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W. O. No.

STR. SITE No. 43-350

HWY. No. 11 & 17

LOCATION Hwy 11 & 17 Interchange
(North Bay)

No. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FOUNDATION INVESTIGATION REPORT

CONTRACT NO 91-216



Ontario

Ministry of
Transportation

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Note: For purposes of the contract, this report supercedes all other Foundation Reports prepared by, or for the Ministry in connection with the above mentioned project.

N VALUE THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N}

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON A SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS

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

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

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 OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ 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	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
C_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m^2	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

FOUNDATION INVESTIGATION REPORT
FOR
HIGHWAY 11 AND HIGHWAY 17 INTERCHANGE
DISTRICT 13 NORTH BAY
W.P. 703-89-01 SITE 43-350

INTRODUCTION

This report summarizes the results of a foundation investigation for the proposed Highway 11 and Highway 17 Interchange. The investigation was carried out at the request of Foundation Design Section of the Ministry of Transportation of Ontario.

This report applies to the proposed bridge structure, high light masts, and approaches between Sta. 10 + 580 and Sta. 10 + 725.

SITE DESCRIPTION

The proposed bridge structure is located to the immediate north of the existing intersection of Highway 17 Eastbound and Highway 11, in District 13, North Bay, Ontario.

The surrounding area can be described as gently rolling bush covered land, with rock outcrops visible on both sides of the existing highway.

PROCEDURE

The field investigation was carried out between the period of May 7 and June 13, 1990. The fieldwork consisted of drilling twelve boreholes and one test pit for the bridge structure, and six boreholes for high mast lights. The boreholes were drilled at the proposed locations of high mast lights, where rock was not present at the surface. The boreholes were advanced using a track mounted auger machine equipped with B size casing and tricone bits. Eleven boreholes were further advanced in the rock, by using BXT size core bits.

Samples were recovered by means of a 50 mm O.D. split spoon sampler driven into the soil according to the specification of the Standard penetration Test (ASTM D 1587-8). Due to poor recoveries in the split spoon samples, one test-pit was excavated, adjacent the south west abutment, to further explore the soil and groundwater conditions. Field vane tests were carried out in the stiff to soft cohesive deposits.

Laboratory testing was carried out on representative samples to identify and determine the physical properties of the overburden including:

Natural moisture content
Grain size distribution
Atterberg Limit

The elevations and the co-ordinates of the boreholes were provided by Northland Engineering limited.

SITE GEOLOGY

Physiographically, the site lies in the area known as Algonquin Highlands, characterized by shallow soils and bare rock knobs and ridges. The soils are generally stony and sandy. Many of the valleys are floored with outwash sand and gravel, with frequent swamps and bogs in hollows. However, several areas are noted to have deep till with fewer rock outcrops, and the surface of the till is smoothed and moulded with occasional drumlins appearing.

SUBSURFACE CONDITIONS FOR BRIDGE STRUCTURE

The subsoil conditions are variable across the site. At the west abutments, the subsoil conditions consist of shallow granular fill, overlying compact to very dense silty sand till, overlying Gneiss Bedrock at 9.8 to 10.7 m depth. The bedrock level rises up, 1.1 to 3.4 m depth, as it approaches the east abutments. At the central piers and east abutments, the overburden soils consist of shallow granular fill, overlying probable fill consisting of rock fragments with boulders and sand.

The boundaries of the different strata, together with the field and laboratory test results, appear on the Record of Borehole sheets appended to this report. Also refer to the sheets for the locations and elevations of the boreholes. Stratigraphical sections of the subsurface conditions are shown on Drawing No. 7038901-A.* Detailed description of the different strata are provided below.

Sand and Gravel (Fill material)

Granular fill consisting of sand and gravel, underlying 80 to 100 mm of asphalt, extends to depths varying from 0.6 to 1.7 m. The fill is generally in a compact state. The fill, in the vicinity of Borehole 4, contains some organic stained pockets.

* DWG NO 2 OF THE CONTRACT DWG'S

Rock Fragments, Boulders and Sand (Probable Fill)

Dense to very dense material consisting of rock fragments, boulders and sand, underlies the above fill at the central piers and east abutments. This material was not, however, encountered at Borehole 4. The material overlies the bedrock at Boreholes 5, 8, 9, 9A, 10 and 10A. The thickness of this strata varies from 3.3 m at Borehole 3, to 1.0 m at Borehole 5.

Heterogeneous Mixture of Sand, Silt, Gravel, Cobbles and Boulders (Glacial Till)

The glacial till deposit is the pre-dominant subsurface deposit at the west abutments. This heterogeneous glacial till deposit consist of a mixture of mainly silty sand with a large quantity of gravel, cobbles and boulders. The thickness of this layer varies from 8.3 to 9.0 m at west abutments. At Borehole 3, the thickness of this layer is about 2.8 m. It overlies the bedrock at Boreholes 1,2,3,6 and 7.. This layer was not fully penetrated at Test-pit No. 11.

The 'N' values for this material range from 22 blows/0.3 m penetration to 100 blows/0.05 m penetration, indicating a state of compaction described as compact to very dense. The moisture content of till deposit varies from 10 % to 14 %.

Typical gradation envelope is given in Figure 1.

Bedrock

Bedrock was core drilled at the locations of Boreholes 1 to 10. The bedrock is identified as coarse grained gneiss bedrock of metamorphic origin. The rock is generally strong to very strong in nature. Core recoveries were generally 100 % and R.Q.D. ranged from 71 % to 100 %, except Borehole 2 where the R.Q.D. was measured to be about 30 % in the upper 0.9 m. The quality of the rock is defined as fair to excellent, with the exception of Borehole 2 which is defined as poor to excellent. The spacing of discontinuities vary from close to moderately close.

The bedrock dips down from east to west. At the east abutments, the bedrock is encountered at Elevation ranging from 209.4 m to 207.6 m, dips to Elevation 207.1 m (central south pier) to 204.1 (central north pier), and further dips to Elevation ranging from 201.3 m to 200.3 m at the west abutments. Additional two auger holes (Boreholes 9A and 10A) were drilled to determine the probable bedrock levels, in between the boreholes at the south east abutment. The results of the auger holes are given in the appendix.

Groundwater Conditions

Observation of the groundwater level was carried out by measuring the water levels in the open boreholes. Groundwater levels varied from dry to 1.2 m depth (Elevation 209.5 m). Based on the soil examination, moisture content profile, and the examination of the water conditions in the Test-pit 11, it is noted that the water in the boreholes, at shallow depths, is generally due to seepage from minor wet seams. The ground water in the test-pit was encountered at 5.6 m depth (Elevation 204.9 m). The long term ground water levels may vary due to seasonal fluctuations and precipitation.

SUBSURFACE CONDITIONS FOR HIGH MAST LIGHTS

The subsoil conditions were observed to vary across the site. The soils encountered during the course of the investigation, together with the field test results, are shown on the Record of Borehole sheets contained in the appendix of this report. The location of the boreholes are given in Drawing No. 7038901-B.* Considering the variations in subsoil conditions, they are discussed separately.

High Mast Light Nos. 2, 6, 7, 8, 10

At the proposed mast locations, gneiss rock is exposed at the surface. Therefore, boreholes were not drilled at these locations. Based on our observations and experience, the rock is generally sound.

High Mast Light No. 1

Borehole 101 was advanced at the proposed location and indicates the presence of loose sandy and silty organic stained fill to 1.5 m depth. This is underlain by 0.8 m of loose sand, which overlies the probable gneiss bedrock. Penetration of two additional auger holes, drilled 2.0 m east and 2.0 m west of Borehole 101, refused on the probable bedrock at 2.3 m and 2.1 m respectively. The borehole was dry.

High Mast Light No. 3

Borehole 102 was advanced at the proposed location and indicates the presence of very loose organic silt and sand with roots to a depth of 1.6 m. This is underlain by 1.4 m thick firm clayey silt, having a field vane shear strength of 35 kpa, with plastic limit of 21 and plasticity index of 24. It overlies 2.3 m of compact wet silty sand. Typical gradation analysis of clayey silt is given in Figure 3. Gneiss Bedrock of excellent quality exist at 5.3 m depth. The groundwater was observed at the ground surface.

* SHEET NO 107-1 OF THE CONTRACT DWG'S

High Mast Light No. T1

The subsoil conditions, at Borehole 103, consist of a thin layer of gravelly sand overburden, about 1.2 m thick, overlying probable bedrock. Penetration of two additional auger holes, drilled 1.0 m north and 1.0 m south of Borehole 103, was refused on the probable bedrock at 1.1 m and 1.2 m respectively.

High Mast Light Nos. 5 and T2

Boreholes 104 and 105 were advanced at the proposed locations of High Mast Light Nos. 5 and T2 respectively. A shallow veneer of sand and gravel fill, about 0.5 m thick, was encountered at Borehole 104. Sand to silty sand, underlies the topsoil or fill. This strata is 1.0 to 2.3 m thick and based on N values, the deposit is in a compact to very dense state. This is underlain by a compact to very dense heterogeneous mixture of sand, silt with some gravel (glacial till) deposit, which overlies the probable bedrock at 2.9 to 3.3 m depth. Perched groundwater was encountered at 0.6 m and 1.6 m in Boreholes 104 and 105 respectively.

High Mast Light No. 9

Borehole 106 was advanced at 2.0 m north from the proposed location, due to the low lying swampy area, and indicates the presence of organic stained very loose silty sand to a depth of 1.7 m. This is underlain by 1.5 m thick firm clayey silt, which overlies compact to very dense glacial till with sand layers. Typical gradation analyses are given in Figure 2. The glacial till consist of a heterogeneous mixture of sand, silt, gravel with cobbles and boulders and was proven to extend to the depth of investigation, i.e. 8.7 m. The groundwater in the borehole was at 1.0 m depth.

