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GEOCRES No. 30M5-157

DIST. 4 REGION

W.P. No. 107-86-1

CONT. No.

W. O. No.

STR. SITE No. 36-140

HWY. No. 8

LOCATION BURLINGTON

SPENCER CREEK BRIDGE

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 107-86-01

DIST 4

HWY 8

STR SITE 36-140

Spencer Creek Bridge Replacement

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GEOCRES 30M5-157

DATE OCT 2 1987

FOUNDATION INVESTIGATION REPORT
For
Spencer Creek Bridge Replacement
Highway #8
WP 107-86-01 SITE 36-140
District #4, Burlington

INTRODUCTION

This report contains the results of a foundation investigation carried out at the above-mentioned site where it is proposed to abandon the existing structure and to realign and construct a new bridge. The field-work was conducted during the period 87 05 04 to 87 05 07. The work consisted of three sampled boreholes and one dynamic cone penetration test. The boreholes were advanced using a skid-mounted diamond drill with NW-sized casing and a BQ-sized core barrel.

A previous investigation was carried out at the site in January and February of 1971. It consisted of two boreholes advanced in the vicinity of the proposed abutments. The results have been compiled and are included in this report.

In addition to the results of the field investigations, this report contains recommendations for the design and construction of the proposed structure foundations.

SITE DESCRIPTION

The intersection of Spencer Creek and Highway #8 is located near the western limits of the city of Dundas at the base of the Niagara Escarpment. Spencer Creek, at the site of the proposed structure, ranges in width from 10 m to 15 m. Its flow is directed by a concrete sluice that extends from the north end of the existing bridge to a distance approximately 30 m south of the existing structure. The creek channel is bound on either side by steeply sloping embankments that extend some 8 m above the creek bed. At the time of the investigation the depth of the creek was approximately 10 cm and the velocity of flow was considerable and constant.

Physiographically, the site is located in the Dundas Valley adjacent to the Niagara Escarpment.

SUBSURFACE CONDITIONS

General

The overburden at the borehole locations varies in depth from 1.5 m to 9.7 m. It is composed largely of escarpment talus containing cobbles, gravel and sand in a matrix of silt and clay. Occasional boulders were encountered at variable depths throughout the overburden. Bedrock was proven in each of the boreholes beneath the talus deposit.

The boundaries of the soil and bedrock, together with the field and laboratory test results appear on the Record of Borehole sheets appended to this report. Refer to these sheets for the locations and elevations of the boreholes. A stratigraphical profile is shown on Dwg. No. 1078601-A. A description of the different strata encountered is provided below.

Mixture of Gravel, Sand, Silt; Trace Clay

This deposit comprises the entire overburden overlying the bedrock. Its extent is greatest on the east side of Spencer Creek where its depth varies from 6.2 m to 9.7 m. At the borehole locations west of the creek, the extent of the overburden ranges from 1.5 m to 3.1 m. The deposit is a heterogeneous mixture of gravel, sand, silt and clay. Cobbles and boulders were encountered throughout the deposit. Traces of organic material are present in each of the boreholes to a maximum depth of 2.5 m. The material is slightly cohesive with pockets of silt to silty clay exhibiting slight to low plasticity. The plasticity of the deposit is presented in Figure 1, Plasticity Chart. 'N' values ranging from 14 blows to blows in excess of 120 blows per 30 cm were obtained from field testing. The consistency of the material ranges from stiff to hard. The physical properties of the talus material obtained from laboratory testing are as follows:

	<u>RANGE</u>
Natural Moisture Content (%)	5.0 - 18.0
Liquid Limit (%)	19.0 - 24.0
Plastic Limit (%)	13.0 - 20.0
Unit Weight (kN/m ³)	21.9

Refer to Figure 2 for a grain size distribution of the material in an envelope form.

BEDROCK

Bedrock was proven in Boreholes 1 and 2 of the 1971 investigation and in Boreholes 3, 4 and 5 of the most recent foundation investigation. The latter cores were logged by Mr. S. A. Senior, MTC Geologist, and described as shale bedrock of the Queenston Formation. The following are bedrock elevations encountered at the borehole locations:

<u>Borehole</u>	<u>Bedrock Elevation</u>
1	112.5 m
2	116.8 m
3	112.3 m
4	112.4 m
5	116.9 m

Detailed bedrock descriptions of the rock cores recovered from Borehole's 3, 4, and 5 may be found in the Appendix of this report.

