAR STRAIN  
 $\nu$  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  
**NOTE:** EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:  
 $\phi'$  = EFFECTIVE ANGLE OF SHEARING RESISTANCE;  
 $\sigma'$  = EFFECTIVE NORMAL STRESS

##### HYDRAULIC TERMS

$h$  HYDRAULIC HEAD OR POTENTIAL  
 $q$  RATE OF DISCHARGE  
 $v$  VELOCITY OF FLOW  
 $i$  HYDRAULIC GRADIENT  
 $j$  SEEPAGE FORCE PER UNIT VOLUME  
 $\eta$  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  
 $O_c$  OVERCONSOLIDATION RATIO (OCR)

## FOUNDATION INVESTIGATION REPORT

For

Grading, Drainage, Granular Base and Paving  
Hwy. 406 at St. Catharines, Ontario.  
District 4, Hamilton.  
W.P. 46-74-42.

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### INTRODUCTION

This report contains the results of foundation investigations carried out at the site of the above mentioned project. Field investigations have been carried out in this area during the 15 year period 1963 to 1978. They provided geotechnical information for a series of proposals, some of which differed considerably from the one finally adopted. For this reason much of the factual data presented does not relate directly to the scheme adopted but it is included to provide general subsoil information in this area.

### SITE DESCRIPTION

The site is located in central St. Catharines on the east bank of Twelve Mile Creek. The creek valley is from  $\frac{1}{4}$  to  $\frac{1}{2}$  mile in width with its floor 70 to 80 feet below the surrounding tableland. The natural slopes are gentle with overall slopes of 3 horizontal to 1 vertical or flatter. A little used roadway parallels Twelve Mile Creek on the narrow strip of level ground bordering the water. The Burgoine Bridge is a high level structure crossing the valley at this point.

### SUBSOIL CONDITIONS

The valley of Twelve Mile Creek has been eroded in a deep deposit of clayey silt to silty clay which is up to 100 feet in thickness at the valley crest. It has developed a desiccated crust from 10 to 20 feet in thickness which is

brown in colour and has an undrained shear strength ranging from 2000 to 10,000 psf. The moisture content in the crust ranges from 20 to 25 percent. Beneath the crust there is a transition from brown to grey with the moisture content increasing to as much as 35 percent. The undrained shear strength decreases varying from 1000 to 3000 psf.

The clayey silt to silty clay layer is underlain by a glacial fluvial deposit up to 70 feet in thickness. It consists of discontinuous layers of irregular thickness which range from clayey silt to fine sand. The till portion of the deposit consists of a hard reddish brown silt to clayey silt containing some sand and a trace of gravel. Standard Penetration 'N' values for this material range from 30 to in excess of 100 blows per foot. The layers of fluvial origin vary from clayey silt to silty sand but consist primarily of silt and silty sand. Standard Penetration 'N' values in these soils are generally between 10 and 50 indicating they are compact to dense.

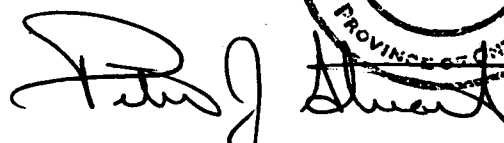
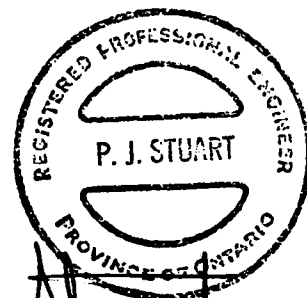
Between the toe of the valley slope and the stream channel there is a deposit of up to 25 feet of organically contaminated soil. It was built up by natural deposition in areas flooded to construct the original Welland Canal and through filling of these areas both by dredging from the channel and as a dumping area for surplus material from construction projects in the area. Much of the material was then repositioned when Ontario Hydro employed a hydraulic dredge to widen and deepen the channel in the late 1940's. As a result this deposit is highly variable with some areas being sandy enough to be non-plastic while others show considerable plasticity. The undrained shear strength of the cohesive portion is judged to vary from 500 to in excess of 1000 psf. The granular portion varies from very loose to compact.

Reference should be made to the Record of Boreholes Sheets which are contained in the report Appendix. They show the

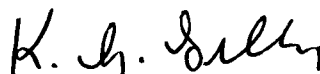
boundaries between different soil types, as well as a summary of the results of all field and laboratory tests performed. Reference should also be made to Sheet Nos. 17, 17A and 17B of the Contract Drawings which show the location and elevation of the borings, together with profiles and sections showing inferred subsoil stratigraphy.

### Groundwater

Groundwater levels were recorded in the open boreholes during field investigations with readings in standpipes taken over more extended periods. Based on these observations it is estimated the groundwater is from 15 to 20 feet below the surface at the top of slope but decreases in depth until it is at or near the surface at the toe of slope. Water levels in the organically contaminated deposit bordering the stream channel varied from being at the surface to being 5 feet below it. An artesian head of up to 11 feet was encountered in the underlying sands and silts in the vicinity of Station 299+00.



P. J. Stuart, P. Eng.  
Foundations Engineer.



K. G. Selby, P. Eng.  
Senior Foundations Engineer.

January, 1980.

## APPENDIX



## HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

# RECORD OF BOREHOLE No 38 S (W.P. 46-74-13, 40 & 39)

W P 46-74-42 LOCATION Coords. N 15 679 653; E 1 066 107 ORIGINATED BY PS  
 DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY JA  
 DATUM Geodetic DATE June 8, 1978 CHECKED BY P-S

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20					
276.2	Ground Level												
0.0						270							
264.2													
12.0	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION

\*3, x5: Numbers refer to  
 Sensitivity

20  
 15  
 10  
 5 (%) STRAIN AT FAILURE

## RECORD OF BOREHOLE No 39S (W.P. 46-74-13, 40 &amp; 39)

W P 46-74-42 LOCATION Coords. N 15 679 684; E 1 066 065 ORIGINATED BY PS  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY JA  
DATUM Geodetic DATE June 8, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
274.2	Ground Level													
0.0														
258.3							270							
15.9	End of Cone Test						260							

**\*3, x5: Numbers refer to Sensitivity**

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 40S

W P 46-74-42 LOCATION Coords. N 15 679 432; E 1 066 790 ORIGINATED BY JA  
 DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY JA  
 DATUM Geodetic DATE June 20, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
271.8	Ground Level																
0.0	Grey Organic Silt and Sand Soft to Stiff		1	SS	7		270										
			2	SS	2												
			3	SS	5		260										
			4	SS	3												
			5	SS	9												
251.8			6	TW	PH		250										
20.0	Sandy Silt to Silty Sand Compact		7	SS	30												
			8	SS	11												
			9	SS	11		240										
			10	SS	11												
229.8			11	SS	23		230										
42.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		12	SS	60												
218.6			13	SS	104/8"		220										
53.2	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 45S

W P 46-74-42 LOCATION Coords. N 15 679 488; E 1 066 805 ORIGINATED BY JA  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY JA  
 DATUM Geodetic DATE June 21, 1978 CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	VALUES		20	40	60	80	100					
271.6	Ground Level															
0.0	Grey Organic Silt and Sand		1	SS	4											
	Soft to Stiff		2	TW	PH											
			3	SS	6											
			4	TW	PH											
			5	SS	1											
254.6			6	SS	6											
17.0	Clayey Silt															
250.1	Very Stiff		7	SS	25											
21.5	End of Borehole															
246.6																
25.0	End of Cone Test															

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 465

W P 46-74-42 LOCATION Coords. N 15 679 390; E 1 066 775 ORIGINATED BY JA  
 DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger, Cone Test COMPILED BY JA  
 DATUM Geodetic DATE June 21, 1978 CHECKED BY ES

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
271.6	Ground Level																
0.0	Rock Rip Rap						270										
267.6			1	SS	33												
4.0	Organic Silt and Sand		2	SS	4												
263.6	Soft to Firm																
8.0	End of Borehole Probable Organic Silt and Sand						260										
254.6																	
17.0							250										
							240										
236.6																	
35.0	End of Cone Test  Note: Water Level Not Established																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 47S

W P 46-74-42 LOCATION Coords. N 15 679 462; E 1 066 691 ORIGINATED BY JA  
 DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY JA  
 DATUM Geodetic DATE June 21, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
270.0	Ground Level																
0.0																	
	Grey Organic Silt and Sand, Soft to Stiff		1	SS	2												
			2	SS	2												
254.5			3	TW	PH												
15.5	Clayey Silt to Silt Hard to Dense		4	SS	37												
248.5			5	SS	44												
21.5	End of Borehole																
	Note: Water Level Not Established																

OFFICE - REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 485

W P 46-74-42 LOCATION Coords. N 15 679 407; E 1 066 672 ORIGINATED BY JA  
 DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY JA  
 DATUM Geodetic DATE June 22, 1978 CHECKED BY KS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.5	Ground Level																
0.0	Probable Organic Silt and Sand						270										
255.5							260										
15.0																	
248.5							250										
22.0	End of Cone Test																

\*3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 49S

W P 46-74-42 LOCATION Coords. N 15 679 528; E 1 066 711 ORIGINATED BY JA  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY JA  
DATUM Geodetic DATE June 22, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
271.4	Ground Level						270										
0.0	Probable Orgnaic Silt and Sand						260										
254.4																	
17.0																	
251.4																	
20.0	End of Cone Test																

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 50 S

W P 46-74-42 LOCATION Coords. N 15 679 502; E 1 066 592 ORIGINATED BY JA  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY JA  
DATUM Geodetic DATE June 22, 1978 CHECKED BY JS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.4	Ground Level																
0.0	Grey Organic Silt and Sand Soft to Stiff		1	SS	4		270										
			2	TW	PH												
			3	TW	PM												
			4	SS	2		260										
255.4			5	TW	PH												
15.0	Clayey Silt to Silt Dense to Very Dense		6	SS	14												
			7	SS	36												
246.4							250										
24.0	End of Borehole		8	SS	57												

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 51 S

W P 46-74-42 LOCATION Coords. N 15 679 553; E 1 066 615 ORIGINATED BY JA  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger, Cone Test COMPILED BY JA  
 DATUM Geodetic DATE June 27, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.9	Ground Level																
0.0	Grey Organic Silt and Sand, Soft to Stiff		1	SS	4		270									0m	
			2	TW	PH											2.22%	
			3	SS	3												
			4	SS	2		260										
			5	SS	2												
			6	SS	2												
249.9			7	SS	1												
21.0			8	SS	4		250										
246.9	Silt, Very Dense		9	SS	52												0 39 50 11
24.0	End of Borehole																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 ◇ 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 52 S

W P 46-74-42 LOCATION Coords, N 15 679 446; E 1 066 580 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 27, 1978 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
271.5	Ground Level																
0.0	Rock Rip Rap						270										
266.5																	
5.0	Grey Organic Silt and Sand  Soft to Stiff		1	SS	2		260		+6							113	0 48 42 10
			2	SS	2												
			3	TW	PH												
			4	SS	4												
253.0			5	SS	22												
18.5			6	SS	27		250										
250.0	Silt, Compact																
21.5	End of Borehole																
246.5																	
25.0	End of Cone																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 53 S

W P 46-74-42 LOCATION Coords. N 15 679 531; E 1 066 502 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 22, 1978 CHECKED BY KS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
270.3	Ground Level															
0.0	Grey Organic Silt and Sand		1	SS	3											
	Soft to Stiff		2	SS	1											
			3	SS	1											
			4	TW	PH											
254.3			5	SS	1											
16.0	Silt, Dense to Very Dense		6	SS	2											
			7	SS	54											
243.8			8	SS	48											
26.5	End of Borehole															

\*<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 54 S

W P 46-74-42 LOCATION Coords. N 15 679 473; E 1 066 492 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 23, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES							
269.0	Ground Level											
0.0	Probable Organic Silt and Sand											
253.0												
16.0												
248.0												
21.0	End of Cone Test											

# RECORD OF BOREHOLE No 555

W P 46-74-42 LOCATION Coords. N 15 679 585; E 1 066 528 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 23, 1978 CHECKED BY FS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.7	Ground Level																
0.0	Probable Organic Silt																
263.7																	
7.0	Probable Clayey Silt																
254.7																	
16.0	End of Cone Test																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 56S

W P 46-74-42 LOCATION Coords. N 15 679 568; E 1 066 408 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 26, 1978 CHECKED BY R

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	PSF					
270.0	Ground Level													
0.0	Grey Organic Silt and Sand, Soft to Stiff		1	SS	6									
			2	SS	2									
			3	SS	2									
258.0			4	TW	PH									
12.0			5	SS	9									
255.0	Silty Clay, Stiff													
15.0	Silt, Dense to Very Dense		6	SS	34									
248.5			7	SS	85									
21.5	End of Borehole													

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 57 S

W P 46-74-42 LOCATION Coords. N 15 679 590; E 1 066 408 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 26, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.2	Ground Level																
0.0	Probable Organic Silt																
226.2																	
4.0	Probable Clayey Silt																
256.2																	
14.0	End of Cone Test																

\*<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 58 S

W P 46-74-42 LOCATION Coords. N 15 679 512; E 1 066 390 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger, Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 26, 1978 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
267.7	Ground Level																
0.0	Organic Silt and Sand		1	TW	PM											104	Om=4.55%
	Soft to Stiff		2	TW	PM											117	Om=2.11%
			3	TW	PM		260									124	Om=0.99%
			4	TW	PM											127	Om=0.73%
252.7																	
251.2	Silt, Dense		5	SS	41												
16.5	End of Borehole						250										
18.0	Note: Water Level Not Established																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 59S

W P 46-74-42 LOCATION Coords. N 15 679 588; E 1 066 310 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE \_\_\_\_\_ CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
270.7	Ground Level													
0.0	Clayey Silt Stiff to Very Stiff		1	SS	7									
			2	SS	8									
			3	SS	5									
			4	SS	7									
256.2			5	SS	62									
14.5	End of Borehole													

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE





RECORD OF BOREHOLE No 60S

W P 46-74-42 LOCATION Coords. N 15 679 550; E 1 066 292 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 26, 1978 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
269.2	Ground Level						20	40	60	80	100						
0.0	Grey Organic Silt and Sand, Soft to Stiff		1	SS	3												
			2	SS	1												
			3	TW	PH												
			4	TW	PH												
255.2			5	SS	11												
14.0	Sand and Gravel		6	SS	56												
252.2	Compact																
17.0	Red Silt, Very Dense																
19.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 61S

W P 46-74-42 LOCATION Coords. N 15 679 569; E 1 066 302 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 26, 1978 CHECKED BY KS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
269.9	Ground Level																GR SA SI CL
0.0	Probable Organic Silt																
262.9																	
7.0							260										
255.9																	
14.0	End of Cone Test																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 62 S