MISCELLANEOUS

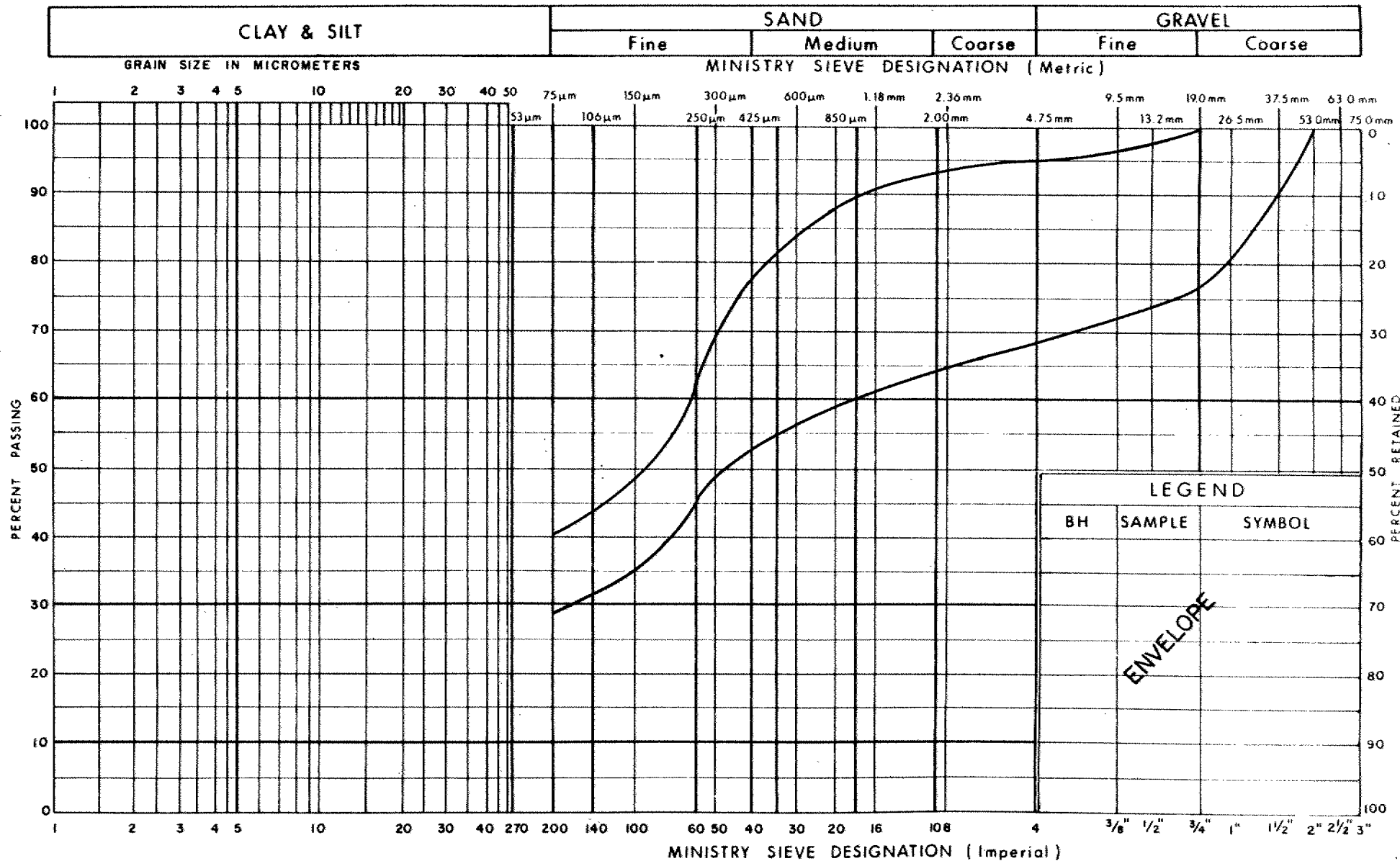
The field work for this investigation was carried out under the supervision of S. Magdolen, Geologist. The drilling equipment used is owned and operated by Merleux Engineering, North Bay.

The project was carried out under the supervision of S. Bandukwala, Project Engineer. The report was written by S. Bandukwala, and reviewed by L. Rak, Principal Engineer.

NOTE: The preceding report is a copy of the factual information from the Foundation Investigation Report prepared by McClymont & Rak Engineering Inc. (consulting geotechnical engineers for this project), under the technical supervision of the MTO Foundation Design Section.

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



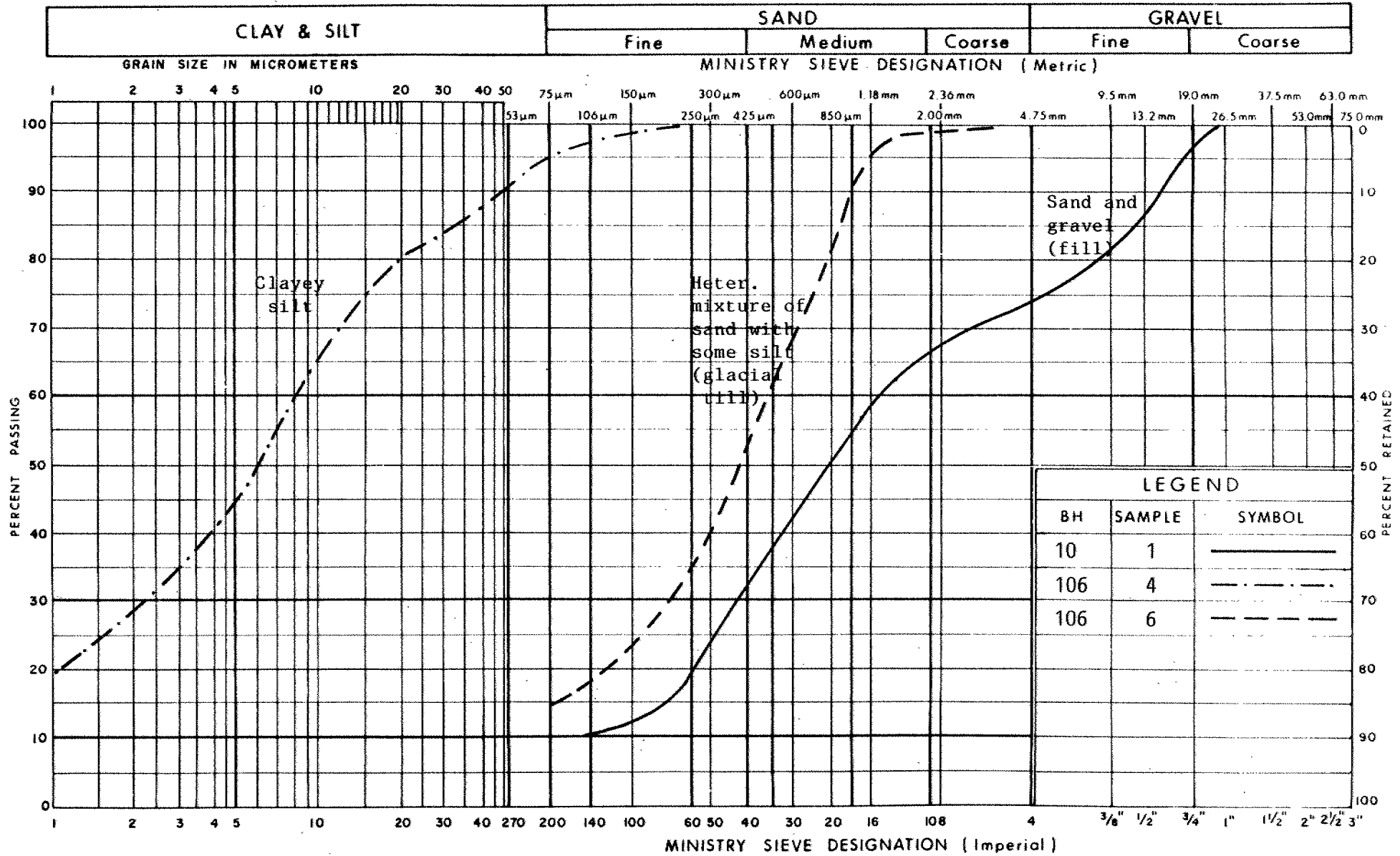
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GRAIN SIZE DISTRIBUTION
HETEROGENOUS MIXTURE OF SAND, SILT, GRAVEL (GLACIAL TILL)

FIG No 1

W P 703-89-01

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

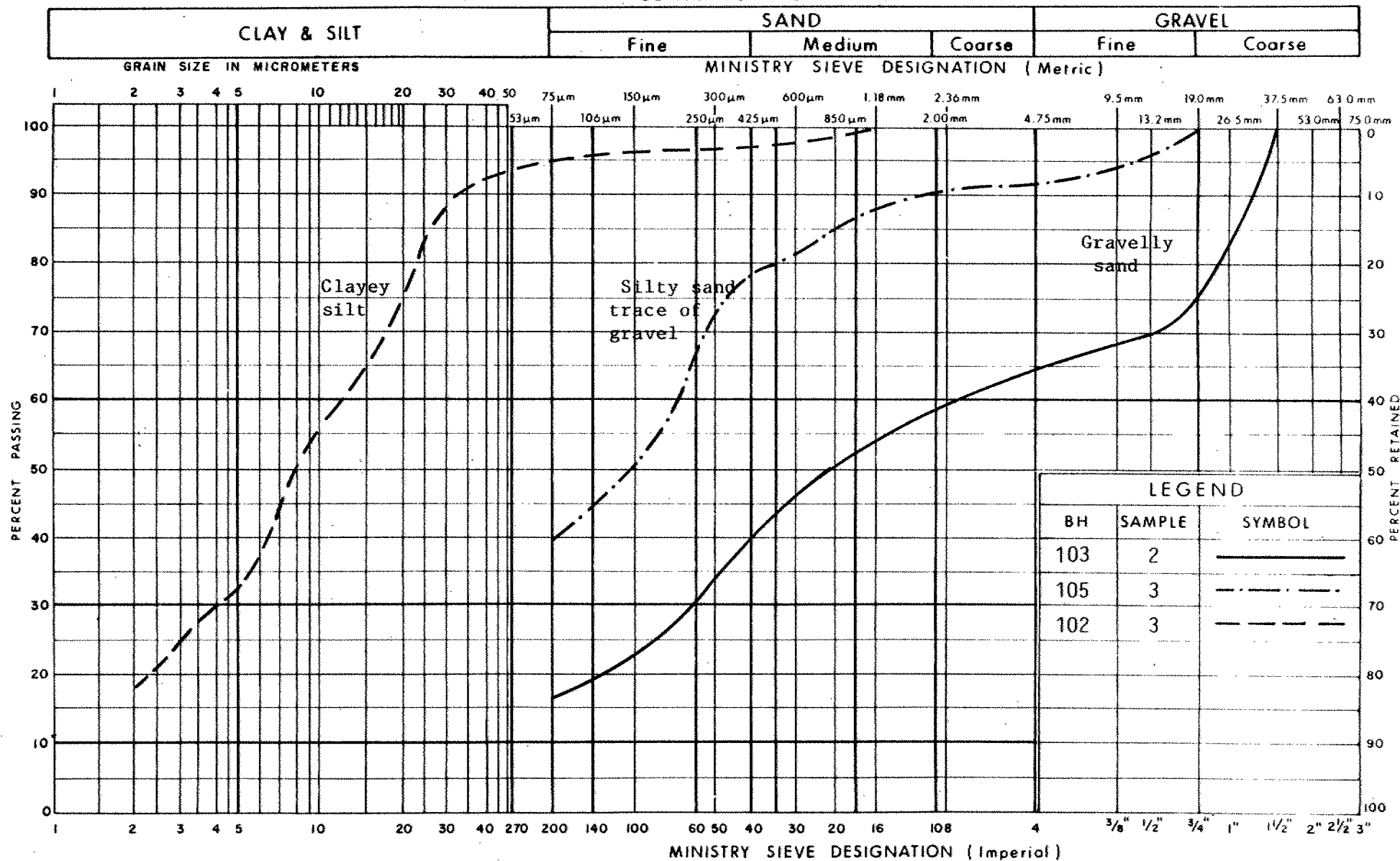
FIG No 2

W P 703-89-01

Ministry of
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UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