GROUNDWATER

The following groundwater elevations were recorded at the borehole locations:

<u>Borehole</u>	<u>Groundwater Elevation</u>
1	120.1 m (1971)
2	117.7 m (1971)
3	116.8 m
4	117.2 m
5	118.8 m

The river elevation at the time of the investigation was 118.1 m. No artesian groundwater conditions were encountered.

DISCUSSION AND RECOMMENDATIONS

Structure Foundations

East Abutment

From the soil stratigraphy it appears that this abutment can be economically supported on spread footings at shallow depths. The footings may be placed below the depth of frost penetration but not above Elev. 117.0 m. The depth of the footings should comply with hydrogeological requirements as well. A safe design load of 380 kPa is recommended. For purposes of the O.H.B.D.C., the following design values are applicable:

Factored Bearing Capacity at U. L. S.	570 kPa
Bearing Capacity at S. L. S., Type II	380 kPa

A shearing resistance value of 70 kPa against sliding may be assumed.

The surface of the subsoil should be roughened before the concrete is placed.

West Abutment

The evidence of bedrock close to the original ground surface at the West Abutment location suggests that the spread footing may be founded on the shale bedrock at or below Elev. 116.8 m. The safe design load recommended on shale bedrock is 1500 kPa. In accordance with the O.H.B.D.C., the following design values apply:

Factored Bearing Capacity at U.L.S.	1500 kPa
Bearing Capacity at S.L.S., Type II	Does Not Apply

In this case, a coefficient of friction equal to $\tan 25^\circ$ should be assumed for computing resistance to sliding. The frost penetration required in this area is a minimum of 1.2 m of earth cover.

The exposed footing bases (soil and shale) should be covered with a 15 cm thick mass concrete pad within 8 hours of exposure.

The concrete for the footings should be placed 'in the dry'.

Alternatively, the structure may be founded on drilled caissons. In adopting such foundations, the caissons should be socketed at least 1.2 m into the sound bedrock. For estimating purposes, the caissons may be designed with an end-bearing value of 5000 kPa within the sound shale. For the elevations of sound shale bedrock refer to the appropriate borehole log sheets. In accordance with the O.H.B.D.C., the following design values are recommended:

Factored Bearing Capacity at U.L.S.	7500 kPa
Bearing Capacity at S.L.S., Type II	5000 kPa

The caissons should have a minimum diameter of 75 cm.

No stability problems are anticipated for the approach fills, provided they are constructed with 2H:1V slopes.

In considering the type of foundations for the structure, it was realized that large lateral earth pressures will develop behind the retaining walls and bridge abutments, pressures being further augmented by possible creep of the talus slopes. For these reasons, it is recommended that the structure be supported on drilled caissons of a minimum diameter of 75 cm, socketed some 1.2 m to 2.4 m into the bedrock. It has been estimated that the Queenston shale bedrock under the caissons will develop safe strengths of 5000 kPa by end-bearing.

Lateral Earth Pressure

Backfill to the structure should consist of granular material in accordance with MTC SPP #121 (83 10). Earth pressure should be computed as per Subsection 6.6.1.2.2 of the O.H.B.D.C.. An 'at rest' condition may be assumed to apply.

The physical properties of the backfill are as follows:

<u>Material</u>	<u>ϕ</u>	<u>γ</u>
Granular 'A'	35°	22.8 kN/m ³
Granular 'B'	30°	21.2 kN/m ³

Dewatering

The groundwater level occurs above the elevation of the proposed foundations. Any excavation required will take place in cohesive soils of relatively low permeability. Hence no major dewatering problems are anticipated.

MISCELLANEOUS

The fieldwork for this investigation was carried out by Mrs. B. Bennett, Jr. Foundation Engineer. The equipment was owned and operated by Master Soil Investigation Limited. The report was written by Mrs. B. Bennett and Mr. P. Payer, Senior Foundation Engineer and approved by Mr. K. G. Selby, Chief Foundation Engineer.