W P 46-74-42 LOCATION Coords. N 15 679 559; E 1 066 297 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 26, 1978 CHECKED BY KS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
269.6	Ground Level												
0.0													
	Probable Organic Silt and Sand						260						
253.6													
16.9													
251.6													
18.0	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION

\*<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

W P 46-74-42 LOCATION Coords. N 15 679 593; E 1 066 193 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 27, 1978 CHECKED BY RS

+3, x5: Numbers refer to Sensitivity

## RECORD OF BOREHOLE No 64 S

W P 46-74-82 LOCATION Coords. N 15 679 612; E 1 066 205 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Conc Test COMPILED BY J.A.  
DATUM Geodetic DATE June 27, 1978 CHECKED BY RS

[illegible]

$\times^3, \times^5$ : Numbers refer to Sensitivity

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 65S

W P 46-74-42 LOCATION Coords. N 15 679 580; E 1 066 377 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 27, 1978 CHECKED BY KS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.2	Ground Level																
0.0	Probable Organic Silt																
264.2																	
6.0	Probable Clayey Silt																
255.2																	
15.0	End of Cone Test																

OFFICE REPORT ON SOIL EXPLORATION

\*3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 665

W P 46-74-42 LOCATION Coords. N 15 679 416; E 1 067 008 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger COMPILED BY J.A.  
DATUM Geodetic DATE June 27, 1978 CHECKED BY SS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
271.9	Ground Level																
0.0	Organic Silt and Sand, Soft to Stiff		1	SS	4		270									118	Om=1.26%
264.9			2	TW	PH												
7.0	Clayey Silt With Layers of Organic Silt		3	SS	7												
			4	SS	3		260			+ 2.9							
			5	SS	1												
253.9	Soft to Firm		6	SS	5					+ 1.8						Om=0.85%	
18.0	Silty Sand to Sandy Silt		7	SS	37		250										
	Compact to Dense																
			8	SS	47		240										
			9	SS	19		230									0 78 15 7	
			10	SS	13		220										
			11	SS	17		210									0 0 91 9	
206.9																	
65.0	Queenston Shale																Harder at 65'
202.7			12	SS	100/ 2"												
69.2	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 67S

W P 46-74-42 LOCATION Coords. N 15 679 315; E 1 067 744 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 28, 1978 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100				
275.7	Ground Level														
0.0	Organically Contaminated Clayey Silt With Sandy Layers Firm to Stiff		1	SS	17										
			2	SS	6										
			3	TW	PH										
			3A	SS	5										
			4	SS	3										
			5	TW	PH										
			6	SS	2										
254.7			7	SS	9										
21.0	Silty Clay Stiff		8	SS	6										
245.7															
244.2	Silt, Compact		9	SS	25										
31.5	End of Borehole														
33.0	End of Cone Test														

\*3, \*5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE





## RECORD OF BOREHOLE No 68 S

W P 46-74-42 LOCATION Coords. N 15 679 215; E 1 067 770 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 28, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
273.8	Ground Level																
0.0	Organically Contaminated Clayey Silt With Sandy Layers		1	SS	3		270										
	Soft to Firm		2	SS	4												
			3	TW	PH												
			4	SS	2												
			5	SS	4												
			6	TW	PH		260										
255.8			7	SS	3												
18.0	Silty Clay		8	SS	3												
	Firm		9	SS	7		250										
247.3																	
26.5	End of Borehole																
242.8																	
31.0	End of Cone Test																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 69 S

W P 46-74-42 LOCATION Coords. N 15 679 242; E 1 067 568 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 29, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
276.6	Ground Level																
0.0	Silt to Clayey Silt Some Sand Loose		1	SS	8		270										
270.6			2	SS	2												
6.0	Organically Contaminated Clayey Silt With Sandy Layers Soft to Firm Black and Grey		3	TW	PH												
			4	SS	6												
			5	TW	PH												
260.6			6	SS	9												
16.6	Silty Clay  Firm		7	SS	8		260										
			8	SS	3												
250.1			9	SS	14												
26.5	End of Borehole																
245.6																	
31.5	End of Cone Test  Note: Water Level Not Established																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 705

W P 46-74-42 LOCATION Coords. N 15 679 242; E 1 067 456 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 29, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
274.8	Ground Level																
0.0	Pavement and Gravel																
1.0	Clayey Silt With Sand, Some Gravel		1	SS	9												
267.8	Stiff		2	SS	6												
7.0	Silty Clay Very Stiff		3	SS	10												
			4	SS	19												
258.3			5	SS	11												
16.5	End of Borehole																
244.8																	
30.0	End of Cone Test																

OFFICE REPORT ON SOIL EXPLORATION

\* 3, x 5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 71S

W P 46-74-42 LOCATION Coords. N 15 679 265; E 1 067 367 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger COMPILED BY J.A.  
 DATUM Geodetic DATE July 6, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
274.3	Ground Level																
0.0	Pavement, Gravel																
1.0	Sand, Some Gravel and Silt Trace of Clay Loose		1	SS	8		270										24 56 14 6
			2	SS	3												
264.3			3	SS	6												
10.0	Clayey Silt to Silty Clay  Firm to Stiff		4	SS	11												
			5	SS	3												
			6	SS	4		260										
			7	TW	PH												
							250										
245.3			8	SS	4												
242.8	Red Silt to Clayey Silt																
242.8			9	SS	38												
31.5	End of Borehole																

\*3, \*5: Numbers refer to  
Sensitivity

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10

## RECORD OF BOREHOLE No 72 S

W P 46-74-42 LOCATION Coords. N 15 679 362; E 1 067 182 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 29, 1978 CHECKED BY RS

[illegible]

$\times^3, \times^5$  : Numbers refer to Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



## RECORD OF BOREHOLE No 73 S

W P 46-74-42 LOCATION Coords. N 15 679 318; E 1 067 170 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE July 4, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION-SCALE Head	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	1200 1600 2000	400 800	1200 1600 2000					
273.4	Ground Level															
0.0	Organically Contaminated Silt and Sand		1	SS	4		270	+2.0							104	
	Soft to Firm		2	TW	PH										Om=7.7%	
			3	SS	3				+4.4							
			4	TW	PM			+2.5							125	Om=1.86%
258.4			5	SS	2		260									
15.0			6	SS	10										Om=2.6%	8 66 20 6
256.4	Sand & Gravel, Compact		7	SS	2											
17.0	Silt to Clayey Silt, Stiff to Very Stiff (Layered)		8	SS	14											
			9	SS	22		250									
			10	SS	14											
238.4							240									
35.0	Fine Sand Some Silt		11	SS	23											
	Compact						230									
			12	SS	10											3 83 11 3
222.4							220									
51.0	Gravel Some Sand, Trace of Silt		13	SS	100/9"											71 18 9 2
	Very Dense						210									
			14	SS	100											
203.9			15	SS	-											
							↓ Encountered									
69.5	End of Borehole															

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



RECORD OF BOREHOLE No 74 S

W P 46-74-42 LOCATION Coords. N 15 679 300; E 1 067 260 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger COMPILED BY J.A.  
DATUM Geodetic DATE July 6, 1978 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
273.8	Ground Level																
0.0	Sand and Gravel																
269.8	Loose		1	SS	7		270										
4.0	Clayey Silt to Silty Clay		2	SS	3												
	Firm to Very Stiff		3	SS	7												
			4	TW	PH												
			5	TW	PH		260										
			6	SS	2												
			7	TW	PH												
252.8																	
21.0	Silt to Clayey Silt																
249.8	Compact		8	SS	25		250										
24.0	End of Borehole																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 201

W P 46-74-42 LOCATION Coords. N 15 679 347; E 1 067 522 ORIGINATED BY WA  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY ABK  
DATUM Geodetic DATE June 21-22, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
306.2	Ground Level																
0.0	Silty Clay to Clayey Silt Some Organics		1	SS	8		300									125.5	0 6 66 28
296.7	Stiff - Brown		2	TW	PH												
9.5	Silty Sand With Some Gravel		3	SS	25												
	Dense		4	TW	PH												
288.2			5	SS	35												8 76 (16)
18.0	Clayey Silt to Silty Clay Traces of Sand and Gravel		6	SS	47												
	Stiff to Very Stiff		7	TW	PM												
	Grey		8	SS	5												
			9	TW	PM												
			10	SS	19												
			11	SS	21												
			12	SS	12												
253.2			13	&													
53.0	Silt to Clayey Silt Some Sand and Gravel Very Dense to Hard (Glacial Till) Brown		14	TW	PM												9 35 46 10
			15	SS	110												
			16	SS	74												
			17	SS	88												
230.2																	
76.0	Silty Sand Dense to Very Dense Brown		18	SS	28												0 70 (30)
			19	SS	58												
208.2																	
98.0	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



W P 46-74-42 LOCATION Coords. N 15 679 472; E 1 067 921 ORIGINATED BY W.A.  
DIST 4 HWY 406 BOREHOLE TYPE Pennndrill and Cone Test COMPILED BY A.B.K.  
DATUM Geodetic DATE June 23, 1971 CHECKED BY \_\_\_\_\_

+3, x5: Numbers refer to Sensitivity



## RECORD OF BOREHOLE No 203

W P 46-74-42 LOCATION Coords. N 15 679 543; E 1 067 714 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Pennndrill and Cone Test COMPILED BY A.K.B.  
DATUM Geodetic DATE June 24-29, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	400 800 1200 1600 2000					
328.5	Ground Level													
0.0	Silty Sand Traces of Gravel (Fill) Compact, Brown		1	SS	14									
320.5			2	SS	15									5 54 37 4
8.0	Clayey Silt to Silty Clay, Traces of Coarse Sand  Firm to Very Stiff  Brown Becoming Grey		3	SS	22									
			4	SS	36									
			5	SS	30									
			6	SS	22									
			7	SS	18									
			8	SS	17									
			9	SS	10									
			10	TW	PM								122	
			11	SS	11		285.1						120.5	
			12	TW	PM								118	0 1 48 51
270.5			13	TW	PM								125	
58.0	Clayey Silt With Sand and Gravel  Very Stiff		14	SS	27								123	
			15	SS	28									4 11 52 33
			16	SS	31									
			17	SS	16									
247.5			18	TW	PM								120	
81.0	Silt to Clayey Silt Some Sand, Traces of Gravel Very Dense to Hard (Glacial Till) Brown		19	SS	113									5 17 62 16
			20	SS	121									
			21	SS	82									
			22	SS	93									
			23	SS	148									
225.5			24	SS	14									3 79 (18)
103.0	Silty Sand, Traces of Gravel Very Dense													
213.5			25	SS	120/ 7"									
115.0	Silt to Clayey Silt													
210.0	Hard													
118.5														

Continued

+3, x5: Numbers refer to  
Sensitivity20  
15 5 (%) STRAIN AT FAILURE  
10

W P 46-74-42 LOCATION Coords. N 15 679 543; E 1 067 714 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill COMPILED BY A.K.B.  
DATUM Geodetic DATE June 24-29, 1971 CHECKED BY RS

+3, x5: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 204

W P 46-74-42 LOCATION Coords. N 15 679 550; E 1 068 105 ORIGINATED BY K.W.  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill COMPILED BY A.K.B.  
 DATUM Geodetic DATE June 23-24, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
315.6	Ground Level																
0.0	Clayey Silt to Silty Clay, Traces of Sand and Gravel Random Pockets of Sand  Hard to Stiff Brown Becoming Grey		1	SS	21		310										
			2	SS	38												
			3	SS	37												
			4	SS	36												
			5	SS	32		300										
			6	SS	31												
			7	SS	13		290										
			8	TW	PH												
			9	TW	PM		280										
			10	SS	13												
			11	TW	PM		270										
			12	SS	19												
			13	SS	26		260										
			14	SS	31												
			15	SS	17		250										
245.6			16	TW	PH												
70.0	Silt to Clayey Silt Some Sand, Trace of Gravel, Very Dense to Hard (Glacial Till)		17	SS	102		240										
			18	SS	118												
			19	SS	168												
235.6	Reddish Brown		20	SS	507												
80.0	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



## RECORD OF BOREHOLE No 205

W P 46-74-42 LOCATION Coords. N 15 679 284; E 1 067 778 ORIGINATED BY W.A.  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY A.K.B.  
DATUM Geodetic DATE June 24-28, 1971 CHECKED BY PS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
274.3	Ground Level							20 40 60 80 100	400 800 1200 1600 2000	20 40 60					
0.0	Clayey Silt With Traces of Sand, Seams of Sand and Gravel, Organic Contamination Firm to Stiff		1	SS	4		270								
			2	SS	14										
			3	SS	11										
			4	TW	PH										
			5	TW	PH										
			6	SS	5										
248.3			7	TW	PH		250								
26.0			8	SS	73										
	Clayey Silt to Silt Some Sand, Trace of Gravel, Very Stiff to Hard or Dense (Glacial Till) Reddish Brown		9	SS	89		240								
			10	SS	86/11"										
			11	SS	22		230								
			12	SS	16										
			13	TW	PH		220								
			14	SS	14										
			15	SS	43		210								
			16	SS	46		200								
			17	SS	43		190								
180.6			18	SS	60/2"										
93.7	End of Borehole														

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 206

W P 46-74-42 LOCATION Coords. N 15 679 659; E 1 067 524 ORIGINATED BY W.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Washboring BX Casing COMPILED BY A.K.B.  
 DATUM Geodetic DATE July 8-12, 1971 CHECKED BY R.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
356.5	Ground Level																
0.0	Gravelly Sand to Sandy Gravel Traces of Silt Compact to Dense Brown		1	SS	51		350										41 51 (8)
			2	SS	18												68 26 (6)
			3	SS	25												33 53 (14)
			4	SS	10												
			5	SS	42												
335.5																	
21.0	Clayey Silt to Silty Clay Traces of Sand and Gravel  Occasionally Laminated Firm to Stiff  Grey		6	SS	14		330									123	
			7	TW	PH												
			8	TW	PH											129	
			9	TW	PH		320									127	
			10	TW	PH											119	
			11	TW	PH		310									118.5	
			12	TW	PH												
			13	TW	PM		300										
			14	TW	PH											117	
			15	TW	PH		290									120	
			16	TW	PH											119	
							280										
			17	TW	PH		270									120	
	Gravelly Sand Seams		18	SS	18		260										
			19	SS	9												
250.8							250										
105.7	Silt to Clayey Silt Some Sand & Gravel (Till), Very Dense to Hard, Red		20	SS	60/5"												
245.8			21	SS	60/2"												
110.7	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 207