FIG No 3

W P 703-89-01

RECORD OF BOREHOLE No 1

METRIC

W P 703-89-01 LOCATION Co-ord. 5,129,354 N; 309,936 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 11, 1990 CHECKED BY SB

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT	NUMBER	TYPE			20	40	60	80	100					
211.1	Ground surface					211										
0.0	Asphalt: 100 mm Fill, sand and gravel, cobbles, boulders, compact		1	AS		210										
209.6			2	SS	22	209										
1.5			3	SS	28	208										
	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, compact to very dense (glacial till)		4	SS	45	207										
			5	SS	100/ 5cm	206										
			6	SS	100/ 10cm	205										
						204										
						203										
						202										
201.3						201										
9.8			7	RC BXT	REC 100%	200										
	Gneiss bedrock, coarse crystalline gneissic layering, grey with pink feldspar, strong to very strong, excellent to good quality, below 11.3m some fissure		8	RC BXT	REC 100%	199										
198.3																
12.8	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,340 N; 309,932 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 14, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION


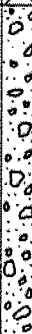


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100				
								SHEAR STRENGTH kPa				
210.9	Ground surface											
0.0	Asphalt: 90 mm											
	Fill, sand and fine-medium gravel, compact		1	SS	31							
209.6												
1.3	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, dense to very dense (glacial till)		2	SS	49							
			3	SS	76							
			4	SS	38							
			5	SS	98							
			6	SS	100/ 5cm							
			7	SS	100/ 10cm							
	more boulders below 8.2m											
200.8												
10.1	Gneiss bedrock, brown-grey weathered, fractured, poor quality, below 10.8m grey-pink, excellent quality, very strong		8	RC BXT	REC 100%							
			9	RC BXT	REC 100%							
199.3												
11.6	End of Borehole											

RECORD OF BOREHOLE No 3

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,334 N: 309,987 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 9-10, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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 _p	W	W _L	WATER CONTENT (%)		
211.1	Ground surface													GR SA SI CL
0.0	Asphalt: 100 mm Fill, sand and gravel, compact						211							
210.2			1	SS	100/0cm		210							
0.9	Rock fragments, boulders, silty sand, dense to very dense (Possible fill)		2	RC BXT			209							
			3	SS	100/0cm		208							
206.9							207							
4.2	Heterogeneous mixture of sand, silt, gravel and boulders, very dense (glacial till)		4	SS	100/0cm		206							
							205							
204.1							204							
7.0	Gneiss bedrock, coarse crystalline, gneissic layering, grey-pink, biotite and feldspar phenocryst, strong to very strong, excellent quality		1	RC BXT	REC 100%		203							RQD 92%
			2	RC BXT	REC 100%									RQD 100%
201.1														
10.0	End of Borehole													

RECORD OF BOREHOLE No 4

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,333 N; 310,050 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
210.6	Ground surface																
0.0	Fill, silty sand, organic stained pockets, compact		1	SS	20	Dry	210										
209.2							209										
1.4	Biotite gneiss bedrock, grey, below 3.30m pink feldspar phenocryst, strong to very strong, excellent quality		2	RC BXT	REC 100%		208									RQD 100%	
			3	RC BXT	REC 100%		207									RQD 100%	
206.3																	
4.3	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 5

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,314 N; 310,044 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 15, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
211.0	Ground surface																
0.0	Asphalt: 80 mm					Dry	211										GR SA SI CL
210.4	Fill, sand and gravel																
0.6	Rock fragments, boulders, some sand (probable fill)		1	SS	1007 0cm		210										
209.4																	
1.6	Gneiss bedrock grey, some pink feldspar phenocryst, gneissic layering, strong to very strong, excellent quality		2	RC BXT	REC 100%		209										RQD 95%
							208										
							207										RQD 91%
206.3			3	RC BXT	REC 100%												
4.7	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,334 N; 309,943 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 15, 1990 CHECKED BY SB

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						
								SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L					WATER CONTENT (%) 5 10 15		
211.0	Ground surface													GR SA SI CL
0.0	Asphalt: 80 mm						211							
	Fill, sand and fine-medium gravel, compact		1	SS	31		210					0		
209.3														
1.7			2	SS	22		209					0		
	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, compact to very dense (glacial till)		3	SS	44		208					0		20 50 (3)
			4	SS	72		207					0		
							206						0	
			5	SS	100/12cm		205						0	
							204							
			6	SS	100/8cm		203						0	
							202							
	more boulders below 7.8m					201								
200.3														
10.7	Gneiss bedrock, gneissic layering, grey-pink, feldspar and biotite phenocrysts very strong, excellent quality		8	RC BXT	REC 100%		200							RQD 100%
198.8							199							
12.2	End of Borehole													

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METRIC

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[illegible]

*3, x5: Numbers refer to Sensitivity

15 ϕ 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 8

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,316 N; 309,996 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 7-9, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
210.9	Ground surface																GR SA SI CL
0.0	Asphalt: 80 mm Fill, sand and gravel, compact		1	SS	1007 0cm		210										
0.9	Rock fragments, boulders, silty sand, dense to very dense (probable fill)		2	SS	1007 0cm		209										
			3	RC BXT			208										
207.1							207										
3.8	Gneiss bedrock coarse crystalline, gneissic layering, grey-pink, biotite and feldspar phenocryst, strong to very strong excellent quality		4	RC BXT	REC 100%		206										RQD 100%
			5	RC BXT	REC 100%		205										RQD 100%
204.0							204										
6.9	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 9

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,309 N; 310,054 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 16, 1990 CHECKED BY SB

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			20	40	60	80	100		
211.0	Ground surface												
0.0	Asphalt: 45 mm Fill, sand, some gravel, dark brown, compact				Dry								
210.1 0.9			1	SS		210							
	Rock fragments, boulders, some sand, very dense (probable fill)		2	SS		209							
207.6						208							
3.4	Gneiss bedrock gneissic layering, grey, pink feldspar phenocryst, very strong, excellent quality		3	RC EXT		207							RQD 100%
206.1 4.9	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 9A

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,304 N; 310,055 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
DATUM Geodetic DATE May 18, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
210.8	Ground surface										
0.0	Asphalt: 80 mm					Dry					
	Fill, sand, gravel, rock fragments. (no sampling)										
209.0	Probable bedrock										
1.8	Auger refusal at 1.8m										

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 10

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,295 N. 310,053 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 16, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
210.7	Ground surface													
0.0	Fill, sand and gravel, compact		1	SS	100/2cm	Dry	210							25 65 (9)
209.6														
1.1	Rock fragments, boulders, some sand (Probable fill)						209							
208.5														
2.2	Gneiss bedrock gneissic layering, grey, pink feldspar phenocryst, very strong, excellent quality		2	RC BXT	REC 100%		208							RQD 100%
			3	RC BXT	REC 98%		207							RQD 71%
205.5	Below 4.7m fair quality						206							
5.2	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 10A

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,299 N; 310,053 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
 DATUM Geodetic DATE May 18, 1990 CHECKED BY SB

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W		
210.7	Ground surface															
0.0	Asphalt: 80 mm Fill. sand, gravel, rock pieces,	X				Dry										
209.8	Probable bedrock	X				210										
0.9	Auger refusal at 0.9m															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF TEST PIT No 11

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,321 N; 309,937 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE C790 John Deer Excavator COMPILED BY SM
DATUM Geodetic DATE June 13, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
210.5	Ground surface																
0.0	Topsoil: 200 mm																
	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, dense to very dense (glacial till)		1	AS			210										
			2	AS			209										
			3	AS			208										
			4	AS			207										
			5	AS			206										
			6	AS			205										
204.7			7	AS													
5.8	End of Test-pit																

NOTES: 1) Below 1.5m depth, very dense to hand probing.
2) Minor seepage at 2.4m depth.
3) Ground water encountered at 5.4m depth in the test hole.
4) The test-pit excavated at near vertical surfaces. After 1 hour, about 0.6m wide soil block in the upper 2.5m caved.
5) Hard excavating below 4.1m depth.

RECORD OF BOREHOLE No 101

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,191 N: 310,680 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
 DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
208.1	Ground surface																
0.0	Fill, sand and silt, organic stained, loose		1	SS	6	Dry											
206.6																	
1.5	Sand, fine to medium, loose		2	SS	9												
205.8	Assumed bedrock																
2.3	End of Borehole																
NOTE: Penetration of two additional auger holes, drilled 2.0m east and 2.0m west of this borehole, was refused on the probable bedrock at 2.3m and 2.1m respectively.																	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 102

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,288 N; 310,282 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

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					
								SHEAR STRENGTH kPa					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
						PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L			WATER CONTENT (%) 15 30 45				
205.0	Ground surface												
0.0	Organic Silt and Sand roots, wet, very loose		1	SS	1		204						
203.4			2	SS	5		203						
1.6	Clayey silt, mottled, wet, firm		3	SS	3		202						0 5 77 18
202.0			4	SS	10		201						
3.0	Silty Sand grey, wet, compact		5	SS	12		200						RQD 100%
199.7			6	RC EXT	REC 100%								
199.4	Gneiss bedrock												
5.6	End of Borehole												

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 103

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,364 N; 310,007 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
 DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
210.4	Ground surface																
0.0	Topsoil: 220 mm Gravelly sand, some silt. compact		1	SS	6	Dry	210										
209.2	Assumed bedrock		2	SS	20												
1.2	End of Borehole																
NOTE: Penetration of two additional auger holes, drilled 1.0m north and 1.0m south of this borehole was refused on the probable bedrock at 1.1m and 1.2m respectively.																	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 104

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,245 N; 310,089 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
207.1	Ground surface																
0.0	Fill, sand and gravel, loose	1	1	SS	3		206						0				
206.6																	
0.5	Sand, mottled, compact	2	2	SS	29		205						0				
205.6																	
1.5	Heterogeneous mixture of sand, silt, gravel, compact (glacial till)	3	3	SS	20		204						0				
204.2	Assumed bedrock	4	4	SS	22								0				
2.9	End of Borehole																
NOTE: Penetration of two additional auger holes, drilled 2.0m east and 2.0m west of this borehole, was refused on the probable bedrock at 2.6m depth.																	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 105

METRIC

W.P. 703-89-01 LOCATION Co-ords. 5,129,508 N; 309,853 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

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		
210.3	Ground surface													
0.0	Topsoil: 50 mm		1	SS	4		210							
	Silty sand, brown to grey, dense to very dense		2	SS	32		209							
			3	SS	62		208							
208.0														
2.3	Heterogeneous mixture of sand, silt, gravel, very dense (glacial till)		4	SS	100/ 10cm		208							
207.0	Probable bedrock		5	SS	100/ 8cm		207							
3.3	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 106

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,171 N; 309,981 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
 DATUM Geodetic DATE May 14, 1990 CHECKED BY 3B

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
204.3	Ground surface													
0.0	Topsoil: 60 mm		1	SS	3		204							
	Silty Sand, organic stained, black-brown, very loose		2	SS	4		203							
202.6														
1.7	Clayey Silt, grey, firm		3	SS	6		202							
			4	SS	4									
201.1														
3.2	Heterogeneous mixture of sand, silt, gravel, compact, grey (glacial till)		5	SS	31		201							0 5 66 29
							200							
199.4			6	SS	25									
4.9	Sand, medium, compact						199							0 86 (14)
198.8														
5.5	Heterogenous mixture of sand, silt, gravel, cobbles and boulders, very dense (glacial till)		7	SS	100/5cm		198							
							197							
			8	SS	100/0cm									
195.6							196							
8.7	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

C1144

JULY 1990

FOUNDATION INVESTIGATION REPORT
FOR
HWY 11 AND HWY 17 INTERCHANGE
DISTRICT 13 NORTH BAY
W.P. 703-89-01 SITE 43-350

CONT 91-216

GEOCRE# 31L-54

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ROOM 315, CENTRAL BUILDING
DOWNSVIEW, ONTARIO
M3M 1J8

FOUNDATION INVESTIGATION REPORT
FOR
HIGHWAY 11 AND HIGHWAY 17 INTERCHANGE
DISTRICT 13 NORTH BAY
W.P. 703-89-01 SITE 43-350

INTRODUCTION

This report summarizes the results of a foundation investigation for the proposed Highway 11 and Highway 17 Interchange. The investigation was carried out at the request of Foundation Design Section of the Ministry of Transportation of Ontario.

This report applies to the proposed bridge structure, high light masts, and approaches between Sta. 10 + 580 and Sta. 10 + 725.

SITE DESCRIPTION

The proposed bridge structure is located to the immediate north of the existing intersection of Highway 17 Eastbound and Highway 11, in District 13, North Bay, Ontario.

The surrounding area can be described as gently rolling bush covered land, with rock outcrops visible on both sides of the existing highway.

PROCEDURE

The field investigation was carried out between the period of May 7 and June 13, 1990. The fieldwork consisted of drilling twelve boreholes and one test pit for the bridge structure, and six boreholes for high mast lights. The boreholes were drilled at the proposed locations of high mast lights, where rock was not present at the surface. The boreholes were advanced using a track mounted auger machine equipped with B size casing and tricone bits. Eleven boreholes were further advanced in the rock, by using BXT size core bits.

Samples were recovered by means of a 50 mm O.D. split spoon sampler driven into the soil according to the specification of the Standard penetration Test (ASTM D 1587-8). Due to poor recoveries in the split spoon samples, one test-pit was excavated, adjacent the south west abutment, to further explore the soil and groundwater conditions. Field vane tests were carried out in the stiff to soft cohesive deposits.

Laboratory testing was carried out on representative samples to identify and determine the physical properties of the overburden including:

Natural moisture content
Grain size distribution
Atterberg Limit

The elevations and the co-ordinates of the boreholes were provided by Northland Engineering limited.

SITE GEOLOGY

Physiographically, the site lies in the area known as Algonquin Highlands, characterized by shallow soils and bare rock knobs and ridges. The soils are generally stony and sandy. Many of the valleys are floored with outwash sand and gravel, with frequent swamps and bogs in hollows. However, several areas are noted to have deep till with fewer rock outcrops, and the surface of the till is smoothed and moulded with occasional drumlins appearing.

SUBSURFACE CONDITIONS FOR BRIDGE STRUCTURE

The subsoil conditions are variable across the site. At the west abutments, the subsoil conditions consist of shallow granular fill, overlying compact to very dense silty sand till, overlying Gneiss Bedrock at 9.8 to 10.7 m depth. The bedrock level rises up, 1.1 to 3.4 m depth, as it approaches the east abutments. At the central piers and east abutments, the overburden soils consist of shallow granular fill, overlying probable fill consisting of rock fragments with boulders and sand.

The boundaries of the different strata, together with the field and laboratory test results, appear on the Record of Borehole sheets appended to this report. Also refer to the sheets for the locations and elevations of the boreholes. Stratigraphical sections of the subsurface conditions are shown on Drawing No. 7038901-A. Detailed description of the different strata are provided below.

Sand and Gravel (Fill material)

Granular fill consisting of sand and gravel, underlying 80 to 100 mm of asphalt, extends to depths varying from 0.6 to 1.7 m. The fill is generally in a compact state. The fill, in the vicinity of Borehole 4, contains some organic stained pockets.

Rock Fragments, Boulders and Sand (Probable Fill)

Dense to very dense material consisting of rock fragments, boulders and sand, underlies the above fill at the central piers and east abutments. This material was not, however, encountered at Borehole 4. The material overlies the bedrock at Boreholes 5, 8, 9, 9A, 10 and 10A. The thickness of this strata varies from 3.3 m at Borehole 3, to 1.0 m at Borehole 5.

Heterogeneous Mixture of Sand, Silt, Gravel, Cobbles and Boulders (Glacial Till)

The glacial till deposit is the pre-dominant subsurface deposit at the west abutments. This heterogeneous glacial till deposit consist of a mixture of mainly silty sand with a large quantity of gravel, cobbles and boulders. The thickness of this layer varies from 8.3 to 9.0 m at west abutments. At Borehole 3, the thickness of this layer is about 2.8 m. It overlies the bedrock at Boreholes 1,2,3,6 and 7. This layer was not fully penetrated at Test-pit No. 11.

The 'N' values for this material range from 22 blows/0.3 m penetration to 100 blows/0.05 m penetration, indicating a state of compaction described as compact to very dense. The moisture content of till deposit varies from 10 % to 14 %.

Typical gradation envelope is given in Figure 1.

Bedrock

Bedrock was core drilled at the locations of Boreholes 1 to 10. The bedrock is identified as coarse grained gneiss bedrock of metamorphic origin. The rock is generally strong to very strong in nature. Core recoveries were generally 100 % and R.Q.D. ranged from 71 % to 100 %, except Borehole 2 where the R.Q.D. was measured to be about 30 % in the upper 0.9 m. The quality of the rock is defined as fair to excellent, with the exception of Borehole 2 which is defined as poor to excellent. The spacing of discontinuities vary from close to moderately close.

The bedrock dips down from east to west. At the east abutments, the bedrock is encountered at Elevation ranging from 209.4 m to 207.6 m, dips to Elevation 207.1 m (central south pier) to 204.1 (central north pier), and further dips to Elevation ranging from 201.3 m to 200.3 m at the west abutments. Additional two auger holes (Boreholes 9A and 10A) were drilled to determine the probable bedrock levels, in between the boreholes at the south east abutment. The results of the auger holes are given in the appendix.

Groundwater Conditions

Observation of the groundwater level was carried out by measuring the water levels in the open boreholes. Groundwater levels varied from dry to 1.2 m depth (Elevation 209.5 m). Based on the soil examination, moisture content profile, and the examination of the water conditions in the Test-pit 11, it is noted that the water in the boreholes, at shallow depths, is generally due to seepage from minor wet seams. The ground water in the test-pit was encountered at 5.6 m depth (Elevation 204.9 m). The long term ground water levels may vary due to seasonal fluctuations and precipitation.

SUBSURFACE CONDITIONS FOR HIGH MAST LIGHTS

The subsoil conditions were observed to vary across the site. The soils encountered during the course of the investigation, together with the field test results, are shown on the Record of Borehole sheets contained in the appendix of this report. The location of the boreholes are given in Drawing No. 7038901-B. Considering the variations in subsoil conditions, they are discussed separately.

High Mast Light Nos 2, 6, 7, 8, 10

At the proposed mast locations, gneiss rock is exposed at the surface. Therefore, boreholes were not drilled at these locations. Based on our observations and experience, the rock is generally sound.

High Mast Light No. 1

Borehole 101 was advanced at the proposed location and indicates the presence of loose sandy and silty organic stained fill to 1.5 m depth. This is underlain by 0.8 m of loose sand, which overlies the probable gneiss bedrock. Penetration of two additional auger holes, drilled 2.0 m east and 2.0 m west of Borehole 101, refused on the probable bedrock at 2.3 m and 2.1 m respectively. The borehole was dry.

High Mast Light No. 3

Borehole 102 was advanced at the proposed location and indicates the presence of very loose organic silt and sand with roots to a depth of 1.6 m. This is underlain by 1.4 m thick firm clayey silt, having a field vane shear strength of 35 kpa, with plastic limit of 21 and plasticity index of 24. It overlies 2.3 m of compact wet silty sand. Typical gradation analysis of clayey silt is given in Figure 3. Gneiss Bedrock of excellent quality exist at 5.3 m depth. The groundwater was observed at the ground surface.

High Mast Light No. T1

The subsoil conditions, at Borehole 103, consist of a thin layer of gravelly sand overburden, about 1.2 m thick, overlying probable bedrock. Penetration of two additional auger holes, drilled 1.0 m north and 1.0 m south of Borehole 103, was refused on the probable bedrock at 1.1 m and 1.2 m respectively.

High Mast Light Nos. 5 and T2

Boreholes 104 and 105 were advanced at the proposed locations of High Mast Light Nos. 5 and T2 respectively. A shallow veneer of sand and gravel fill, about 0.5 m thick, was encountered at Borehole 104. Sand to silty sand, underlies the topsoil or fill. This strata is 1.0 to 2.3 m thick and based on N values, the deposit is in a compact to very dense state. This is underlain by a compact to very dense heterogeneous mixture of sand, silt with some gravel (glacial till) deposit, which overlies the probable bedrock at 2.9 to 3.3 m depth. Perched groundwater was encountered at 0.6 m and 1.6 m in Boreholes 104 and 105 respectively.