W P 46-74-4 LOCATION Coords. N 15 679 212; E 1 067 400 ORIGINATED BY WA  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY AKB  
 DATUM Geodetic DATE July 14-15, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
273.0	Ground Level																
0.0	Mixed Fill																
268.5			1	SS	2		270										
4.5	Clayey Silt to Silty Clay Layers of Sand and Gravel		2	SS	6												
	Traces of Organics		3	SS	3												
	Soft to Firm		4	SS	2												
	Brown and Grey		5	SS	5												
			6	TW	PH												
			7	TW	PH												
245.0			8	SS	19												
28.0	Clayey Silt Some Sand and Gravel		9	SS	30												
	Hard		10	SS	37												
	Red-Brown																
229.0			11	SS	59												
44.0	Silty Sand		12	SS	20												
	Compact		13	SS	16												
	Grey-Brown																
214.2			14	SS	43												
58.8	Clayey Silt		15	SS	46												
	Traces of Sand																
	Hard		16	SS	34												
190.0																	
81.0	Weathered Shale		17	SS	60												
187.9			18	SS	60												
85.1	End of Borehole																

\*<sup>3</sup>, \*<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 208

W P 46-74-4\* LOCATION Coords. N 15 679 496; E 1 067 346 ORIGINATED BY K.W.  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY A.K.B.  
 DATUM Geodetic DATE July 1-7, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
324.7	Ground Level							20 40 60 80 100												
0.0	Silty Sand Traces of Gravel Loose		1	SS	7		320	400 800 1200 1600 2000					20 40 60			PCF	GR SA SI CL			
318.2			2	SS	4												9 59 26 6			
6.5	Clayey Silt to Silty Clay With Traces of Sand and Gravel, Occ. Laminated  Firm to Very Stiff  Grey		3	SS	4															
			4&5	TW	PM															
			6&7	TW	PM															
			8	SS	PM															
			9	SS	8															
			10	TW	PM															
			11	SS	7															
			12	SS	7															
			13	TW	PM															
			14	SS	8															
			15	TW	PM															
			16	SS	24															
			17	SS	21															
			18	SS	31															
		254.7			19	SS	101													
		70.0	Silt to Silty Clay Some Sand and Gravel Very Dense to Hard (Glacial Till) Red		20	SS	100/10"											30 42 24 4		
					21	SS	100/9"													
		239.7																	1 18 60 21	
85.0	Silty Sand Very Dense		22	SS	9															
232.2			23	SS	79												0 77 (23)			
92.5	End of Borehole																			

\*<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 209

W P 46-74-42 LOCATION Coords. N 15 679 479; E 1 067 187 ORIGINATED BY WA  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY AKB  
 DATUM Geodetic DATE July 5, 6, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
302.7	Ground Level													
0.0	Clayey Silt to Silty Clay With Traces of Sand and Gravel  Occasionally Laminated  Stiff to Hard  Grey		1	SS	10		300							
			2	SS	16									
			3	SS	29									
			4	SS	45		290							
			5	SS	43									
			6	SS	21									
			7	TW	PH		280						117	
			8	SS	9								120	
			9	TW	PM		270						130	
			10	SS	24									1 9 54 36
			11	TW	PH		260						128	
			12	SS	31									
			13	SS	100/	10"	250							
244.7			14	SS	60/	4"	240							1 10 73 16
58.0	Silt With Pockets of Clayey Silt  Hard		15	SS	55									
229.7							230							
228.2	Silty Sand		16	SS	41									0 76 (24)
74.5	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 210

W P 46-74-12 LOCATION Coords. N 15 679 575; E 1 066 964 ORIGINATED BY K.W.  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY K.W.  
 DATUM Geodetic DATE June 30 and July 1, 1971 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL 400 800 1200 1600 2000	+ FIELD VANE x LAB VANE						
286.5	Ground Level							20 40 60 80 100							
0.0	Clayey Silt With Traces of Sand and Gravel  Stiff to Very Stiff  Grey and Brown					284.9 283.0 280 270 260 250 240 230 220									
			1	SS	5								131.5		
			2	SS	13										
			3	TW	PM										
			4	SS	9										
			5	TW	PM								130		
			6	SS	10										
			7	TW	PM								135.5		
			8	SS	79										
248.5			9	SS	4/6										
38.0	Silty Sand to Sandy Silt  Dense		10	SS	33									0 53 (47)	
			11	SS	21										
231.5			12	SS	113										
55.0	Silt to Clayey Silt Some Sand and Gravel Hard to Very Dense Red (Glacial Till)		13	SS	100/5"									8 28 54 10	
			14	SS	71/6"										
211.9			15	SS	30/1"										
74.6	End of Borehole														

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 211

W P 46-74-42 LOCATION Coords. N 15 679 672; E 1 066 665 ORIGINATED BY W.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY K.W.  
 DATUM Geodetic DATE July 7, 8, 1971 CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80					
300.8	Ground Level														
0.0															
	Clayey Silt to Silty Clay With Traces of Sand and Gravel		1	SS	16										
			2	SS	6										
			3	SS	11										
			4	SS	9										
	Firm to Stiff		5	TW	PH										
	Brown and Grey		6	SS	8										
			7	TW	PM										
			8	SS	13										
			9	SS	18										
			10	TW	PH										
			11	SS	17										
252.8			12	SS	70/4 1/2"										
48.0	Silt to Clayey Silt Trace of Sand and Gravel (Glacial Till) Very Dense to Hard		13	SS	60/6"										
247.3															
53.5	End of Borehole														

# RECORD OF BOREHOLE No 212

W P 46-74-42 LOCATION Coords. N 15 679 348; E 1 066 916 ORIGINATED BY WA  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and BX Washbore COMPILED BY KW  
 DATUM Geodetic DATE June 30, July 1 & 5, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
271.7	Ground Level																
0.0	Organically Contaminated Clayey Silt Firm		1	SS	4												
			2	SS	3												
			3	TW	PM												
			4	SS	4												
			5	SS	3												
			6	TW	PM												
			7	SS	6												
			8	TW	PH												
237.7			9	SS	8												
34.0	Silty Sand Compact to Dense Greyish-Brown		10	SS	21												
			11	SS	27												
			12	SS	31												
216.5			13	SS	39												
55.2	Silt to Clayey Silt Some Sand and Gravel Hard to Very Dense Red (Glacial Till)		14	SS	33												
204.2			15	SS	60/5"												
67.5	End of Borehole		16	RC	1% Rec.												

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 213

W P 46-74-4 LOCATION Coords. N 15 679 403; E 1 066 715 ORIGINATED BY W.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill, BX and AXT Washboring and Cone Test COMPILED BY K.W.  
 DATUM Geodetic DATE June 28, 29, 30, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
271.7	Ground Level															
0.0	Grey Organic Silt and Sand  Soft to Stiff		1	SS	9		271.7								0m	
			2	SS	3										3.7%	
			3	SS	3											
			4	SS	2											
253.7			5	SS	12											
18.0	Silt to Silty Sand Seams of Gravel Traces of Clay Compact Brown		6	SS	30											
			7	SS	24											
			8	SS	21											
			9	SS	21											
232.7			10	SS	64											
39.0	Clayey Silt to Silt Some Sand and Gravel  Very Dense to Hard (Glacial Till)  Red-Brown		11	SS	60/ 3"											
			12	SS	60/ 2"											
			13	SS	60/ 2½"											
209.2			14	RC	50%											
62.5	End of Borehole															

+3, x5 : Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 214

W P 46-74-42 LOCATION Coords. N 15 679 467; E 1 066 514 ORIGINATED BY K.W.  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY K.W.  
 DATUM Geodetic DATE June 29, 1971 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
270.0	Ground Level													
0.0	Organic Silt With Some Sand Traces of Vegetable Matter  Very Loose  Dark Brown and Black		1	SS	2	269.2								
			2	SS	4									
			3	SS	3		260							
			4	SS	4									
255.0			5	SS	42									
15.0	Silt to Sandy Silt  Traces of Clay and Gravel  Very Dense  Grey		6	SS	121		250							
			7	SS	57									
			8	SS	70		240							
235.0			9&10	SS	91									
35.0	Clayey Silt to Silt Some Sand, Trace of Gravel  (Glacial Till)  Very Dense to Hard  Red-Brown		11	SS	93 7 6"		230							
			12	SS	100 7 6"									
			13	SS	101 7 7"		220							
215.4			14	SS	50 7 1 1/2"									
54.6	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 215

W P 46-74-42 LOCATION Coords. N 15 679 710; E 1 066 436 ORIGINATED BY W.A.  
DIST 4 HWY 406 BOREHOLE TYPE Pennndrill and Cone Test COMPILED BY K.W.  
DATUM Geodetic DATE July 13, 14, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
305.6	Ground Level																
0.0	Silty Sand With Some Gravel (Fill?) Very Loose Brown		1	SS	5		300										1 80 (19)
296.6			2	SS	3												
9.0	Clayey Silt to Silty Clay Traces of Sand and Gravel		3	SS	10												
			4	SS	8												
			5	TW	PM												
			6	SS	15												
	Stiff to Very Stiff Grey		7	TW	PM												
			8	SS	19												
			9	TW	PM/ PH/ 15"												
			10	SS	24												
			11	TW	PH												
257.6			12	SS	73												
48.0	Clayey Silt to Silt		13	SS	100/11"												
	Traces of Sand and Gravel Very Dense to Hard Red-Brown (Glacial Till)		14	SS	88												
			15	SS	105/11"												
236.7			16	SS	607/4"												
68.9	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



## RECORD OF BOREHOLE No 216 W.P. 46-74-13, 40 &amp; 39

W P 46-74-42 LOCATION Coords, N 15,679,834 ; E 1,066,169 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY K.W.  
DATUM Geodetic DATE July 8 & 9, 1971 CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
324.7	Ground Level															
0.0	Clayey Silt With Organics		1	SS	6	323.2										
317.2	Firm Dark Grey		263	SS	5											
7.5	Clayey Silt to Silty Clay, Traces of Sand and Gravel		4	SS	16											
			5	SS	25											
			6	SS	31											
	Occasionally Laminated		7	SS	34											
			8	SS	24											
	Stiff to Hard		9	SS	27											
			10	SS	17											
	Grey and Brown		11	SS	13											
			12	TW	PM											
			13	SS	29											
			14	SS	32											
264.7			15	SS	100/ 11"											
60.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		16	SS	100/ 11"											
			17	SS	70/ 6"											
250.1			18	SS	50/ 11"											
74.6	End of Borehole															



RECORD OF BOREHOLE No 219

W P 46-74-42 LOCATION Coords. N 15 680 043; E 1 066 283 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill COMPILED BY K.W.  
DATUM Geodetic DATE July 13, 14, 15, 1971 CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80					
348.5	Ground Level														
0.0	Silty Sand With Gravel. Fill, Loose		1	SS	9										4 74 (22)
342.0			2	SS	25										
6.5	Clayey Silt to Silty Clay		3	SS	43	340									
	Traces of Sand and Gravel		4	SS	29										
			5	SS	21										0 4 41 55
	Hard, Becoming Stiff		6	SS	14	330									
			7	TW	PM										
	Grey and Brown		8	SS	9	320									
			9	TW	PM										118
			10	SS	11	310									
			11	TW	PM										119
			12	SS	8	300									100
			13	TW	PM/	290									120
			14	SS	12										
			15	TW	PM/	280									114
			16	SS	20										121
272.0			17	SS	48										
76.5	Clayey Silt to Silt Some Sand and Gravel Very Dense to Hard (Glacial Till) Red-Brown		18	SS	73	270									
			19	SS	50/	260									
			20	SS	53/										
253.7			21	SS	50/										
94.8	End of Borehole														

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE



## RECORD OF BOREHOLE No 220 W.P. 46-74-13, 40 &amp; 39

W P 46-74-42 LOCATION Coords. N 15,679,705; E 1,066,028 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Pennndrill and Cone Test COMPILED BY K.W.  
DATUM Geodetic DATE July 12, 1971 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
273.5	Ground Level																
0.0	Clayey Silt		1	SS	22		270										
268.5	Very Stiff		3	SS	67												
5.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	62												
			5	SS	57												
			6	SS	76		260										
			7	SS	60/	3"											
			8	SS	75/	6"	250										
243.7			9	SS	50/	3"											4 31 49 16
29.8	End of Borehole Note: Water Level Not Established																

<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 221

W P 46-74-42 LOCATION Coords. N 15 679 127; E 1 067 734 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY A.K.B.  
DATUM Geodetic DATE August 6-9, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
273.4	Ground Level																
0.0	Organically Contaminated Clayey Silt, Seams of Silt and Sand Occasional Gravel		1	SS	3		270										
			2	SS	3		270.7										
			3	SS	3												
	Soft to Firm Black and Grey		4	SS	4		260										
			5	SS	10												
			6	SS	3												
			7	TW	PH		250										
246.9			8	TW	PH												
26.5			9	SS	31												
	Clayey Silt to Silt Trace of Sand and Gravel Very Stiff to Hard (Glacial Till)		10	SS	75		240										
			11	SS	70												
	Reddish Brown		12	SS	56		230										
			13	SS	18												
			14	SS	22		220										
			15	SS	17												
			16	SS	33		210										
			17	SS	40												
			18	SS	50		200										
			19	SS	27												
			20	SS	23		190										
			21	SS	33												
181.4			22	SS	25												
92.0	End of Borehole																

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

RECORD OF BOREHOLE No 222

W P 46-74-42 LOCATION Coords. N 15 679 208; E 1 067 946 ORIGINATED BY KW  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY AKB  
DATUM Geodetic DATE August 10-11, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
272.9	Ground Level																
0.0	Layers of Clayey Silt to Silt, Sand and Gravel, Heavily Contaminated With Organics.  Black and Grey  Soft to Firm		1	SS	28		270										
			1A	SS	3												
			2	SS	20												
			3	SS	3		260										
			4	SS	38												
			5	SS	11												
			6	SS	4		250										
244.9			7	SS	8												
28.0	Clayey Silt to Silt Trace of Sand and Gravel Hard  Reddish Brown  (Glacial Till)		8	SS	36												
			9	SS	75		240										
			10	SS	60												
			11	SS	58		230										
			12	SS	69												
			13	SS	54		220										
			14	SS	45												
207.4			15	SS	92		210										
65.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 223

W P 46-74-42 LOCATION Coords. N 15 679 379; E 1 067 881 ORIGINATED BY KW  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill & Washboring, BX Casing & Cone Test COMPILED BY AKB  
DATUM Geodetic DATE August 13-17, 1971 CHECKED BY RES

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60					
274.8	Ground Level					Art. Head							PCF	GR SA SI CL
0.0	Clayey Silt to Silty Clay Layers of Sand Heavily Contaminated With Organics  Soft to Firm		1	SS	18	277.0								
			2	SS	5	271.5	270	100/3"						
			3	SS	9									
			4	TW	PH		260	+ s=18.0					123	
			5	TW	PH			+ s=3.5					128	
254.8			6	SS	16									
20.0	Clayey Silt Some Sand and Gravel Very Stiff		7	SS	21		250							
247.8			8	SS	27									37 19 34 10
27.0	Clayey Silt to Silt Some Sand Very Dense to Hard (Glacial Till) Reddish Brown		9	SS	39									
			10	SS	95		240							
			11	SS	98									
			12	SS	95		230							
226.8			13	SS	17									
48.0	Clayey Silt to Silt  Very Stiff  Grey		14	SS	19		220							
			15	SS	17									
210.8			16	SS	63		210							
64.0	Clayey Silt Traces of Sand and Gravel (Glacial Till)  Hard  Brown		17	SS	51		200							
			18	SS	64									
			19	SS	57									
			20	SS	42		190							
			21	SS	38									
180.1			22	SS	75/13"									
94.7	End of Borehole					180.5								

+3, x5: Numbers refer to  
Sensitivity

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 224

W P 46-74-42 LOCATION Coords. N 15 679 265; E 1 067 685 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Conc Test COMPILED BY A.K.B.  
DATUM Geodetic DATE August 11-12, 1971 CHECKED BY KS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>			
277.7	Ground Level															
0.0	Organically Contaminated Clayey Silt to Silty Clay Traces of Sand  Firm to Very Stiff  Grey and Brown		1	SS	16	*	270						o			
			2	SS	6								o			
			3	SS	24								o			
			4	SS	8											
			5	TW	PH		260									
			6	SS	18											
			7	SS	15											
			8	SS	7		250									
248.7	Clayey Silt Traces of Sand and Gravel  Reddish Brown  Hard  (Glacial Till)		9	SS	80								o			
			10	SS	92								o			
			11	SS	74		240						o			
			12	SS	62											
			13	SS	31		230						o			
225.7	Clayey Silt to Silt Some Sand		14	SS	16		220						o			
			15	SS	62								o			
213.2	Hard and Very Dense		16	SS	72		210						o			
64.5	Clayey Silt Traces of Sand  Hard  (Glacial Till)		17	SS	29		200						o			
			18	SS	34											
			19	SS	37								o			
189.7			20	SS	507	3"	190						o			
88.0	End of Borehole  *Note: Water Level Not Established															

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 225

W P 46-74-42 LOCATION Coords. N 15 679 508; E 1 067 820 ORIGINATED BY K.W.  
 DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Washboring BX Casing and Cone Test COMPILED BY A.K.P.  
 DATUM Geodetic DATE August 17-19, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
300.4	Ground Level																
0.0							300										
	Silty Clay to Clayey Silt Traces of Sand and Gravel  Stiff		1	SS	39												
			2	SS	22												
			3	SS	20												
			4	SS	9												
			5	TW	PH												
			6	TW	PH												
			7	SS	13												
			8	TW	PH												
			9	SS	16												
			10	TW	PH												
			11	SS	14												
			12	TW	PH												
			13	SS	10												
			14	TW	PH												
248.4			15	SS	28		250										
52.0	Clayey Silt to Silt Trace of Sand and Gravel Hard to Very Dense (Glacial Till) Brown		16	SS	75												
			17	SS	73												
			18	SS	58												
			19	SS	66												
227.4							230										
73.0	Silty Sand to Sand  Dense		20	SS	3												
			21	SS	36												
217.4							220										
83.0	Clayey Silt Some Sand and Gravel (Glacial Till) Hard		22	SS	66												
208.9			23	SS	95		210										
91.5	End of Borehole  Note: Water Level Not Established																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 226

W P 46-74-42 LOCATION Coords. N 15 679 605; E 1 067 657 ORIGINATED BY B.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Washboring COMPILED BY P.K.  
DATUM Geodetic DATE December 13-15, 1971 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT $\Sigma$					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
355.5	Ground Level																
0.0	Fill Silty Sand Some Gravel Some Roots Dense		1	SS	5		350										
			2	SS	4												
			3	SS	6												
342.5			4	SS	10												
13.0			5	SS	17		340										
			6	SS	13												
			7	SS	41												
			8	SS	36												
			9	SS	17												
			10	TW	PH												
			11	SS	--												
			12	TW	PH												
			13	TW	PH												
			14	TW	PH												
			15	TW	PH												
			16	TW	PH												
			17	TW	PH												
			18	TW	PH												
			19	TW	PH												
			20	TW	PH												
			21	TW	PH												
			22	TW	PH												
			23	TW	PH												
			24	TW	PH												
			25	SS	--												
270.5			26	SS	--		270										
85.0			27	SS	22												
			28	SS	34												
			29	SS	30												
			30	SS	55												
			31	SS	20												
			32	SS	29												
248.5			33	SS	53		250										
107.0			34	SS	193												
239.0			35	SS	95		240										
116.5	End of Borehole																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\diamond$  5 (%) STRAIN AT FAILURE  
10



RECORD OF BOREHOLE No 227

W P 46-74-42 LOCATION Coords. N 15 679 454; E 1 067 628 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Penndrill and Cone Test COMPILED BY P.F.  
DATUM Geodetic DATE November 29-30, 1971 CHECKED BY S.C.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%, GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
314.8	Ground Level							20 40 60 80 100							
0.0	Sand With Some Silt and Gravel	•••••	1	SS	4	Perched WT 312.5	310							14 71 (15)	
306.3	Loose		2	SS	9										
8.5	Silty Clay to Clayey Silt Traces of Sand Random Pockets of Silt  Occasionally Laminated  Very Stiff to Stiff  Greyish Brown		3	SS	26	296.0	300						121	0 2 59 39                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             <	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 228

W P 46-74-42 LOCATION Coords. N 15 679 176; E 1 067 619 ORIGINATED BY PK  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY PK  
DATUM Geodetic DATE November 29, 1971 CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH PSF						WATER CONTENT (%)
275.4	Ground Level						20 40 60 80 100	400 800 1200 1600 2000	○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE	20 40 60	GR SA SI CL
0.0	Organically Contaminated Silty Clay to Clayey Silt, With Sandy Layers		1	TW	PH	271.9							123	1 49 40 10 1 86 (13)
			2	TW	PH									
			3	TW	PH									
	Soft to Firm		4	TW	PH									
	Black and Grey		5	TW	PH									
			6	TW	PH									
256.4														
19.0	Silty Sand to Sandy Silt, Traces of Clay Compact to Very Dense		7	SS	26								30 49 19 2 0 10 72 18 8 24 58 10	
			8	SS	11									
			9	SS	44									
			10	SS	75									
243.9														
31.5	End of Borehole													

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

# RECORD OF BOREHOLE No 229

W P 46-74-42 LOCATION Coords. N 15 679 153; E 1 067 506 ORIGINATED BY PK  
 DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY PK  
 DATUM Geodetic DATE November 29, 1971 CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH PSF						WATER CONTENT (%)	
								20 40 60 80 100							400 800 1200 1600 2000
274.5	Ground Level														
0.0	Layers of Silty Clay Silty Sand and Silt. Organic Matters Throughout Soft to Stiff		1	TW	PH	270.2								11 54 28 7	
			2	SS	18										120
			3	TW	PH										123
			4	TW	PH										116.5
			5	TW	PH										124
			6	TW	PH										109
			7	SS	41										113
			8	SS	6										
246.5														0 7 75 18	
28.0	Sandy Silt, Traces of Clay, Very Dense		9	SS	84									5 23 60 12	
242.5			10	SS	83										
32.0	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 230

W P 46-74-42 LOCATION Coords. N 15 679 277; E 1 067 458 ORIGINATED BY PK  
DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY PK  
DATUM Geodetic DATE November 30, 1971 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	PSF					
280.5	Ground Level													
0.0	Gravelly Sand With Organics		1	TW	PH		280							40 48 (12)
274.7	Compact		2	SS	32									
5.8	Clayey Silt to Silty Clay		3	SS	26									
	Traces of Sand Becoming Stratified		4	SS	27									
	Clayey Silt and Silty Clay Pockets of Silt		5	TW	PH		270						128	
	Stiff		6	TW	PH								121	
			7	TW	PH								125	3 11 51 35
			8	TW	PH		260						128	
			9	TW	PH								124	
			10	TW	PH								119	
			11	TW	PH		250						118	
245.5	Sandy Silt, Trace of		12	TW	PH								107	0 2 49 50
35.0	Clay, Very Dense		13	SS	70								112	
242.0	End of Borehole		14	SS	55									6 21 65 8
38.5														



RECORD OF BOREHOLE No 231

W P 46-74-42 LOCATION Coords. N 15 679 337; E 1 067 471 ORIGINATED BY DM  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY PK  
DATUM Geodetic DATE November 30, 1971 CHECKED BY RS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH PSF						WATER CONTENT (%)		
								20	40	60	80			100	20	40
304.8	Ground Level															
0.0	Clayey Silt		1	SS	24									1 5 64 30		
	Traces of Sand		2	SS	32											
			3	SS	33											
			4	SS	42											
292.8			5	SS	33										1 5 67 27	
12.0	Gravelly Sand Some Silt Dense		6	SS	32										16 67 (17)	
285.8			7	SS	33											35 40 20 5
19.0	Silty Clay Traces of Sand		8	TW	PM											
278.8			9	AS												
26.0	End of Borehole															

\*<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 231A

W P 46-74-42 LOCATION Coords. N 15 679 339; E 1 067 475 ORIGINATED BY DM  
D.S.T. 4 HWY 406 BOREHOLE TYPE Auger and Washboring COMPILED BY PK  
DATUM Geodetic DATE November 30-December 3, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID LIMIT CONTENT			UNIT WEIGHT  γ  PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
304.8	Ground Level																
0.0	Layers of Gravelly Sand Some Silt and Clayey Silt		1	SS	19		300										35 46 (19)
			2	SS	9												0 2 67 31
			3	SS	25		290										27 45 22 6
265.8																	
19.0	Silty Clay Some Sand Traces of Gravel Occasional Silt Pockets  Stiff  Greyish Brown		4	TW	PM		280										114 0 1 55 44
			5	TW	PM												118
			6	TW	PM												
			7	SS	7		270										126
			8	TW	PM												129
			9	TW	PM												8 12 47 33
			10	SS	14		260										2 12 53 33
			11	TW	PM												128
			12	TW	PM												118
250.8			13	SS	16		250										2 22 62 14
51.0	Silt to Clayey Silt Some Sand, Trace of Gravel, Hard to Dense (Glacial Till)		14	SS	34												9 30 51 10
			15	SS	31												
211.3			16	SS	68												3 23 55 19
63.5	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 232

W P 46-74-42 LOCATION Coords. N 15 679 420; E 1 067 484 ORIGINATED BY PK  
DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY PK  
DATUM Geodetic DATE November 30 to December 2, 1971 CHECKED BY F.S

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF							WATER CONTENT (%)			
								20	40							60	80	100
318.3	Ground Level																	
0.0	Clayey Silt Some Organics Stiff		1	TW	PH								124	0 5 65 30				
			2	SS	12													
312.3			3	SS	9													
6.0	Silty Sand Some Gravel Dense		4	SS	30		310							14 54 26 6				
304.3			5	SS	32													
14.0			6	SS	26													
	Silty Clay		7	TW	PH		300						122					
	Traces of Sand and Gravel		8	TW	PH								122	0 2 38 60				
	Pockets of Silt		9	TW	PH		290						133					
			10	TW	PH								121.5					
			11	TW	PH								113	0 1 38 61				
			12	TW	PH		280						113					
			13	TW	PH								122					
	Sand Seam		14	SS	9		270						115					
	Occasionally		15	SS	18								120	5 37 42 16				
			16	TW	PH													
	Sand Seam		17	TW	PH		260						133	0 90 (10)				
	Laminated		18	SS	22													
	Stiff		19	TW	PH		250							0 3 26 71				
	Greyish Brown		20	TW	PH													
248.3			21	SS	19													
70.0	Silt to Clayey Silt Some Sand, Trace of Gravel. (Glacial Till) Very Dense to Hard		22	SS	66		240							8 32 43 17				
237.8			23	SS	100/	9"								5 27 57 11				
80.5	End of Borehole																	

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



## RECORD OF BOREHOLE No 233

W P 46-74-42

LOCATION Coords. N 15 679 522; E 1 067 477

ORIGINATED BY P.K.

DIST 4 HWY 406

BOREHOLE TYPE Auger and Washboring

COMPILED BY P.K.

DATUM Geodetic

DATE December 2-7, 1971

CHECKED BY K.S.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH PSF					
356.1	Ground Level						20 40 60 80 100	20 40 60					
0.0	Gravelly Sand Traces of Silt Dense to Very Dense Brown		1	SS	43								37 55 (8)
			2	SS	54								4 89 (7)
			3	SS	29								46 45 (9)
			4	SS	56								
			5	SS	30								
338.1			6	AS									
18.0	Clayey Silt Seams of Sandy Silt  Stiff		7	SS	10								
			8	N/R									
			9	SS	7								
325.1			10	TW	PH							127	
31.0	Gravelly Sand Traces of Silt Compact		11	SS	27							128	
317.6			12	SS	22								39 39 17 5 23 68 (9)
38.5	Silty Clay Pockets of Sand and Gravel  Stiff to Very Stiff		13	SS	159/	8"							
			14	SS	48								
			15	SS	11								
			16	TW	PH								
303.6			17	TW	PH							127	
52.5	Sandy Silt With Some Gravel		18	SS	71							131.5	15 33 46 6
296.1	Very Dense		19	SS	73								
60.0	Clayey Silt to Silty Clay  Stiff		20	SS	10								
			21	TW	PH								
			22	SS	7							117	
			23	TW	PH							117	
			24	TW	PH							119	
			25	SS	10							120	
			26	TP	PH								
			27	SS	25							131	
			28	SS	27							133	
			29	TW	PH							132	
257.1			30	SS	37								
99.0	Silt to Clayey Silt Some Sand and Gravel (Glacial Till) Reddish Brown		31	SS	24								17 7 40 36
			32	SS	100/	5"							
245.6			33	SS	11								3 18 60 19
110.5	End of Borehole												

+3, x5: Numbers refer to  
Sensitivity20  
15  
10

5 (% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 234

W P 46-74-42 LOCATION Coords. N 15 679 530; E 1 067 557 ORIGINATED BY PK & BM  
 DIST 4 HWY 406 BOREHOLE TYPE Auger and Washboring COMPILED BY P.K.  
 DATUM Geodetic DATE December 8-10, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF										WATER CONTENT (%)			
																			20	40	60
355.0	Ground Level							20	40	60	80	100									
0.0	Asphalt																				
0.8	Silty Sand		1	SS	8		350										9 66 20 5				
	Traces of Gravel		2	SS	3																
			3	SS	3																
			4	SS	4																
	Concrete																				
	Very Loose to Loose		5	SS	16		340										6 79 (15)				
335.0			6	SS	7												12 75 (13)				
20.0	Silty Clay Seams of Silt		7	SS	7																
	Stiff		8	TW	PH		330														
325.0			9	TW	PH											123					
30.0	Gravelly Sand		10	SS	47												21 68 (11)				
319.0	Some Silt and Clay		11	SS	58												24 65 (11)				
36.0	Very Dense		12	SS	9												9 9 53 29				
	Silty Clay to Clayey Silt		13	TW	PH																
	Traces of Sand and Gravel		14	TW	PH		310														
	Pockets of Silt		15	TW	PH																
	Stiff		16	TW	PH																
	Greyish Brown		17	TW	PH		300														
			18	TW	PH																
			19	TW	PH																
			20	TW	PH		290														
			21	TW	PH																
			22	TW	PH																
			23	TW	PH		280														
			24	TW	PH																
			25	TW	PH		270														
			26	TW	PH																
			27	TW	PH																
262.0			28	TW	PH																
93.0	Clayey Silt With Sand and Gravel (Glacial Till)		29				260														
	Very Stiff to Hard		30	SS	24																
			31	SS	32																
			32	SS	28																
			33	SS	20		250														
			34	SS	29																
			35	SS	100																
238.9			36	SS	105		240														
116.1	End of Borehole																5 20 63 12				