High Mast Light No. 9

Borehole 106 was advanced at 2.0 m north from the proposed location, due to the low lying swampy area, and indicates the presence of organic stained very loose silty sand to a depth of 1.7 m. This is underlain by 1.5 m thick firm clayey silt, which overlies compact to very dense glacial till with sand layers. Typical gradation analyses are given in Figure 2. The glacial till consist of a heterogeneous mixture of sand, silt, gravel with cobbles and boulders and was proven to extend to the depth of investigation, i.e. 8.7 m. The groundwater in the borehole was at 1.0 m depth.

DISCUSSIONS AND RECOMMENDATIONS

It is proposed to construct two double span bridge structures for the Highway 17 crossing at Highway 11. It is further proposed to stage the interchange with the southerly structure being built in the near future, and the northerly one at least ten years in the future. The span length of the structure varies from 55.0 m to 60.6 m. The profile grade of Highway 11 is set at approximate El. 207.0 m, or about 4.0 m below the existing ground level. The profile grade of Highway 17 will vary from Elevation 216.2 m to 212.5 m, and therefore the depth of the fill to be placed at the approaches, will vary from 2.5 m to 4.3 m.

Structure Foundations

Based on the subsoil conditions and the proposed profiles, the bridge structures can be founded on conventional spread footings. At the anticipated founding levels, the central piers and the east abutments can be founded on bedrock, while the west abutments can be founded in the very dense till. It is understood, that the west abutment footing levels may be raised and perched in the upper dense till. The recommended bearing capacities for the footings, as per the O.H.B.D.C., are given in Table 1.

The settlements of the footings founded on bedrock will be negligible. The settlements of the footings founded in the till will be mostly elastic and most of it will occur during the construction stage. The differential settlements will be less than 15 mm.

Lateral Earth Pressure

Free draining granular material such as Granular 'A' or 'B' is recommended as appropriate backfill to the abutment walls to prevent hydrostatic pressure build-up.

Lateral earth pressures should be computed in accordance with Section 6.6.1.2 of the O.H.B.D.C. The design parameters are as follows:

	Granular 'A'	Granular 'B'
Angle of Internal Friction (degrees)	35	30
Unit Weight (KN/cu.m.)	22.8	21.2

An active condition (K_a) may be assumed to apply for a yielding structure. For rigid and unyielding structures, at-rest condition (K_o) is applicable.

TABLE 1

BEARING PRESSURES

<u>BH No./Structure</u>	<u>Bedrock Elevation (m)</u>	<u>Anticipated Founding Elev. (m)</u>	<u>Approx. Bearing Capacity at S.L.S. (Kpa)</u>	<u>Factored Bearing Capacity at U.L.S. (Kpa)</u>	<u>Founding Strata</u>
4/NE abutment	209.2	206.0	*	10,000	Gneiss Bedrock
5/NE abutment	209.4	206.0	*	10,000	"
9/SE abutment	207.6	206.0	*	10,000	"
10/SE abutment	208.5	206.0	*	10,000	"
3/N.Pier	204.1	203.5	*	10,000	"
8/S.Pier	207.1	204.0	*	10,000	"
1/NW abutment	201.3	Below 206.0	*	1,000	Silty sand till boulders
2/NW abutment	200.8	Below 206.0	*	1,000	"
6/SW abutment	200.3	Below 206.0	*	1,000	"
7/SW abutment	201.0	Below 206.0	*	1,000	"

If the west abutments are to be perched in the upper till, then the following bearing pressures are applicable:

NW abutment	208.5-207.5	250	800	Silty sand till
	207.5-206.0	400	1,000	"
SW abutment	208.5-208.0	250	800	"
	208.0-206.0	400	1,000	"

Note: *Design of shallow foundations will not be governed by settlements, since the load required to produce detrimental settlements will be much greater than factored capacity at ultimate limit state.

Lateral Resistance

For footings placed directly on bedrock, the sliding resistance between the concrete footing and bedrock may be calculated using an unfactored ϕ value of 40° , provided the rock surface is generally rough. For footings placed on granular till, an unfactored ϕ of 35° , may be used.

The sliding resistance can be further increased by embedding the dowels into the bedrock.

Frost Protection

The footings require a minimum of 1.8 m of soil cover for frost protection.

Dewatering

Perched groundwater conditions exist at the central piers and west abutments. Based on the observation of the open cut test-pit, adjacent to south west abutment, the groundwater is at approximate 5.6 m depth (Elevation 204.9). Therefore, water entering the excavation can be controlled by conventional pumping from perimeter sumps and ditches. No major dewatering problems are anticipated for the construction of the footings.

Approach Embankment

The fill required to achieve the profile grade of Highway 17, in the vicinity of the proposed bridge structure, is in the order of 2.5 m to 4.3 m. Prior to placement of fill, all surficial topsoil or, if any, other organic material should be removed within the plan limits of the embankments. The sub-excavated material should be replaced with rock fill or native till. Temporary excavations should be inclined at 1 H : 1V or flatter.

The embankment fill, consisting of rock fill can be placed at 1.5 H to 1.0 V. The excavated silty sand till, from Highway 11 road cuts, is also suitable as backfill material for embankment construction. The till material should be placed at 2.0 H to 1.0 V.

There are no settlement concerns for the embankment constructed with the above mentioned materials. Settlement will be elastic in nature and should occur during construction.

No stability problems are anticipated for the proposed height of permanent embankments.

High Mast Lights

It is understood that eleven high mast light supports are proposed for the interchange. At five locations, namely 2, 6, 7, 8, and 10, rock is visible at the ground surface. At these locations, the poles should be anchored or bolted to the bedrock to resist the uplift forces induced by the wind loads and frost heave (depth of frost penetration 1.8 m). A safe bond stress value of 750 kpa is recommended for the design of the bolt or anchor. The factored bearing capacity, at U.L.S., of the bedrock is 10,000 kpa.

At other locations, the properties of the overburden soils are summarized in Table 2.

TABLE 2

SOIL PROPERTIES AT HIGH MAST LIGHTS LOCATIONS

HML No.	BOREHOLE No.	DEPTH (m)	DESCRIPTION OF SOIL	UNIT WEIGHT (Kn/m ³)	ANGLE OF FRICTION ϕ	COHESION 'C' (Kpa)
1	101	0 - 1.5	Organic stained sand & silt, loose	17.5	28	0
		1.5 - 2.3	Loose sand	19.0	30	0
3	102	0 - 1.6	Very loose organic silt and sand	16.0	25	0
		1.6 - 3.0	firm clayey silt	16.5	0	30
		3.0 - 5.3	compact silty sand	21.0	32	0
T-1	103	0 - 1.2	Compact gravelly sand	22.0	36	0
5	104	0 - 0.5	Sand & gravel fill, loose	21.0	32	0
		0.5 - 1.5	compact sand	21.0	34	0
		1.5 - 2.9	silty sand till very dense	24.0	42	0
T-2	105	0 - 2.3	Dense silty sand	23.0	38	0
		2.3 - 3.3	Very dense silty sand till	24.0	42	0
9	106	0 - 1.7	Very loose silty sand	18.0	28	0
		1.7 - 3.2	firm clayey silt	16.5	0	30
		3.2 - 5.5	compact silty sand till with sand layers	22.0	36	0
		5.5 - 8.7	very dense silty sand till	24.0	42	0

MISCELLANEOUS

The field work for this investigation was carried out under the supervision of S. Magdolen, Geologist. The drilling equipment used is owned and operated by Merleux Engineering, North Bay.

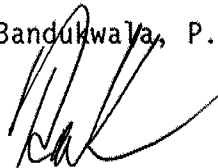
The project was carried out under the supervision of S. Bandukwala, Project Engineer. The report was written by S. Bandukwala, and reviewed by L. Rak, Principal Engineer.

Submitted by

MCCLYMONT AND RAK ENGINEERS INC.

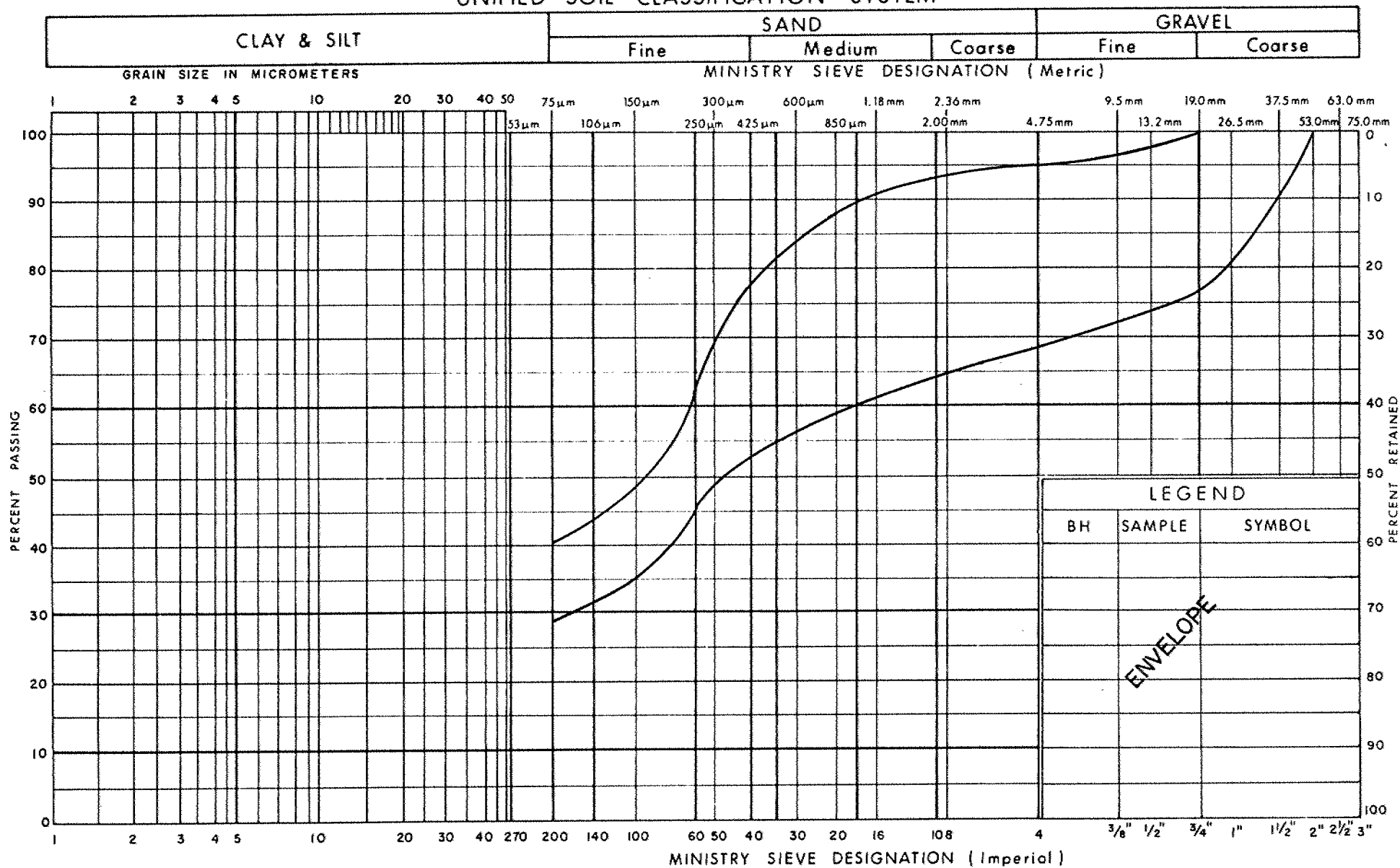


S. Bandukwala, P.Eng.



L.J. Rak, P.Eng.