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 235

W P 46-74-42 LOCATION Coords. N 15 679 734; E 1 066 257 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
DATUM Geodetic DATE December 6-7, 1971 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
310.6	Ground Level																
0.0	Silty Clay to Clayey Silt		1	SS	40		310										
	Traces of Sand and Gravel		2	SS	33												0 3 39 58
	Pockets of Silt		3	SS	42		300										
	Hard to Stiff		4	SS	27												
	Greyish Brown		5	SS	33												
			6	TW	PM		290									120	1 2 32 65
			7	TW	PM											125	
			8	TW	PM		280									119	
			9	SS	11												2 16 56 26
			10	TW	PM		270									127	
262.6			11	TW	PM		269.0									126	
48.0	Silt to Clayey Silt Some Sand Trace of Gravel (Glacial Till) Very Dense to Hard		12	SS	63		260										8 22 56 14
			13	SS	16	10"											
249.6			14	SS	11	5"	250										0 30 66 4
61.0	End of Borehole																

\*3, x5: Numbers refer to  
Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 236 W.P. 46-74-13, 40 & 39

W P 46-74-42 LOCATION Coords. N 15,679,666; E 1,066,129 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
DATUM Geodetic DATE December 13, 1971 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
278.7	Ground Level																
0.0	Silty Clay Some Sand Hard		1	SS	39												
270.7			2	SS	45												
8.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard  (Glacial Till)		3	SS	40		270										
			4	SS	55												
			5	SS	49		267.2										0 15 80 5
			6	SS	116		260										3 23 60 14
			7	SS	100/4"												
			8	SS	100/6"		250										9 10 66 15
248.2	Boulders																
30.5	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15 ± 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 237 W.P. 46-74-30, 40 & 39

W P 46-74-42 LOCATION Coords. N 15,679,597; E 1,066,076 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY P.Y.  
DATUM Geodetic DATE December 17, 1971 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
272.2	Ground Level																
0.0	Rock Rip-Rap																
268.2							270										
4.0	Grey Organic Silt &		1	SS	17												
264.2	Sand, Firm to Stiff		2	TW	PH												
			3	SS	8												
8.0	Red Silt to Clayey		4	SS	74												
	Silt, Some Sand																
	Trace of Gravel																
	Very Dense to Hard		5	SS	148		260										
253.2	(Glacial Till)																
			6	SS	1027	6"											
19.0	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 238 W.P. 46-74-13, 40 & 39

W P 46-74-42 LOCATION Coords. N 15,679,825; E 1,066,126 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
DATUM Geodetic DATE December 8, 1971 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF							WATER CONTENT (%)		
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE								
311.6	Ground Level							20 40 60 80 100									
0.0	Fill Sandy Silt, Silty Clay, Some Brick Fragments		1	AS													
			2	SS	15												
			3	SS	42												
			4	SS	36												
			5	SS	32												
297.6	Clayey Silt to Silty Clay Traces of Sand Pockets of Silt Stiff to Very Stiff		6	TW	PH								127				
			7	TW	PH									123			
			8	SS	15										0 3 52 45		
			9	AS													
			10	TW	PH												
			11	TW	PM									134.5			
			12	SS	16									136	3 12 54 31		
268.6			Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		13	SS	28										
					14	SS	47										
					15	SS	105	6"									5 16 69 10
251.1					16	SS	100	6"									
60.5	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 239 W.P. 46-74-13, 40 & 39

W P 46-74-42 LOCATION Coords. N 15,679,783; E 1,066,089 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
DATUM Geodetic DATE December 9 & 10, 1971 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
							20 40 60 80 100								
							400 800 1200 1600 2000								
							● QUICK TRIAXIAL    × LAB VANE								
300.2	Ground Level														
0.0	Clayey Silt to Silty Clay  Trace of Sand and Gravel  Very Stiff to Hard		1	SS	31		300								
			2	SS	39										0 3 40 57
			3	SS	34		290							125	
			4	TW	PH									127.5	
			5	TW	PH		280							118	
			6	TW	PM									136	
			7	SS	22		270								2 17 50 31
			8	TW	PM									130	
267.2												128			
33.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard  (Glacial Till)  Boulders		9	SS	43		266								
			10	SS	85		260							2 18 66 14	
			11	SS	100/6"										
250.7															
49.5	End of Borehole														

+3, x5: Numbers refer to  
Sensitivity

20  
15 10 5 (%) STRAIN AT FAILURE  
10



RECORD OF BOREHOLE No 240 W.P. 46-74-13, 40 & 39

W P 46-74-42 LOCATION Coords. N 15,679,683; E 1,066,015 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY P.K.  
DATUM Geodetic DATE December 16 & 17, 1971 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						SHEAR STRENGTH PSF		
								○ UNCONFINED      + FIELD VANE					● QUICK TRIAXIAL      x LAB VANE							
271.7	Ground Level																			
0.0	Rock Rip-Rap						270													
267.7																				
4.0	Grey Organic Silt and Sand, Firm to Stiff		162	SS & AS	6	267.2														
261.9			3	TW	PM															
9.8	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	45	260														
253.2			5	SS	98															
18.5	End of Borehole		6	SS	178/ 6"															



# RECORD OF BOREHOLE No 308

W P 46-74-42 LOCATION Coords. N 15 679 590; E 1 068 190 ORIGINATED BY Colder  
DIST 4 HWY 406 BOREHOLE TYPE Power Auger Boring COMPILED BY M.W.  
DATUM Geodetic DATE September 25-26, 1963 CHECKED BY ES

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
317.7	Ground Level																
U.O.	Heterog. Fill Cons. of Chunks of																
315.2	Br. Sa. Si. Brick and																
2.5	Concert. Fragments to 3 inch size		1	SS	16		310							o			
			2	SS	21									o			
			3	SS	19									o o			
	Silty Clay to Clayey Silt		4	TW	PH		300										
	Trace of Sand and Gravel		5	SS	25									o			
	Stiff to Very Stiff		6	TW	PH									o		120	
			7	SS	8	W.L. in standpipe 'A'	290							o			
			8	TW	PH	@ elev. 285.8 Oct. 25/63								o		119	
			9	SS	9	W.L. 280 in standpipe 'B'	280							o o			
			10	TW	PH	@ elev. 273.8								o o o			
			11	SS	14		270							o			
			12	SS	18		268							o			
			13	SS	16		260							o			
			14	TW	PM												
			15	SS	11		250							o o			
			16	SS	11									o o			
245.7																	
72.0			17	SS	96		240										
	Silt to Clayey Silt Some Sand, Trace of Gravel, Very Dense to Hard (Glacial Till) Reddish Brown		18	SS	87												
			19	SS	93		230										
227.7			20	SS	66												
90.0	End of Borehole																

3, x 5: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE





RECORD OF BOREHOLE No 309

W P 46-74-42 LOCATION Coords. N 15 679 430; E 1 067 822 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Power Auger Boring COMPILED BY ML  
DATUM Geodetic DATE September 27, 1963 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
294.0	Ground Level																
0.0	Loose Heterogeneous Mixture of Brick and Concrete Fragments Brown Silty Sand and Gravel (Fill)		1	AS	--		290										
			2	SS	8												
280.8																	
13.2	Silty Clay to Clayey Silt, Trace of Sand and Gravel, Very Stiff, Brown Desiccated		3	SS	14		280										
			4	TW	17												
269.5																	
24.5	Silty Clay to Clayey Silt, Trace of Sand and Gravel Stiff to Very Stiff Grey Dense Silty Sand Layers at 34.5 to 35.2 and 44.7 to 46.0 Foot Depth		5	SS	15		270										
			6	SS	12												
			7	TW	PM		260									145	
			8	SS	8												
			9	TW	PM		250										
			10	SS	14												
246.5																	
47.5	Silt to Clayey Silt Some Sand, Trace of Gravel Very Dense to Hard (Glacial Till) Reddish Brown		11	SS	59		240										
			12	SS	61												
			13	SS	69												
			14	SS	84		230										
229.5																	
64.5	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 310

W P 46-74-42 LOCATION Coords. N 15 679 258; E 1 067 625 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Washboring COMPILED BY MW  
DATUM Geodetic DATE September 20-23, 1963 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF										WATER CONTENT (%)		
								20	40	60	80	100						UNCONFINED	FIELD VANE	QUICK TRIAXIAL
277.1	Ground Level																			
0.0	Loose Brown Silty Sand, Some Brick Fragments (Fill)		1	SS	5		W.L. @ elev. 277.0 Oct. 25/63													
271.8			2	SS	16															
5.3		Stiff Grey (Brown Coloured & Desiccated Down to 10 Ft. Depth) Silty Clay With a Few Scattered Sand and Gravel Size Particles		3	SS	19														
				4	TW	PM														
				5	TP	PM														
				6	TP	PM														
				7	TW	PM														
248.1	Dense to Very Dense Grey Sandy & Clayey Silt With Some Gravel Size Particles Scattered Throughout Few Sand Lenses		8	SS	43															
29.0			9	SS	67															
236.6			10	SS	64															
40.5	Very Dense Stratified Sandy Silts Becoming Stiff Layered Silty Clay and Clayey Silt With Some Layers of Fine Sandy Silt Below																			
225.6			11	SS	33															
	About 44 Ft. Depth		12	SS	16															
51.5	End of Borehole																			

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 313

W P 46-74-42 LOCATION Coords. N 15 679 290; E 1 067 170 ORIGINATED BY Golder  
 DIST 4 HWY 406 BOREHOLE TYPE Washboring HX and BX Casing COMPILED BY MW  
 DATUM Geodetic DATE September 23-25, 1963 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
273.2	Ground Level																
0.0	Cinders																
269.3	Loose Brown Sand		1	SS	6												
	Stiff Brown Si.Cl. Fill		2	SS	2												
3.9	Organically Contaminated Clayey Silt and Silty Sand Soft to Firm		3	SS	1												
			4	SS	3												
258.0																	
15.2	Soft Grey Brown Silty Clay		5	SS	3												
255.2																	
18.0	Silt to Clayey Silt Firm to Very Stiff (Layered)		6	TW	PM												
			7	SS	4												
			8	SS	23												
			9	SS	13												
240.0																	
33.2	Sand and Silt Loose to Very Dense		10	SS	46												
			11	SS	7												
221.7																	
			12	SS	67												
51.5	End of Borehole																
	Note: Artesian Water Pressure First Noticed During Drilling When Casing Was at 35 Foot Depth																

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 314

W P 46-74-42 LOCATION Coords. N 15 679 456; E 1 066 720 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Washboring HX and BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE September 25-27, 1963 CHECKED BY KS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20 40 60 80 100					
270.9	Ground Level												
0.0	Grey Organic Silt and Sand Firm to Stiff		1	SS	10								
			2	SS	6								
			3	SS	4								
			4	SS	3								
			5	SS	PM								
255.9			6	SS	23								
15.0	Silt to Sandy Silt Layers of Clayey Silt Dense to Very Dense		7	SS	33								
			8	SS	57								
			9	SS	28								
			10	SS	WH								
			11	SS	35								
			12	SS	95								
218.9			13	SS	87								
52.0	Silt to Clayey Silt		14	SS	100								
215.6	Red-Brown (Glacial Till)												
55.3	End of Borehole												

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 315

W P 46-74-42 LOCATION Coords. N 15 679 572; E 1 066 212 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Power Auger, Washboring and BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE September 28-October 8, 1963 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
270.6	Ground Level																
268.1	Br. Cl. Si. With Sa. & Boulders (Fill)		1	SS	4	W.L. in pipe @ elev. 266.5 Oct. 25/63											
261.3	Organic Silt and Sand Firm to Stiff		2	TW	PM											122	
234.8	Reddish Brown Silt to Clayey Silt Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		3	SS	16												
			4	SS	26												
			5	SS	>100												
			6	SS	>100												
			7	SS	>100												
			8	SS	>100												
35.8	End of Borehole																

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 316

W P 46-74-42 LOCATION Coords. N 15 679 095; E 1 066 908 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Washboring HX and BX Casing and Cone Test COMPILED BY M.W.  
DATUM Geodetic DATE September 27-October 1, 1963 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
270.0	Ground Level																
0.0	Grey Organic Silt and Sand Pieces of Wood Soft to Firm		1	SS	7	W.L. @ elev. 270.0 Oct. 2/63											
			2	SS	4												
			3	SS	3												
			4	SS	1												
			5	TW	5												
249.2			6	SS	18												
20.8	Silt to Sandy Silt Occasional Clayey Silt Layers Compact to Dense		7	SS	43												
			8	SS	36												
			9	TW	PM												
			10	SS	25												
			11	SS	15												
			12	SS	27												
			13	SS	28												
			14	SS	33												
204.5			15	SS	46												
65.5	Silt to Clay Silt, Some Sand & Gravel, Hard to Very Dense, Reddish- Brown (Clayey Silt)		16	SS	100												
200.0																	
70.0	End of Borehole																

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 338

W P 46-74-42 LOCATION Coords. N 15 679 145; E 1 066 693 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Power Auger COMPILED BY M.W.  
DATUM Geodetic DATE September 30, 1963 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
272.9	Ground Level																
0.0	Brown-Black Sandy & Clayey Silt, Some Gravel																
269.6																	
3.3	Very Stiff Brown Silty Clay With Some Sand and Gravel (Desiccated Zone)		1	SS	14		270										
			2	SS	15												
			3	SS	13												
260.9																	
12.0	Very Stiff Grey Silty Clay With Some Sand		4	TW	PM		260									123	
253.8			5	TW	PM												
19.1	Silt to Sandy Silt Dense to Very Dense		6	SS	61		250										
			7	SS	92												
			8	SS	50												
234.7							240										
38.2	End of Borehole Note: Water Level Not Established																

OFFICE REPORT ON SOIL EXPLORATION

\*<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 349

W P 46-74-42 LOCATION Coords. N 15 679 246; E 1 066 163 ORIGINATED BY Golder  
 DIST 4 HWY 406 BOREHOLE TYPE Washboring IIX and BX Casing COMPILED BY M.W.  
 DATUM Geodetic DATE October 28-30, 1963 CHECKED BY PS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
270.1	Ground Level		1	SS	10									
0.0	Organically Contaminated Clayey Silt  Firm to Stiff		2	SS	7									
			3	SS	3									
			4	TW	PM									
			5	SS	2									
251.1			6	SS	24									
19.0	Silt to Clayey Silt Some Sand and Gravel Hard to Very Dense Red-Brown (Glacial Till)		7	SS	100									
			8	SS	100									
238.6			9	SS	74									
31.5	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION



## FOUNDATION INVESTIGATION REPORT

For

Twelve Mile Creek Bridges and Retaining Walls  
W.P. 46-74-13/40/39, Site 18-233A/B  
Hwy. 406, District 4, Hamilton

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INTRODUCTION

This report contains the results of a foundation investigation for the above crossing including subsoil conditions and detailed recommendations for the design and construction of the 2 bridges and associated retaining walls to carry Hwy. 406 across Twelve Mile Creek. Fieldwork consisted of 53 boreholes in the general area carried out over the 15 year period 1963 to 1978. A number of the boreholes were related to proposals other than the one finally adopted and are presented only to indicate general subsoil conditions in the area.

SITE DESCRIPTION

The site is located in the valley of Twelve Mile Creek in the western part of the City of St. Catharines. The valley is from 1/4 to 1/2 mile in width with its floor 70 to 80 feet below the surrounding tableland. The natural slopes are gentle ranging from 2.5:1 to 3:1 and are mostly tree covered.

In 1829 man started his modification of the valley by raising the water level of Twelve Mile Creek to construct the first Welland Canal. Its use as a route for water transport continued for approximately 100 years. Gradually the canal's use switched to that of a disposal channel for water used for hydraulic power generation at the escarpment. In the late 1940's a hydraulic dredge was used to widen the old canal so that today it is a fast flowing channel 180 to 200 feet in width carrying approximately 7000 cfs diverted from the Niagara River.

## SUBSURFACE CONDITIONS

### General

Subsoil consists of a deposit of silty clay to clayey silt varying in thickness from zero in the vicinity of the stream to 70 feet at the crest of the valley slope. This deposit is underlain by red silt to clayey silt of glacial origin. It forms the stream bed for Twelve Mile Creek and varies in thickness from about 10 feet under the channel to 25 to 30 feet where no erosion has taken place. This layer is in turn underlain by Queenston Shale bedrock which varies in surface elevation from 240 to 245. In the vicinity of the stream there are local deposits of up to 15 feet of organic silt and sand.

Reference should be made to the Record of Borehole Sheets which are contained in the report Appendix. They show the boundaries between different soil types, as well as a summary of the results of all field and laboratory tests performed. Reference should also be made to sheet nos. 43, 44, 45, 106, 107, 108, 157, 158 and 159 of the Contract Drawings which show location and elevation of the borings, together with the inferred subsoil stratigraphy. Detailed descriptions of the soil types encountered are given below.

### Clayey Silt to Silty Clay

This stratum extends from approximate elevation 270 to 340 and is, therefore, exposed in the valley slopes. The upper 15 to 20 feet of material forms a desiccated crust. It is brown in colour with a moisture content of about 20 percent. The undrained shear strength which ranges from 2000 to 5000 psf is deceptive in that the material is highly fissured. Beneath the crust there is a transition in colour from brown to grey and an increase in moisture content to about 30 percent. The undrained shear strength decreases and varies from 1000 to 2500 psf. Atterberg Limit Tests as shown in Figure 1 of the Appendix show the deposit to be of low to medium plasticity.

### Silt to Clayey Silt

This deposit lies between the silty clay to clayey silt deposit and the underlying bedrock. In thickness it varies from 10 feet under the stream channel to from 25 to 30 feet where no removal by erosion has taken place. It is of glacial origin and consists of

silt with lesser quantities of sand, clay and gravel. The origin of the material is primarily the underlying Queenston Shale which gives it a characteristic red colour. The lower portion of the deposit is composed almost entirely of shale fragments which have been compressed together to form a breccia or shale till. As shown on the log sheets, this shale till was on occasion cored and partially recovered employing both NXL and NV3 corebarrels. The deposit is hard to very dense with Standard Penetration 'N' values generally in excess of 100 blows per foot. Atterberg Limit Tests as shown in Figure 2 indicate a low plasticity generally in the silt to clayey silt transition zone. The natural moisture content is below the plastic limit and ranges from 8 to 12 percent.

#### Organic Silt and Sand

This deposit is found between the toe of the valley slope and the stream channel. It has built up outside the channel by a combination of natural deposition in areas flooded to construct the original Welland Canal and through filling both by dredging from the channel and as a dumping area for surplus material from construction projects in the area. The single largest source of material was Ontario Hydro's use of a hydraulic dredge to widen and deepen the channel in the late 1940's. This has led to a highly variable deposit with some layers being sandy enough to be non-plastic while other layers show considerable plasticity. The undrained shear strength is judged to vary from 500 psf to in excess of 1000 psf. Moisture contents vary from 20 to 40 percent.

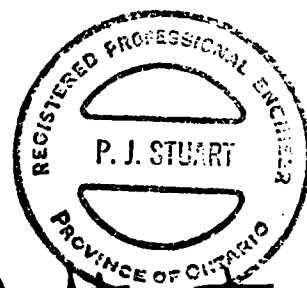
#### Queenston Shale

Queenston shale bedrock was encountered under the till layer between elevations 240 and 245. It is red in colour and dips gently toward the south. The shale is generally sound but in places the upper 2 or 3 feet shows some weathering. Periodic limestone beds generally having a thickness of less than 3 inches but occasionally reaching a foot were encountered.

#### Groundwater

Groundwater levels were observed and recorded in the open boreholes during periods of fieldwork. In the area of organic silt and sand adjacent to the channel, water levels were equal to or slightly above the water level in the channel. Water levels recorded in

boreholes on the valley slopes are less reliable due to the relatively imperviousness of the silty clay to clayey silt. However, based on this information, combined with groundwater records from the area of the Burgoine Bridge, it is assumed that the groundwater surface is 15 to 20 feet below ground surface at the crest of the valley with drainage toward Twelve Mile Creek following the general topography of the slope.



*P. J. Stuart*

P. J. Stuart, P. Eng.  
Foundations Engineer.

*K. G. Selby*

K. G. Selby, P. Eng.  
Senior Foundations Engineer.

January, 1980.

**APPENDIX**

RECORD OF BOREHOLE No 12 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,467; E 1,065,438 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger COMPILED BY P.S.  
DATUM Geodetic DATE August 31, 1977 CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.4	Ground Level																
0.0	Rock Rip-Rap						270										
267.4																	
3.0	Grey Clayey Silt		1	SS	10												
	Stiff		2	SS	14												
260.4			3	SS	100/	11"	260										
10.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	100/	7"											
			5	SS	138/	10"	250										
245.4			6	SS	100/	9"											
25.0	Queenston Shale		7	SS	100/	9"											
			8	SS	100/	6"											
237.8			9	SS	100/	1"	240										
			10	SS	50/	1"											
32.6	End of Borehole																
	Note: Water Level Not Established																

OFFICE REPORT ON SOIL EXPLORATION

\*3, \*5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 13 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,472; E 1,065,438 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Augers and NV3 Core COMPILED BY P.S.  
DATUM Geodetic DATE September 1 & 2, 1977 CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.4	Ground Level																
0.0 267.4	Rock Rip-Rap						270										
3.0	Grey Clayey Silt Stiff																
260.4							260										
10.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard Glacial Till		1	RC	100% Rec												
			2	NV3	95% Rec												
			3	RC NV3	75% Rec		250										
245.4																	
25.0	Queenston Shale		4	RC NV3	90% Rec		240										
			5	RC NV3	100% Rec												
			6	RC NV3	100% Rec												
			7	RC NV3	95% Rec		230										
225.3																	
45.1	End of Borehole  Note: Water Level Not Established																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 14 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,607; E 1,065,149 ORIGINATED BY P.S.  
 DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and NV3 Core COMPILED BY P.S.  
 DATUM Geodetic DATE September 6, 1977 CHECKED BY DP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH						
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE						
272.6	Ground Level													
0.0	Rock Rip-Rap						270							
268.6														
4.0	Grey Organic Silt and Sand		1	SS	5									
			2	SS	10									
260.6	Firm		3	SS	14		260							
12.0	Clayey Silt to Silty Clay, Stiff to Very Stiff		4	SS	8									
			5	SS	9									
254.1			6	SS	13									
18.5	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		7	SS	100/ 6"									
			8	SS	100/ 8"		250							
			9	SS	100/ 10"									
244.2			10	RC NV3	65% Rec									
28.4	Queenston Shale		11	RC NV3	92% Rec		240							
			12	RC NV3	90% Rec									
230.1			13	RC NV3	92% Rec									
42.5	End of Borehole													
	Note: Water Level Not Established													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 155

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,738; E 1,065,995 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE May 29, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80					
271.4	Ground Level															
0.0	Rock Rip-Rap						270									
267.9																
3.5	Grey Organic Silt and Sand  Soft to Firm		1	SS	4											
			2	SS	2											
			3	SS	1											
			4	SS	3											
256.4							260									
15.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		5	SS	40											
			6	SS	109											
			7	SS	124/8"											
			8	SS	125/9"											
236.9							250									
34.5	End of Borehole  Note: Water Level Not Established		9	SS	305/7"		240									

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 16 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,760; E 1,066,005 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE May 30, 1978 CHECKED BY Φ

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100		
269.9	Ground Level												
0.0	Clayey Silt		1	SS	7								
	Stiff		2	SS	23								
260.9			3	SS	28								
9.0	Sandy Silt		4	SS	104/	10"							
	Compact to Very Dense												
253.5													
16.4	End of Borehole												

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Pier # 1 S.B.L.  
Rock Coring above bedrock not necessary  
Piled Foundation - el. 253.5

# RECORD OF BOREHOLE No 17 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,864; E 1,065,899 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Augers BXL Core and Cone Test COMPILED BY P.S.  
DATUM Geodetic DATE May 30, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			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	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)				
270.8	Ground Level													
0.0	Rock Rip-Rap													
266.3														
4.5	Grey Organic Silt and Sand Soft to Firm		1	SS	3									
			2	SS	2									
			3	SS	3									
255.3			4	SS	42									
15.5	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		5	SS	110									
			6	SS	110/12"									
			7	SS	104/10"									
239.8			8	SS	100/6"									
31.0	Weathered		9	BXL	25% Core Rec									
	Queenston Shale Limestone Beds 42'5" to 43'7"		10	BXL	100% Core Rec									RQD = 72%
			11	BXL	100% Core Rec									RQD = 56%
226.8														
44.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

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

# RECORD OF BOREHOLE No 18 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,057; E 1,065,737 ORIGINATED BY P.S.  
 DIST 4 HWY 406 BOREHOLE TYPE N Casing and BXL Core COMPILED BY P.S.  
 DATUM Geodetic DATE May 31, 1978 CHECKED BY CP.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
265.6	Water Level																GR SA SI CL
0.0	Water																
261.6	Channel Bottom																
4.0	Grey Organic Silt and Sand Soft to Firm		1	SS	3		260										
			2	SS	4												
			3	SS	3												
253.6			4	SS	18												
12.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		5	SS	100/8"		250										32 24 30 14
			6	BXL Core	40% Rec												
			7	BXL Core	17% Rec												
240.6							240										
25.0	Weathered Queenston Shale Limestone Beds 36'5" to 37'9"		8	BXL Core	45% Rec												RQD = 0%
			9	BXL Core	95% Rec												RQD = 62%
			10	BXL Core	88% Rec		230										RQD = 30%
227.9																	
37.7	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 195

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,889; E 1,065,923 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE May 31, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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 PSF					
270.8	Ground Level							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	400 800 1200 1600 2000	20 40 60				
0.0	Grey Organic Silt and Sand Soft to Firm		1	SS	5		270							
			2	SS	1									
			3	SS	2									
			4	SS	5									
257.2			5	SS	19		260							
255.7	Silt, Compact to V.Dense		6	SS	100/1"									
15.1	End of Borehole													
	Note: Water Level Not Established													

+3, x5: Numbers refer to Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 20S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,856; E 1,065,951 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE May 31, 1978 CHECKED BY *JP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40					
269.6	Ground Level													
0.0	Grey Organic Silt and Sand Soft to Firm		1	SS	5									
262.6			2	SS	3									
7.0	Brown Clayey Silt		3	SS	11									
257.6	Stiff													
12.0	Red Sandy Silt		4	SS	106									
254.0	Very Dense		5	SS	106/7"									
15.6	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 215

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,975; E 1,065,849 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE May 31, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
270.9	Ground Level													
0.0	Rock Rip-Rap													
265.4														
5.5	Grey Organic Silt and Sand Soft to Firm		1	SS	1									
			2	SS	2									
			3	SS	2									
252.9														
18.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel, Very Dense to Hard (Glacial Till)		4	SS	120									
244.9			5	SS	105	5"								
26.0	End of Borehole													
	Note: Water Level Not Established													

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 22 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,797; E 1,065,991 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 8, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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						
270.4	Ground Level													
0.0	Clayey Silt		1	SS	9		270							
	Stiff		2	SS	11									
261.4			3	SS	68		260							
9.0	Sandy Silt													
257.4	Very Dense													
13.0	Red Silt to Clayey													
254.4	Silt, Very Dense to Hard		4	SS	107									
16.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

\*3, \*5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (% STRAIN AT FAILURE)



RECORD OF BOREHOLE No 23 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,027; E 1,065,800 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 1, 1978 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60						80
270.3	Ground Level															
0.0	Rock Rip-Rap						270	Auger Through Rip-Rap								
265.3																
5.0	Probable Organic Silt and Sand						260									
257.3																
13.0																
253.3																
17.0	End of Cone Test															

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 24 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,075; E 1,065,769 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 1, 1978 CHECKED BY J.P.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
270.4	Ground Level																
0.0	Rock Rip-Rap						270										
266.4																	
4.0	Grey Organic Silt and Sand Soft to Firm		1	SS	4												
			2	SS	2												
			3	SS	2												
256.9			4	SS	100/10"		260										
254.7	Red Silt to Clayey Silt		5	SS	100/9"												
15.7	End of Borehole																

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

Pier # 2 S.B.L.  
Rock coring above bedrock not required.  
Piled foundation — el. 245.5  
HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 255