UNIFIED SOIL CLASSIFICATION SYSTEM



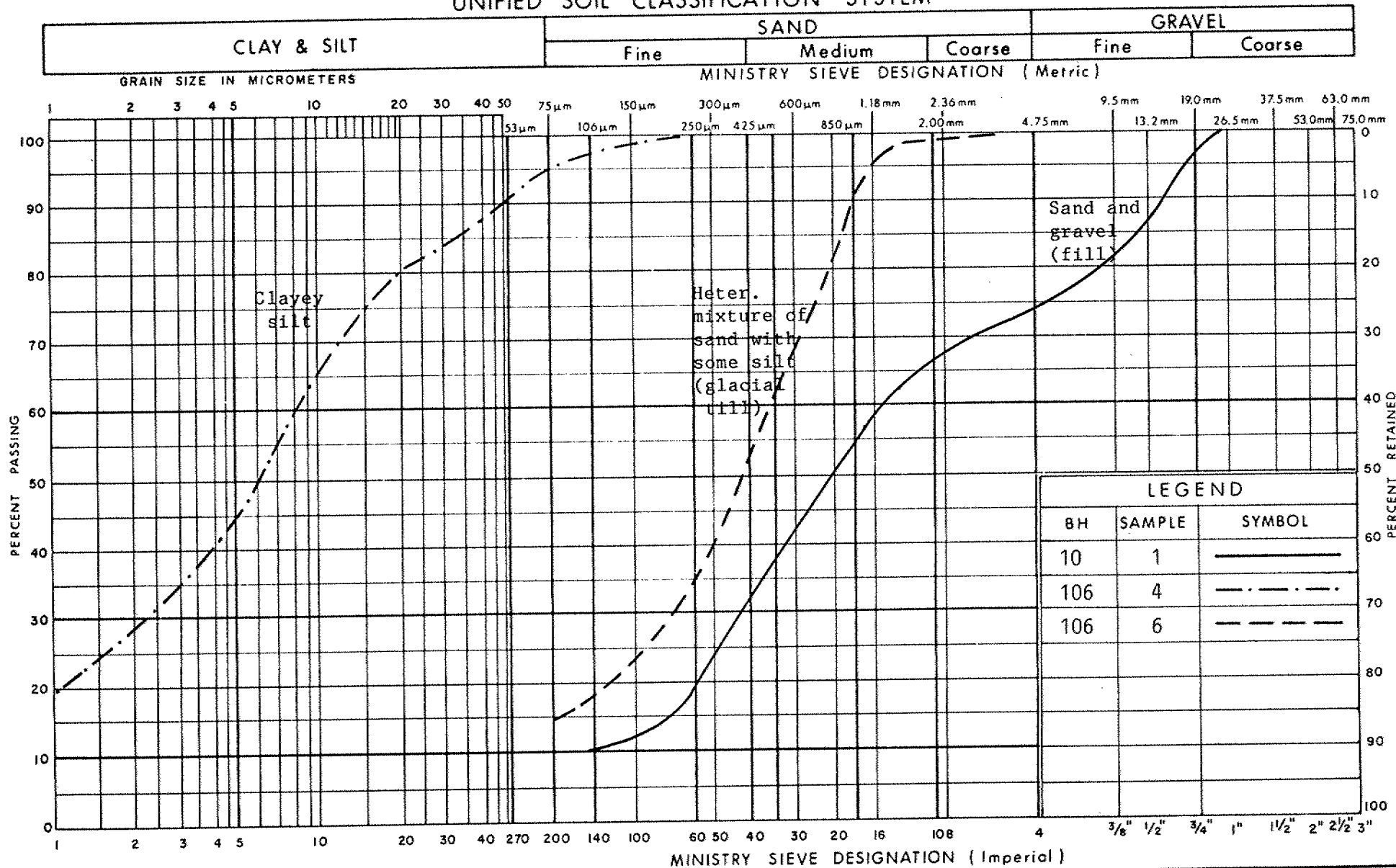
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
HETEROGENOUS MIXTURE OF SAND, SILT, GRAVEL (GLACIAL TILL)

FIG No 1

W P 703-89-01

UNIFIED SOIL CLASSIFICATION SYSTEM



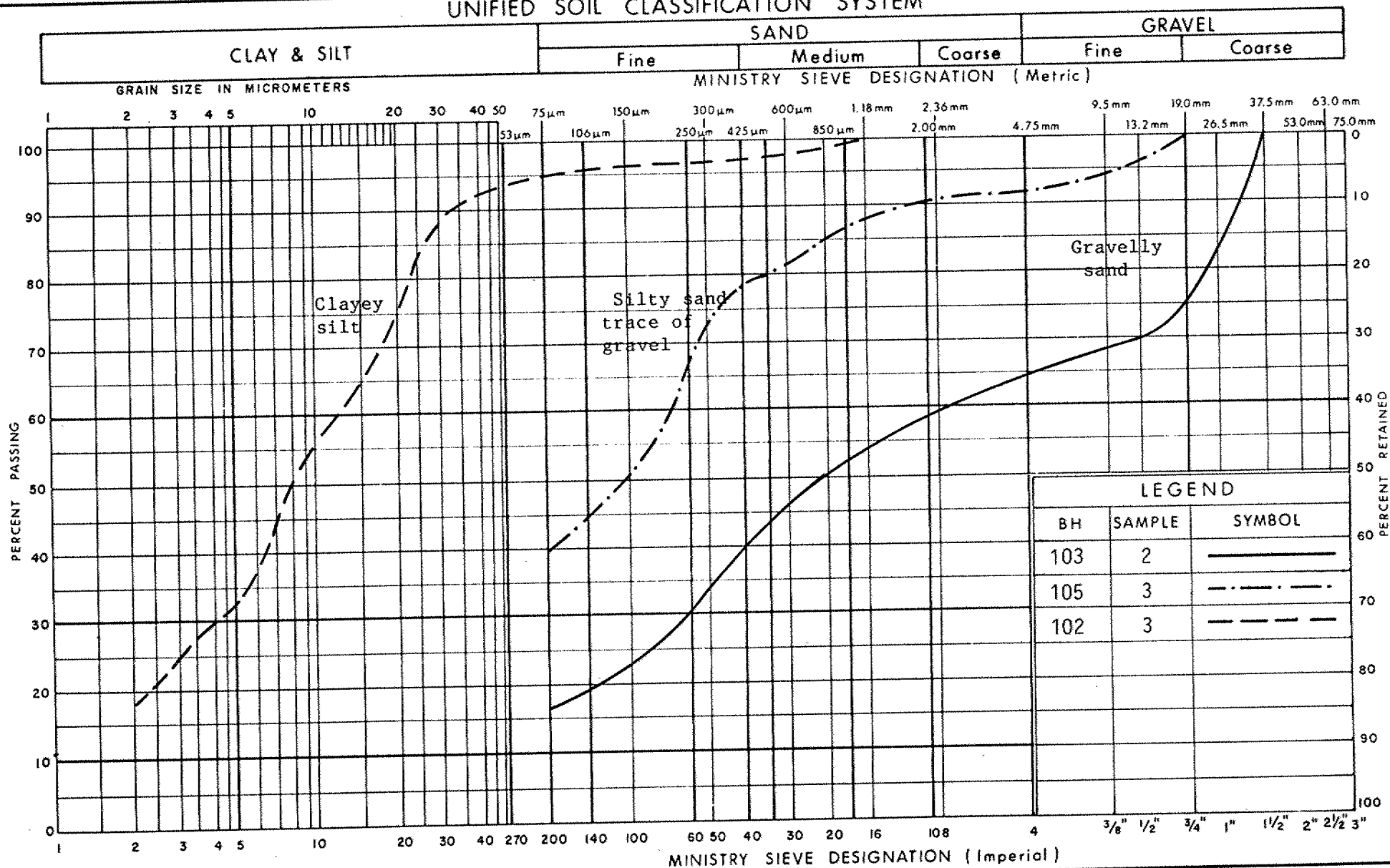
GRAIN SIZE DISTRIBUTION

FIG No 2

W P 703-89-01

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UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FIG No 3

W P 703-89-01

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Transportation

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

N (BLOWS / 0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

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 OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ 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	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_a	1	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{v0}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ² /s	RATE OF DISCHARGE
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m ³	SEEPAGE FORCE
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 1

METRIC

W P 703-89-01 LOCATION Co-ord. 5,129,354 N; 309,936 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 11, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W _p	W	W _L		
211.1	Ground surface															
0.0	Asphalt: 100 mm Fill, sand and gravel, cobbles, boulders, compact		1	AS												
209.6			2	SS	22											
1.5	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, compact to very dense (glacial till)		3	SS	28											
			4	SS	45											
			5	SS	100/ 5cm											
			6	SS	100/ 10cm											
	more bouldery below 7.3m															
201.3			7	RC BXT	REC 100%											
9.8	Gneiss bedrock, coarse crystalline gneissic layering, grey with pink feldspar, strong to very strong, excellent to good quality, below 11.3m some fissure		8	RC BXT	REC 100%											
198.3																
12.8	End of Borehole															

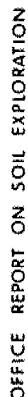
RECORD OF BOREHOLE No 2

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,340 N; 309,932 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 14, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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		
210.9	Ground surface													GR SA SI CL
0.0	Asphalt: 90 mm													
	Fill, sand and fine-medium gravel, compact		1	SS	31		210							
209.6														
1.3	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, dense to very dense (glacial till)		2	SS	49		209							12 58 (30)
			3	SS	76		208							
			4	SS	38		207							
							206							5 60 (35)
			5	SS	98		205							
							204							
			6	SS	100/ 15cm		203							
							202							
			7	SS	100/ 10cm		201							
	more boulders below 8.2m						200							
200.8														
10.1	Gneiss bedrock, brown-grey weathered, fractured, poor quality, below 10.8m grey-pink, excellent quality, very strong		8	RC EXT	REC 100%									RQD 30%
			9	RC EXT	REC 100%									RQD 92%
199.3														
11.6	End of Borehole													





METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,334 N; 309,987 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 9-10, 1990 CHECKED BY SB

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+3, x⁵: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 4										METRIC					
W P 703-89-01		LOCATION Co-ords. 5,129,333 N; 310,050 E.				ORIGINATED BY SM									
DIST 13 HWY 11		BOREHOLE TYPE Solid Stem Auger, Rock Core				COMPILED BY SM									
DATUM Geodetic		DATE May 17, 1990				CHECKED BY SB									
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 _p	W	W _L	5 10 15			
210.6	Ground surface													GR SA SI CL	
0.0	Fill, silty sand, organic stained pockets, compact		1	SS	20	Dry	210								
209.2															
1.4	Biotite gneiss bedrock, grey, below 3.30m pink feldspar phenocryst, strong to very strong, excellent quality		2	RC BXT	REC 100%		209								RQD 100%
								208							
								207							RQD 100%
206.3	End of Borehole														
4.3															

RECORD OF BOREHOLE No 5

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,314 N; 310,044 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 15, 1990 CHECKED BY SB

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		
211.0	Ground surface													GR SA SI CL
0.0	Asphalt: 80 mm					Dry	211							
210.4	Fill, sand and gravel													
0.6	Rock fragments, boulders, some sand (probable fill)		1	SS	100% 0cm		210							
209.4														
1.6	Gneiss bedrock grey, some pink feldspar phenocryst, gneissic layering, strong to very strong, excellent quality		2	RC BXT	REC 100%		209							RQD 95%
							208							
			3	RC BXT	REC 100%		207							RQD 91%
206.3														
4.7	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION



METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,334 N; 309,943 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 15, 1990 CHECKED BY SB

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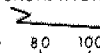




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RECORD OF BOREHOLE No 7

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,321 N; 309,940 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 10-14, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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			SHEAR STRENGTH kPa					WATER CONTENT (%)
								UNCONFINED ○	FIELD VANE +	QUICK TRIAXIAL ●			
			W _p	W	W _L								
210.7	Ground surface												
0.0	Fill, sand and gravel, compact												
209.8			1	SS	100/0cm		210						
0.9	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, dense to very dense (glacial till)		2	SS	100/0cm		209						
							208						
			3	SS	100/0cm		207						
							206						
							205						
							204						
							203						
							202						
201.0							201						
9.8	Gneiss bedrock, gneissic layering, grey, pink feldspar phenocryst, very strong, excellent quality		4	RC BXT	REC 100%		200					RQD 100%	
			5	RC BXT	REC 100%		199					RQD 100%	
			6	RC BXT	REC 100%		198					RQD 100%	
197.9													
12.8	End of Borehole												

RECORD OF BOREHOLE No 8

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,316 N; 309,996 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Tricone, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 7-9, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION




SOIL PROFILE		STRAT. PLT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
210.9	Ground surface																GR SA SI CL
0.0	Asphalt: 80 mm Fill, sand and gravel, compact																
210.0			1	SS	100/0cm		210										
0.9			2	SS	100/0cm		209										
	Rock fragments, boulders, silty sand, dense to very dense (probable fill)		3	RC BXT			208										
207.1							207										
3.8			4	RC BXT	REC 100%		206										RQD 100%
	Gneiss bedrock coarse crystalline, gneissic layering, grey-pink, biotite and feldspar phenocryst, strong to very strong excellent quality		5	RC BXT	REC 100%		205										RQD 100%
204.0							204										
6.9	End of Borehole																

RECORD OF BOREHOLE No 9

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,309 N; 310,054 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 16, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100										SHEAR STRENGTH kPa			WATER CONTENT (%)		
																		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					
211.0	Ground surface																						
0.0	Asphalt: 45 mm Fill, sand, some gravel, dark brown, compact					Dry																	
210.1			1	SS	100/ 8cm		210							0									
0.9	Rock fragments, boulders, some sand, very dense (probable fill)																						
			2	SS	100/ 0cm		209																
								208															
207.6																							
3.4	Gneiss bedrock gneissic layering, grey, pink feldspar phenocryst, very strong, excellent quality		3	RC BXT	REC 100%		207										RQD 100%						
206.1																							
4.9	End of Borehole																						

RECORD OF BOREHOLE No 9A

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,304 N; 310,055 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
 DATUM Geodetic DATE May 18, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
210.8	Ground surface												
0.0	Asphalt: 80 mm					Dry							
	Fill, sand, gravel, rock fragments, (no sampling)						210						
209.0	Probable bedrock						209						
1.8	Auger refusal at 1.8m												


OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 10

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,295 N. 310,053 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
DATUM Geodetic DATE May 16, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

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 kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				
							PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT W _p W W _L			WATER CONTENT (%) 5 10 15		
210.7	Ground surface					Dry						
0.0	Fill, sand and gravel, compact		1	SS	100/ 2cm	210						25 65 (9)
209.6							209					
1.1	Rock fragments, boulders, some sand (Probable fill)						208					
208.5												
2.2	Gneiss bedrock gneissic layering, grey, pink feldspar phenocryst, very strong, excellent quality		2	RC BXT	REC 100%	207						RQD 100%
	Below 4.7m fair quality		3	RC BXT	REC 98%	206						RQD 71%
205.5												
5.2	End of Borehole											

RECORD OF BOREHOLE No 10A

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,299 N; 310,053 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
 DATUM Geodetic DATE May 18, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
210.7	Ground surface																
0.0	Asphalt: 80 mm Fill, sand, gravel, rock pieces,	X				Dry											
209.8	Probable bedrock	X															
0.9	Auger refusal at 0.9m																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF TEST PIT No II										METRIC			
W P 703-89-01		LOCATION Co-ords. 5,129,321 N; 309,937 E.				ORIGINATED BY SM							
DIST 13 HWY 11		BOREHOLE TYPE C790 John Deer Excavator				COMPILED BY SM							
DATUM Geodetic		DATE June 13, 1990				CHECKED BY SB							
SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			N' VALUES	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
210.5	Ground surface												
0.0	Topsoil: 200 mm												
	Heterogeneous mixture of sand, silt, gravel, cobbles and boulders, dense to very dense (glacial till) brown grey		1	AS									
			2	AS									
			3	AS									
			4	AS									
			5	AS									
			6	AS									
204.7			7	AS									
5.8	End of Test-pit												
NOTES: 1) Below 1.5m depth, very dense to hand probing. 2) Minor seepage at 2.4m depth. 3) Ground water encountered at 5.4m depth in the test hole. 4) The test-pit excavated at near vertical surfaces. After 1 hour, about 0.6m wide soil block in the upper 2.5m caved. 5) Hard excavating below 4.1m depth.													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 101

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,191 N; 310,680 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
 DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

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 _p	W	W _L		
208.1	Ground surface																
0.0	Fill, sand and silt, organic stained, loose	X	1	SS	6	Dry	208										
206.6		X					207										
1.5	Sand, fine to medium, loose	.	2	SS	9												
205.8	Assumed bedrock	.					206										
2.3	End of Borehole	.															

NOTE: Penetration of two additional auger holes, drilled 2.0m east and 2.0m west of this borehole, was refused on the probable bedrock at 2.3m and 2.1m respectively.

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 102

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,288 N; 310,282 E. ORIGINATED BY SM
 DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger, Rock Core COMPILED BY SM
 DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
205.0	Ground surface															GR SA SI CL
0.0	Organic Silt and Sand roots, wet, very loose		1	SS	1		204									
203.4			2	SS	5		203									
1.6	Clayey silt, mottled, wet, firm		3	SS	3		202									0 5 77 18
202.0			4	SS	10		201									
3.0	Silty Sand grey, wet, compact		5	SS	12		200									
199.7																
5.3	Gneiss bedrock		6	RC BXT	REC 100%											RQD 100%
199.4																
5.6	End of Borehole															

RECORD OF BOREHOLE No 103

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,364 N; 310,007 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100	W _p	W	W _L		
210.4	Ground surface															
0.0	Topsoil: 220 mm Gravelly sand, some silt, compact		1	SS	6	Dry										
209.2	Assumed bedrock		2	SS	20											35 49 (16)
1.2	End of Borehole															
NOTE: Penetration of two additional auger holes, drilled 1.0m north and 1.0m south of this borehole, was refused on the probable bedrock at 1.1m and 1.2m respectively.																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 104

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,245 N; 310,089 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
207.1	Ground surface																
0.0	Fill, sand and gravel, loose	⊗	1	SS	3		206										
0.5	Sand, mottled, compact		2	SS	29		205										
205.6																	
1.5	Heterogeneous mixture of sand, silt, gravel, compact (glacial till)		3	SS	20		204										
204.2	Assumed bedrock		4	SS	22												
2.9	End of Borehole																
<p>NOTE: Penetration of two additional auger holes, drilled 2.0m east and 2.0m west of this borehole, was refused on the probable bedrock at 2.6m depth.</p>																	

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 105

METRIC

W P 703-89-01 LOCATION Co-ords. 5,129,508 N; 309,853 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
DATUM Geodetic DATE May 17, 1990 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
210.3	Ground surface																
0.0	Topsoil: 50 mm		1	SS	4		210										
	Silty sand, brown to grey, dense to very dense		2	SS	32		209										
			3	SS	62												
208.0							208										
2.3	Heterogeneous mixture of sand, silt, gravel, very dense (glacial till)		4	SS	100/ 10cm												
207.0	Probable bedrock		5	SS	100/ 8cm		207										
3.3	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No106