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,067; E 1,065,749 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.A.  
DATUM Geodetic DATE June 1, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
269.6	Ground Level																
0.0	Rock Rip-Rap																
265.6																	
4.0	Grey Organic Silt and Sand Soft to Firm		1	SS	3												
			2	SS	1												
			3	SS	3												
253.6																	
16.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	100/ 11"												
			5	SS	100/ 9"												
			6	SS	108												
			7	SS	100/ 10"												
240.6			8	SS	105/ 9"												
29.0	Queenston Shale		9	SS	100/ 6"												
			10	SS	100/ 4"												
234.4			11	SS	75/ 2"												
35.2	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 26 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,244; E 1,065,560 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE N Casing and BXL Core COMPILED BY P.S.  
DATUM Geodetic DATE June 1 & 2, 1978 CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
265.6	Water Level																
0.0	Water																
258.8	Channel Bottom						260										
6.8	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		1	SS	44												
			2	SS	75	6"											
			3	SS	100	5"											
			4	SS	100	7"	250										
			5	SS	100	6"											
243.6			6	SS	100	4"											
22.0	Queenston Shale Limestone Bed		7	SS	100	1"	240										
	25'4" to 26'0"		8	BVL	100												
			9	BXL Core	95% Rec												RQD = 77%
			10	BXL Core	88% Rec												RQD = 100%
230.6																	
35.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 27 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,988; E 1,065,874 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 5, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
273.1	Ground Level																
0.0							270										
							260										
256.2											100/ 10"						
16.9	End of Cone Test																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 28 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,045; E 1,065,825 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 5, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
272.3	Ground Level												
0.0	Probable Organic Silt and Sand						270						
262.3													
10.0													
258.4							260						
13.9	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 29S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,172; E 1,065,675 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 5, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
270.0	Ground Level																
0.0	Rock Rip-Rap																
267.5																	
2.5	Grey Organic Silt and Sand		1	SS	7												
			2	SS	6												
261.0	Firm		3	SS	3												
9.0	Red Silt to Clayey Silt, Very Dense to Hard (Glacial Till)		4	SS	85												
256.4			5	SS	105	7"											
13.6	End of Borehole																

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (% STRAIN AT FAILURE)

Pier #3 SBL (Sp. Footings - el. 243.5  
R.C. Runs 15.5-20.5 Rec. 0% 20.5-24 Rec. 30% 24-29 Rec. 90%

RECORD OF BOREHOLE No 30 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,249; E 1,065,583 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and NV3 Core COMPILED BY P.S.  
DATUM Geodetic DATE June 5 & 6, 1978 CHECKED BY J.P.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
272.2	Ground Level																
0.0	Rock Rip-Rap						270										
3.5	Silt to Clayey Silt Some Sand Compact		1	SS	12												2 41 46 11
263.2			2	SS	13												3 21 66 10
9.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard  (Glacial Till)		3	SS	100/	8"	260										
			4	SS	100/	8"											
			5	SS	100/	6"											
			6	NV3	0% Rec												
			7	NV3	30% Core Rec		250										
244.2			8	NV3	90% Core Rec												
28.0	Queenston Shale		9	NV3	95% Core Rec		240										RQD = 33%
238.2																	
34.0	End of Borehole  Note: Water Level Not Established																

OFFICE REPORT ON SOIL EXPLORATION

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

In Core barrel: Above bedrock between el. 251.7 & 243.2 - 12 inches  
of rock fragments, between el. 248.2 & 244.2 -  
- 43 inches of rock fragments



PIER 4 S.B.L. (Sp. Footing-el 244.5)  
R.C. Run 15'-20.2' Recovery  $\frac{40}{62} = 65\%$  RQD =  $\frac{8}{62} = 13\%$

RECORD OF BOREHOLE No 315

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,427; E 1,065,410 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE N Casing and NXL Core COMPILED BY P.S.  
DATUM Geodetic DATE June 5 & 6, 1978 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
265.6	Water Level																
0.0	Water																
259.9	Channel Bottom						260										18 26 49 7
5.7	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		1	SS	50												
			2	SS	100%	5"											3 26 63 8
			3	SS	100%	5"											
			4	SS	100%	5"											
246.6			5	NXL RC	65% Rec		250										RQD = 13%
19.0	Queenston Shale 20.2'		6	NXL RC	100% Rec												RQD = 48%
			7	NXL RC	100% Rec		240										RQD = 81%
			8	NXL RC	85% Rec												RQD = 48%
230.0																	
35.6	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

\*<sup>3</sup>, \*<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

In Core Barrel: Above bedrock between el. 250.6 — 246.6  
there was 28 inches of rock fragments.



RECORD OF BOREHOLE No 32 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,398; E 1,065,497 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 6, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
270.9	Ground Level																
0.0	Clayey Silt Some Sand Trace of Organics Stiff		1	SS	8		270										
263.9			2	SS	9												
7.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel, Very Dense to Hard (Glacial Till)		3	SS	106												
			4	SS	1007	11"	260										
255.0			5	SS	1007	10"											
15.9	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

\*3, \*5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 33 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,212; E 1,065,644 ORIGINATED BY P.S.  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 7, 1978 CHECKED BY P.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
271.6	Ground Level							20 40 60 80 100							
0.0	Silt With Fine Sand  Compact					↓	270								
			1	SS	17										
262.6			2	SS	28										
9.0	Red Silt To Clayey Silt, Some Sand		3	SS	100/	11"	260							0 34 63 3	
256.1	Trace of Gravel Very Dense to Hard													13 24 52 10	
15.5	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 34 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,421; E 1,065,522 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 6, 1978 CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100		W <sub>p</sub>	W	W <sub>L</sub>		
273.6	Ground Level												
0.0	Clayey Silt Some Sand, Trace of Organics Firm to Stiff		1	SS	13	270							
263.6			2	SS	5								
10.0	Red Silt to Clayey Silt, Very Dense to Hard (Glacial Till)		3	SS	100/ 8"	260							
258.1			4	SS	100/ 6"								
15.5	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

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

RECORD OF BOREHOLE No 355

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,389; E 1,065,488 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 6, 1978 CHECKED BY *JP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
271.7	Ground Level																
0.0	Rock Rip-Rap																
267.7																	
4.0	Probable Clayey Silt																
261.7																	
10.0	End of Cone Test																

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 36 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,352; E 1,065,524 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 6, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			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 PSF ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub>
273.7	Ground Level												
0.0	Rip-Rap												
270.2													
3.5	Silt to Clayey Silt Some Sand Loose to Compact		1	SS	7		270						
			2	SS	11								
262.7			3	SS	15	3"							
			4	SS	100	11"							
11.0	Red Silt to Clayey Silt, Very Dense to Hard (Glacial Till)		5	SS	100	5"	260						
258.2													
15.5	End of Borehole												

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

Pier 1 N.B.L. Spr. Footing - el. 244.5  
Rock coring above bedrock not necessary

RECORD OF BOREHOLE No 37 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,520; E 1,065,382 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE N Casing and NXL Rockcore COMPILED BY P.S.  
DATUM Geodetic DATE June 8 & 9, 1978 CHECKED BY GP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
265.6	Water Level															
0.0	Water															
260.1	Channel Bottom															
5.5	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		1	SS	51	7"										11 25 58 6
			2	SS	100%											
			3	SS	100%	5"										
			4	SS	100%	4"										
			5	SS	78%	6"										
245.6	Queenston Shale															
20.0	Limestone Beds 31'6" to 31'8" 32'5" to 32'10" 34'0" to 34'2" 35'5" to 36'2"		6	NXL RC	90% Rec											RQD = 50%
			7	NXL RC	100% Rec											RQD = 31%
			8	NXL RC	88% Rec											RQD = 58%
			9	NXL RC	100% Rec											RQD = 42%
			10	NXL RC	94% Rec											RQD = 77%
225.0	End of Borehole															
40.6																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 385

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,653; E 1,066,107 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 8, 1978 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
276.2	Ground Level												
0.0							270						
264.2													
12.0	End of Cone Test												

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE





RECORD OF BOREHOLE No 395

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,684; E 1,066,065 ORIGINATED BY P.S.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 8, 1978 CHECKED BY JP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES								
274.2	Ground Level												
0.0							270						
258.3							260						
15.9	End of Cone Test												

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 415

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,582; E 1,065,215 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE N Casing and NXL Core COMPILED BY P.S.  
DATUM Geodetic DATE June 13, 1978 CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
265.6	Water Level																
0.0	Water																
254.6	Channel Bottom																
11.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		1	SS	27												
			2	SS	100% 9"												
246.1			3	NXL	85% Core Rec												
19.5	Queenston Shale Limestone Beds 23'6" to 23'8" 24'7" to 24'10" 31'1" to 31'5" 33'4" to 34'0"		4	NXL	97% Core Rec												RQD = 38%
			5	NXL	98% Core Rec												RQD = 63%
231.6			6	NXL	100% Core Rec												RQD = 87%
34.0	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

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

In core barrel: Between el. 251.6 & 246.6 — 51 inches  
of rock fragments.

Pier # 2 U.B.L. (Sp. Footing el. 244.5)  
Rock core run 15'-20' Recovery = 45%

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

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# RECORD OF BOREHOLE No 42 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,665; E 1,065,179 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE N Casing and NXL Core COMPILED BY P.S.  
DATUM Geodetic DATE June 14, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
265.6	Water Level																
0.0	Water																
257.3	Channel Bottom																
8.3	Organic Silt and		1	SS	2												
254.6	Sand Soft																
11.0	Red Silt to Clayey		2	SS	100% 5"												
	Silt, Some Sand																
	Trace of Gravel		3	SS	100% 7"												
	Very Dense to Hard																
	(Glacial Till)		4	NXL	45% Rec												
245.6	Queenston Shale																
20.0			5	RC	80% Rec												
	Limestone Beds																
	31'5" to 31'9"		6	NXL	95% Rec												
	33'0" to 34'2"																
			7	RC	100% Rec												
225.4																	
			8	NXL	100% Rec												
40.2	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

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

In core barrel: Between el. 250.6 & 245.6 - 27 inches  
of rock fragments (all less than 4 inches  
depth)

# RECORD OF BOREHOLE No 43 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,654; E 1,065,104 ORIGINATED BY J.A.  
 DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
 DATUM Geodetic DATE June 19, 1978 CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
273.6	Ground Level															
0.0	Clayey Silt to Silty Clay, Stiff to Very Stiff		1	SS	10											
266.6			2	SS	28											
7.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		3	SS	100/7	5"										
			4	SS	100/7	8"										
			5	SS	100/7	5"										
			6	SS	100/7	5"										
253.1			7	SS	100/7	6"										
20.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 44 S

W P 46-74-13, 40 & 39 LOCATION Coords. N. 15,680,756; E 1,065,079 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger and Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE June 20, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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		
275.7	Ground Level													
0.0	Clayey Silt to Silty Clay Very Stiff		1	SS	10									
269.7			2	SS	65									
6.0	Silt Some Sand		3	SS	44									
265.7	Dense		4	SS	100	7"								
10.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		5	SS	100	5"								
			6	SS	100	5"								
254.9			7	SS	100	9"								
20.8	End of Borehole													

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

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 755

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,760; E 1,065,090 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger COMPILED BY J.A.  
DATUM Geodetic DATE July 6, 1978 CHECKED BY JP.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
274.0	Ground Level																
0.0	Clayey Silt to Silty Clay Very Stiff						270										
267.0			1	SS	13												
7.0	Silt Some Sand		2	SS	46												
264.0	Dense																
10.0	Red Silt to Clayey		3	SS	100/ 9"												27 38 30 5
261.0	Silt, Very Dense to Hard		4	SS	100/ 7"												
13.0	End of Borehole																
	Note: Water Level Not Established																

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 76 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,658; E 1,065,118 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Solid Auger COMPILED BY J.A.  
DATUM Geodetic DATE July 6, 1978 CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
272.9	Ground Level																
0.0	Clayey Silt to Silty Clay Stiff to Very Stiff		1	SS	10		270										
			2	SS	10												
			3	SS	7												
			4	SS	9		260										
255.9	Organic Silt		5	SS	9												
17.0	Red Silt to Clayey		6	SS	100/ 8"												
252.4	Silt, Very Dense to Hard		7	SS	100/ 6"												
20.5	End of Borehole																
	Note: Water Level Not Established																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 77 S

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,902; E 1,065,936 ORIGINATED BY J.A.  
DIST 4 HWY 406 BOREHOLE TYPE Cone Test COMPILED BY J.A.  
DATUM Geodetic DATE May 31, 1978 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
270.9	Ground Level												
0.0	Probable Organic Silt and Sand						270						
261.9													
9.0							260						
256.1													
14.8	End of Cone Test												

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE





# RECORD OF BOREHOLE No 216

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,834; E 1,066,169 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Pendrill COMPILED BY K.W.  
DATUM Geodetic DATE July 8 & 9, 1971 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	100					
324.7	Ground Level													
0.0	Clayey Silt With Organics		1	SS	6		323.2							
317.2	Dark Grey		2 & 3	SS	5									
7.5	Clayey Silt to Silty Clay, Traces of Sand and Gravel		4	SS	16									
			5	SS	25									
			6	SS	31									
	Occasionally Laminated		7	SS	34									
			8	SS	24									
	Stiff to Hard		9	SS	27									
			10	SS	17									
	Gray and Brown		11	SS	13									
			12	TV	PM									
			13	SS	29									
			14	SS	32									
264.7			15	SS	100/ 11"									
60.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		16	SS	100/ 11"									
			17	SS	70/ 6"									
250.1			18	SS	50/ 11"									
74.6	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 217

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,992; E 1,066,055 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Pendrill COMPILED BY K.W.  
DATUM Geodetic DATE July 15 & 16, 1971 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
325.2	Ground Level																
0.0	Silty Sand, Some Organics Loose		1	SS	7		320										
318.7			2	SS	12												
6.5	Clayey Silt to Silty Clay, Traces of Sand and Gravel		3	SS	17												
			4	SS	28												
			5	SS	30		310										
			6	SS	28												
	Stiff to Hard		7	SS	26												
			8	SS	28		300										
	Grey		9	SS	17												
			10	SS	10		290										
			11	TW	PM		280										
			12	SS	45												
272.2			13	SS	50/	3"	270										
53.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		14	SS	50/	4"											
			15	SS	50/	5"	260										
254.7			16	SS	50/	4"											
70.5	End of Borehole  Note: Hole Caved in to Elevation 267+ Immediately																

OFFICE REPORT ON SOIL EXPLORATION

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



# RECORD OF BOREHOLE No 218

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,963; E 1,065,885 ORIGINATED BY K.W.  
DIST 4 HWY 406 BOREHOLE TYPE Pendrill COMPILED BY K.W.  
DATUM Geodetic DATE July 12, 1971 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT <div>20 40 60 80 100</div>	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) <div>GR SA SI CL</div>
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
273.0	Ground Level												
0.0	Silty Fine Sand												
267.5	Loose		1&2	SS	6	267.9							
5.5	Grey Organic Silt and Sand Soft to Firm		3	SS	3								
			4	SS	6								
			5	SS	4								
			6	TW	PM								
256.0						260							
17.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		7	SS	50/	3 1/2"							
			8	SS	50/	2 1/2"							
			9	SS	50/	3"							
243.2						250							
29.8	End of Borehole												0 38 44 18