METRIC

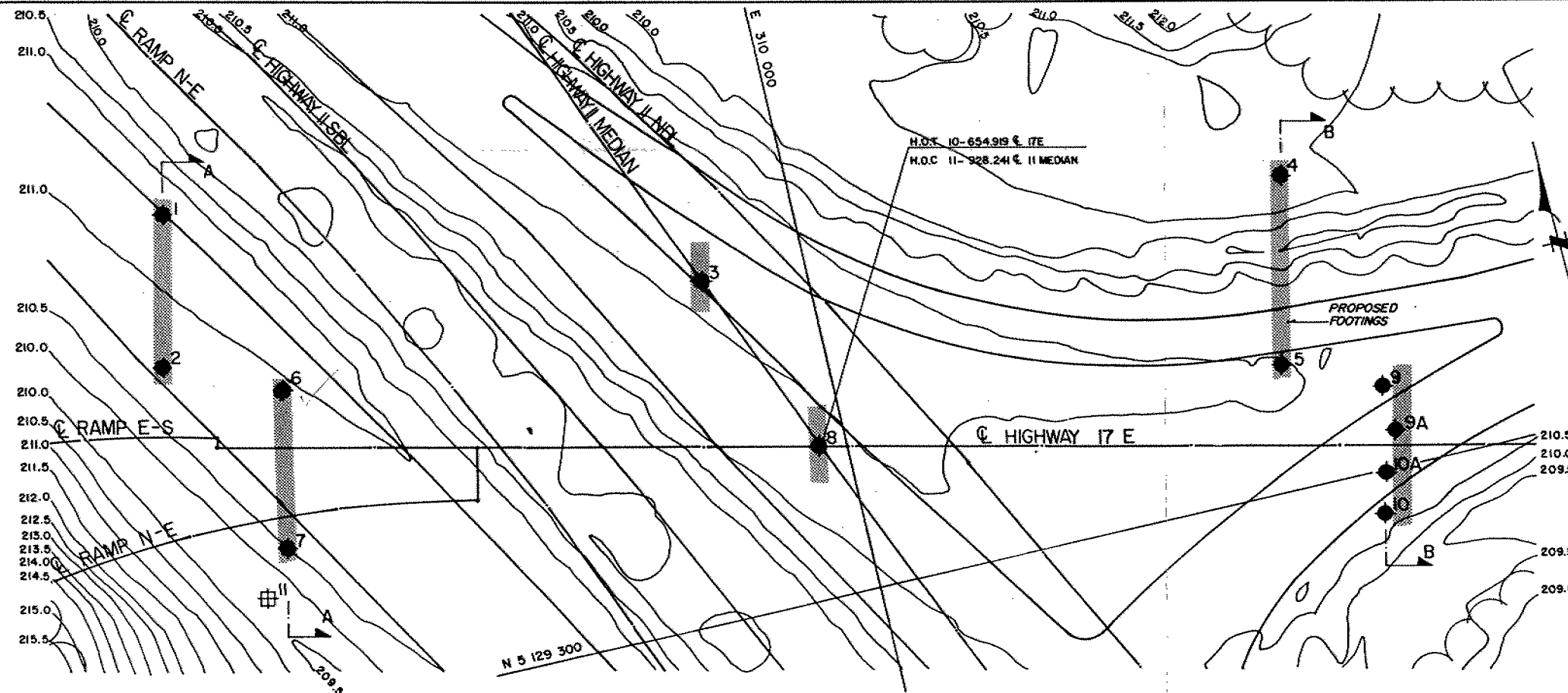
W P 703-89-01 LOCATION Co-ords. 5,129,171 N; 309,981 E. ORIGINATED BY SM
DIST 13 HWY 11 BOREHOLE TYPE Solid Stem Auger COMPILED BY SM
DATUM Geodetic DATE May 14, 1990 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
204.3	Ground surface																
0.0	Topsoil: 60 mm		1	SS	3		204										
	Silty Sand, organic stained, black-brown, very loose		2	SS	4		203										
202.6																	
1.7	Clayey Silt, grey, firm		3	SS	6		202										
			4	SS	4												
201.1																	
3.2	Heterogeneous mixture of sand, silt, gravel, compact, grey (glacial till)		5	SS	31		201										
							200										
199.4			6	SS	25												
4.9	Sand, medium, compact						199										
198.8																	
5.5	Heterogenous mixture of sand, silt, gravel, cobbles and boulders, very dense (glacial till)		7	SS	100/ 5cm		198										
							197										
			8	SS	100/ 0cm		196										
195.6																	
8.7	End of Borehole																

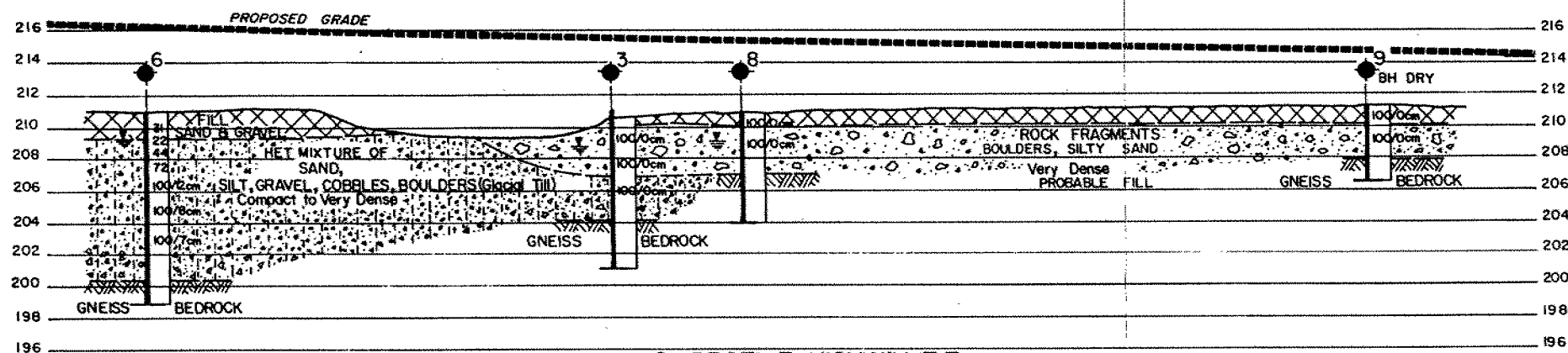
+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



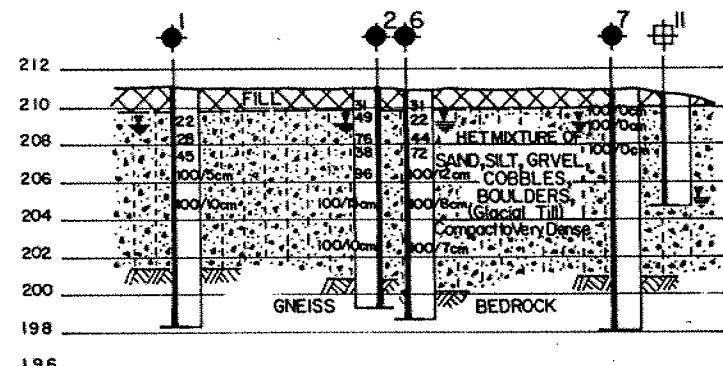
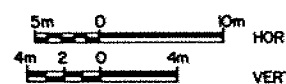
PLAN

SCALE



PROFILE HIGHWAY 17 E

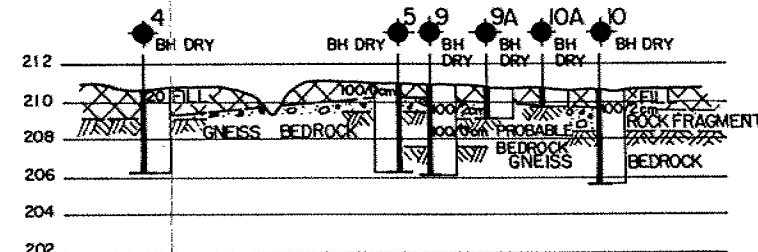
SCALE



A-A

SECTIONS

SCALE



B-B

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES.

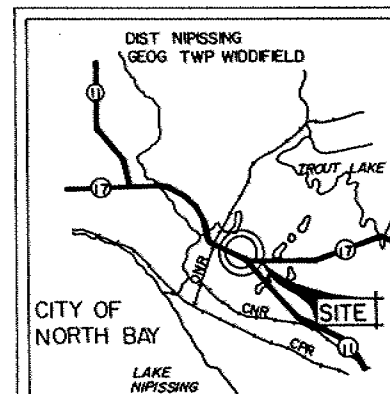
CONT No
WP No 703-89-01

CITY OF NORTH BAY
PROPOSED INTERCHANGE AT
HIGHWAY 11 AND HIGHWAY 17
BORE HOLE LOCATIONS & SOIL STRATA



SHEET

MC CLYMONT & RAK ENGINEERS, INC.



KEY PLAN

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ◆ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation 90.05 and 90.06
- ⊕ Test Pit

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	211.1	5 129 354.2	309 936.2
2	210.9	5 129 340.9	309 932.0
3	211.1	5 129 334.3	309 987.9
4	210.6	5 129 333.8	310 050.4
5	211.0	5 129 314.8	310 044.7
6	211.0	5 129 334.4	309 943.4
7	210.7	5 129 321.2	309 940.2
8	210.9	5 129 316.8	309 996.8
9	211.0	5 129 309.4	310 054.3
9A	210.8	5 129 305.0	310 055.1
10	210.7	5 129 295.5	310 053.4
10A	210.7	5 129 299.8	310 053.7
11	210.5	5 129 321.7	309 937.6

NOTE

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION

Geocres No 31L-54

HWY No 17E	SUBM'D S.B. CHECKED	DATE JULY 9, 1990	DIST 13
DRAWN E.R. CHECKED	APPROVED		SITE 43-350
			DWG 7038901-A

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN KILOMETRES + METRES

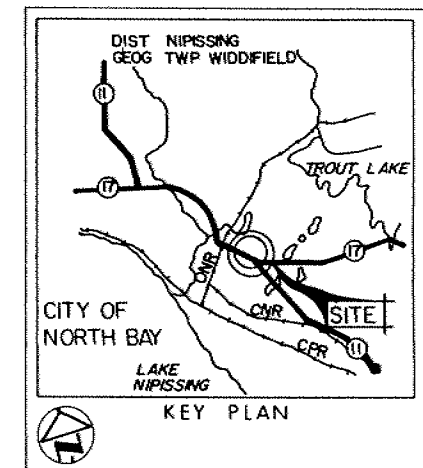
CONT No
WP No 703-89-01



HIGH MAST LIGHTING
Hwy 11 - Hwy 17 Interchange
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

MC CLYMONT & RAK ENGINEERS, INC.



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
101	208.1	5129191.0	310680.0
102	205.0	5129288.0	310289.0
103	210.4	5129364.0	310007.0
104	207.1	5129245.0	310089.0
105	210.3	5129508.0	309853.0
106	204.3	5129321.7	309937.6

NOTE

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION

Geacres No 31L-54

HWY No 17 E	CHECKED	DATE JULY 9, 1990	DIST 13
SUBM'D S.B.	CHECKED	APPROVED	SITE 43 350
DRAWN E.R.	CHECKED		DWG 7038901-B

SCALE