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 220

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,705; E 1,066,028 ORIGINATED BY K.W.  
 DIST 4 HWY 406 BOREHOLE TYPE Pendril COMPILED BY K.W.  
 DATUM Geodetic DATE July 12, 1971 CHECKED BY EP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
								SHEAR STRENGTH						
								○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE						
273.5	Ground Level												PCF	GR SA SI CL
0.0	Clayey Silt		1	SS	22		270							
268.5	Very Stiff		3	SS	67									
5.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	62									
			5	SS	57									
			6	SS	76									
			7	SS	60/ 3"									
			8	SS	75/ 6"									
			9	SS	50/ 3"									
			243.7											
29.8	End of Borehole													
	Note: Water Level Not Established													

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



RECORD OF BOREHOLE No 236

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,666; E 1,066,129 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
DATUM Geodetic DATE December 13, 1971 CHECKED BY P.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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						
278.7	Ground Level													
0.0	Silty Clay Some Sand Hard		1	SS	39									
270.7			2	SS	45		270							
8.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		3	SS	40		267.2							
			4	SS	55		260							
			5	SS	49		250							
			6	SS	116									
			7	SS	100/4"									
248.2	Boulders		8	SS	100/6"									
30.5	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 237

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,597; E 1,066,076 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY P.K.  
DATUM Geodetic DATE December 17, 1971 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
272.2	Ground Level															
0.0	Rock Rip-Rap					270										
268.2			1	SS	17											
4.0	Grey Organic Silt & Sand, Firm to Stiff		2	TW	PH	268.2										3 18 67 12
264.2			3	SS	8											
8.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel		4	SS	74											
			5	SS	148	260										1 7 85 7
253.2	Very Dense to Hard (Glacial Till)		6	SS	1027	6"										
19.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 238

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,825; E 1,066,126 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
DATUM Geodetic DATE December 8, 1971 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH PSF							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
311.6	Ground Level							20 40 60 80 100	20 40 60						
0.0	Fill Sandy Silt, Silty Clay, Some Brick Fragments		1	AS			310							2 39 40 19	
			2	SS	15									0 4 47 49	
			3	SS	42										
			4	SS	36										
297.6			5	SS	32		300								
14.0	Clayey Silt to Silty Clay Traces of Sand Pockets of Silt Stiff to Very Stiff		6	TW	PH							127			
			7	TW	PH		290					123			
			8	SS	15								0 3 52 45		
			9	AS											
			10	TW	PH		280					120			
			11	TW	PM							134.5			
268.6			12	SS	16		270					136	3 12 54 31		
43.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		13	SS	28										
			14	SS	47		260								
			15	SS	105/6"								5 16 69 10		
251.1			16	SS	100/6"										
60.5	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 239


W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,783; E 1,066,089 ORIGINATED BY D.M.  
 DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
 DATUM Geodetic DATE December 9 & 10, 1971 CHECKED BY P.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				NATURAL MOISTURE CONTENT			UNIT WEIGHT Y PCF	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		SHEAR STRENGTH PSF				W <sub>p</sub>	W	W <sub>L</sub>		
300.2	Ground Level						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 400 800 1200 1600 2000				WATER CONTENT (%)				
0.0	Clayey Silt to Silty Clay		1	SS	31										
	Trace of Sand and Gravel		2	SS	39										
	Very Stiff to Hard		3	SS	34										
			4	TW	PH										
			5	TW	PH										
			6	TW	PM										
			7	SS	22										
			8	TW	PM										
267.2			9	SS	43										
33.0	Red Silt to Clayey Silt, Some Sand		10	SS	85										
	Trace of Gravel		11	SS	100/6"										
	(Glacial Till)														
	Boulders														
250.7															
49.5	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 240

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,683; E 1,066,015 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY P.K.  
DATUM Geodetic DATE December 16 & 17, 1971 CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
271.7	Ground Level																
0.0	Rock Rip-Rap						270										
267.7																	
4.0	Grey Organic Silt and Sand, Firm to Stiff		162	AS	6	267.2											
261.9			3	TW	PM												
9.8	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	45		260										0 4 90 6
253.2			5	SS	98												2 20 68 10
18.5	End of Borehole		6	SS	178.7	6"											

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10

RECORD OF BOREHOLE No 241

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,834; E 1,066,009 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger and Cone Test COMPILED BY P.K.  
DATUM Geodetic DATE December 16, 1971 CHECKED BY *SP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
275.8	Ground Level																
0.0	Silty Clay																
270.8	Hard		1	SS	37		270										0 6 48 46
5.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		2	SS	29												
			3	SS	57												6 23 56 15
			4	SS	69												
			5	SS	53												
			6	SS	145												
250.0			7	SS	100/5"												9 23 53 15
25.8	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 242 A

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,767; E 1,065,960 ORIGINATED BY D.M.  
DIST 4 HWY 406 BOREHOLE TYPE Auger COMPILED BY P.K.  
DATUM Geodetic DATE December 17, 1971 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
271.2	Ground Level																
0.0	Rock Rip-Rap						270										
267.7																	
3.5	Organic Silt and Sand, Trace of Gravel		1	SS	61		267.2										
			2	SS	5												
			3	SS	2												
	Soft to Firm		4	SS	2		260										
256.2			5	TV	N/R												
15.0	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		6	SS	145/	11"											
			7	SS	130/	3"	250										
245.7			8	SS	140/	6"											
25.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 317

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,015; E 1,065,805 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Wash Boring BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE October 8 & 9, 1963 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
270.6	Ground Level						270										
0.0	Rock Rip-Rap		1	SS	13		270										
266.6			2	TW	PM		266										
4.0	Grey Organic Silt and Sand Soft to Very Stiff		3	TW	PM		266										
			4	TW	PM		260										
257.6							260										
13.0	Silty Clay		5	SS	14		250										
254.1	Firm		6	SS	> 100		250										
16.5	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		7	SS	> 100		246										
245.1																	
25.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 318

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,436; E 1,065,496 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Wash Boring HX & BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE October 10 & 11, 1963 CHECKED BY J.P.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
272.5	Ground Level															
0.0	Clayey Silt Some Sand Trace of Organics Stiff		1	SS	15	270										
			2	SS	14	268.5										
264.0			3	TW	12	W.L. in pipe Oct. 25, 1963										
8.5	Red Silt to Clayey Silt, Some Sand Trace of Gr.V. Dense to Hard (Glacial Till)		4	SS	> 100	258										
257.0			5	SS	> 100	260										
15.5	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

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

RECORD OF BOREHOLE No 319

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,638; E 1,065,365 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Wash Boring HX & BX Casing, BX Core COMPILED BY M.W.  
DATUM Geodetic DATE October 10 & 11, 1963 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
270.9	Ground Level																
0.0	Very Stiff Mottled Brown Silty Clay Containing a few Rock Fragments		1	SS	13		270										
263.1	(Fill)		2	SS	16												
260.7	Sandy Silt, Compact		3	SS	PM												
10.2	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	70												
250.6			5	SS	>100												
			6	BX Core	-												
			7	SS	>100												
20.3	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 350

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,605; E 1,065,816 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Wash Boring HX & BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE October 28-30, 1963 CHECKED BY *GP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					
275.9	Ground Level		1	SS	9												
0.0	Stiff to Very Stiff Mottled Grey & Brown Silty Clay		2	SS	16												
267.8			3	SS	14												
8.1	Silty Fine Sand Compact		4	SS	13												
261.9			5	SS	17												
14.0	Red Silt to Clayey Silt, Some Sand, Tr. of Gravel, V. Dense to Hard (Glacial Till)		6	SS	46												
255.3			7	SS	>100												
20.6	End of Borehole																

\*3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 351

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,440; E 1,065,206 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Wash Boring BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE October 29, 1963 CHECKED BY OP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
268.8	Ground Level																
0.0	Stiff Becoming Soft to Firm Below About 4' Depth, Silty Clay to Clayey Silt		1	CS	-	W.L. in pipe @ Elev. 268.1 Nov. 1, 1963	260										
			2	SS	9												
			3	SS	4												
259.3																	
9.5	Red Silt to Clayey Silt, Some Sand Trace of Gravel Very Dense to Hard (Glacial Till)		4	SS	>100												
			5	SS	>100												
248.8			6	RC	-												
20.0	End of Borehole																

<sup>3</sup>, <sup>5</sup>: Numbers refer to  
Sensitivity

20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10



RECORD OF BOREHOLE No 352

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,680,580; E 1,064,945 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Wash Boring HX & BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE October 30-31, 1963 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60
								SHEAR STRENGTH PSF							
								○ UNCONFINED      + FIELD VANE							
								● QUICK TRIAXIAL      x LAB VANE							
								400 800 1200 1600 2000				20 40 60			
333.0	Ground Level														
0.0	Hard to Very Stiff Brown-Grey Silty Clay With Some Fissures, Some Scattered Sand and Gravel Size Particles (Desiccated Zone)		1	CS	-		330							132	
			2	SS	26										
			3	CS	-										
			4	SS	27										
			5	SS	26										
			6	SS	25										
			7	TW	21		320								
			8	SS	23										
311.0			9	SS	33		310							119	
22.0	Very Stiff to Firm Grey Silty Clay With a Few Grey Silt Pockets (Generally Less Than 1/2 Inch in Size) and Some Scattered Sand and Gravel Size Particles		10	SS	26										
			11	TW	20		300								
			12	SS	11										
			13	TW	PM		290								
			14	SS	6										
			15	TW	PM		280								
			16	SS	12										
273.5				17	TW	31		270							138
59.5	Red Silt to Clayey Silt, Some Sand Trace of Gravel, V. Dense to Hard (Glacial Till)		18	SS	>100										
265.2			19	SS	>100										
67.8	End of Borehole														

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

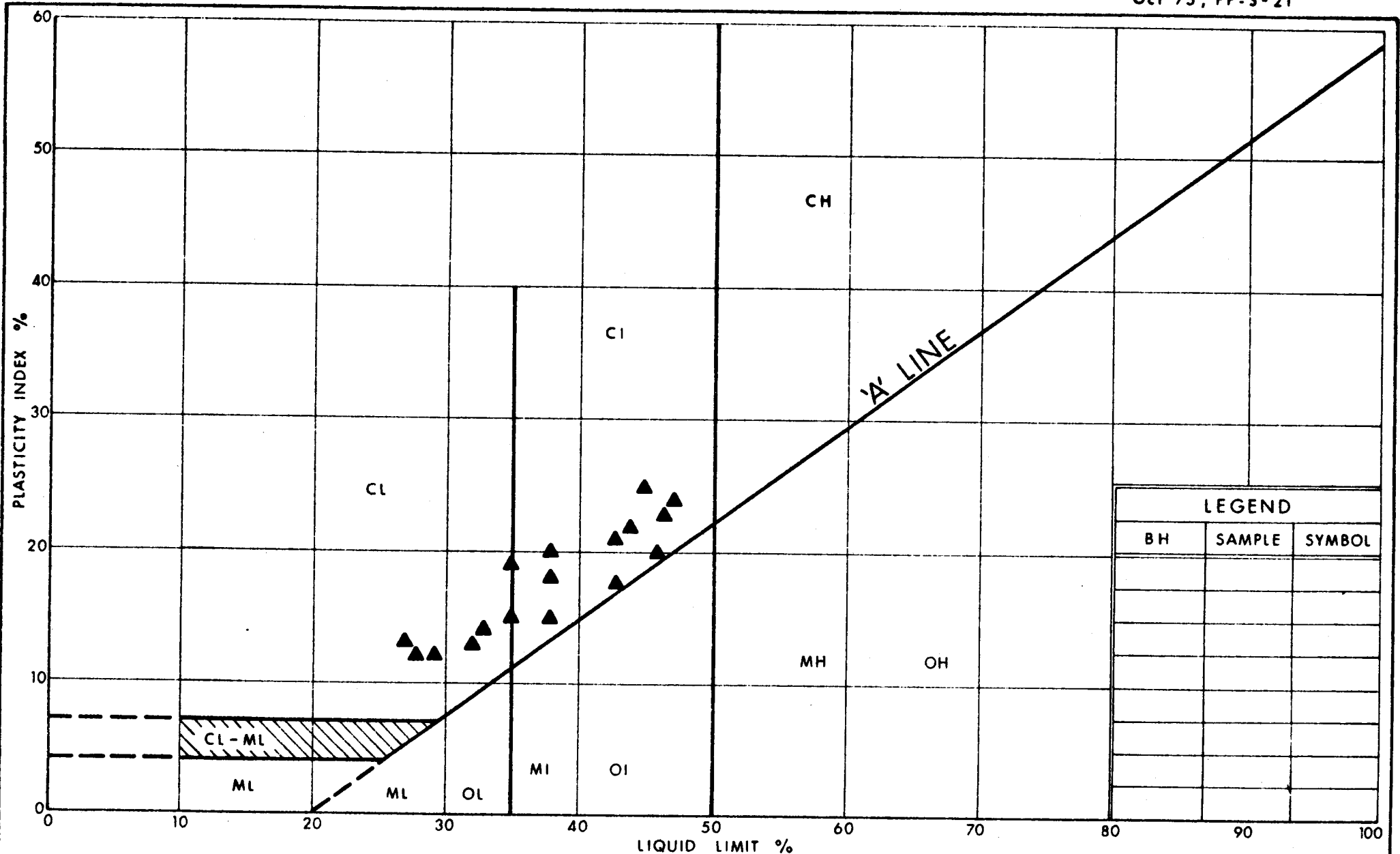
OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 355

W P 46-74-13, 40 & 39 LOCATION Coords. N 15,679,605; E 1,065,817 ORIGINATED BY Golder  
DIST 4 HWY 406 BOREHOLE TYPE Wash Boring HX & BX Casing COMPILED BY M.W.  
DATUM Geodetic DATE November 5, 1963 CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
272.8	Ground Level															
0.0	Hard to Firm, Brown Silty Clay, Some Gravel		1	HX Casing -		270										
266.8			2	SS 14												
6.0	Sandy Silt		3	SS 24												
	Compact		4	SS 14												
260.0			5	SS 30												
12.8	Red Silt to Cl. Silt Some Sand, Tr. of Gr. V. Dense to Hard (Glacial Till)		6	SS 49		260										
254.3			7	SS >100												
18.5	End of Borehole															
	Note: Water Level Not Established															

OFFICE REPORT ON SOIL EXPLORATION



Ministry of  
Transportation and  
Communications

# PLASTICITY CHART CLAYEY SILT TO SILTY CLAY TRACE OF SAND & GRAVEL

FIG No 1

W P 46-74-13/40 & 39