B. Bennett

B. Bennett, P. Eng.
Jr. Foundation Engineer

K. G. Selby

K. G. Selby, P. Eng.
Chief Foundation Engineer (West)

A P P E N D I X

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

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

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 = $\frac{c_u}{\tau_r}$

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

PHYSICAL PROPERTIES OF SOIL

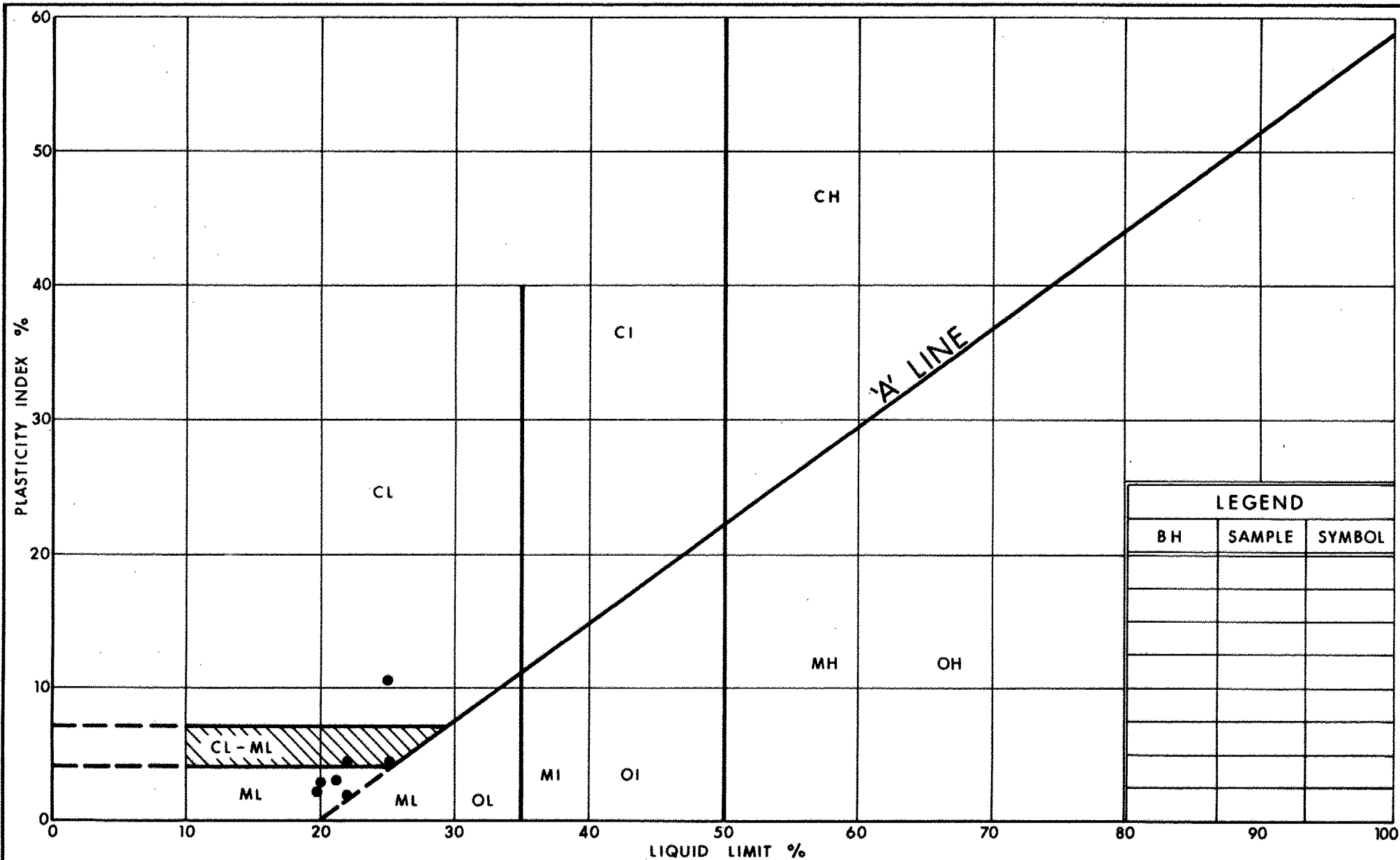
ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{\min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	KN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{\max} - e}{e_{\max} - e_{\min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	KN/m^3	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						

DESCRIPTION OF ROCK CORE - WP 107-86-01

CORE RECOVERY				CORE DESCRIPTION	
HOLE #	DEPTH (m)	%CR*	%RQD*	DEPTH (m)	DESCRIPTION
3	7.01-8.53	72	23	7.01-9.45	SHALE brownish red, occasionally green (2%); very fine grained; slightly weathered to unweathered; weak rock; very closely spaced fractures.
	8.53-9.45	81	14		
4	8.53-10.01	97	56	8.53-10.01	SHALE , interbedded red and green (15%); very fine grained; slightly weathered to unweathered; weak rock; close to very closely spaced fractures.
5	3.81-5.33	84	23	3.81-5.33	SHALE , brownish red, interbedded with green (13%); very fine grained; slightly weathered to unweathered; weak rock; very closely spaced fractures.

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION



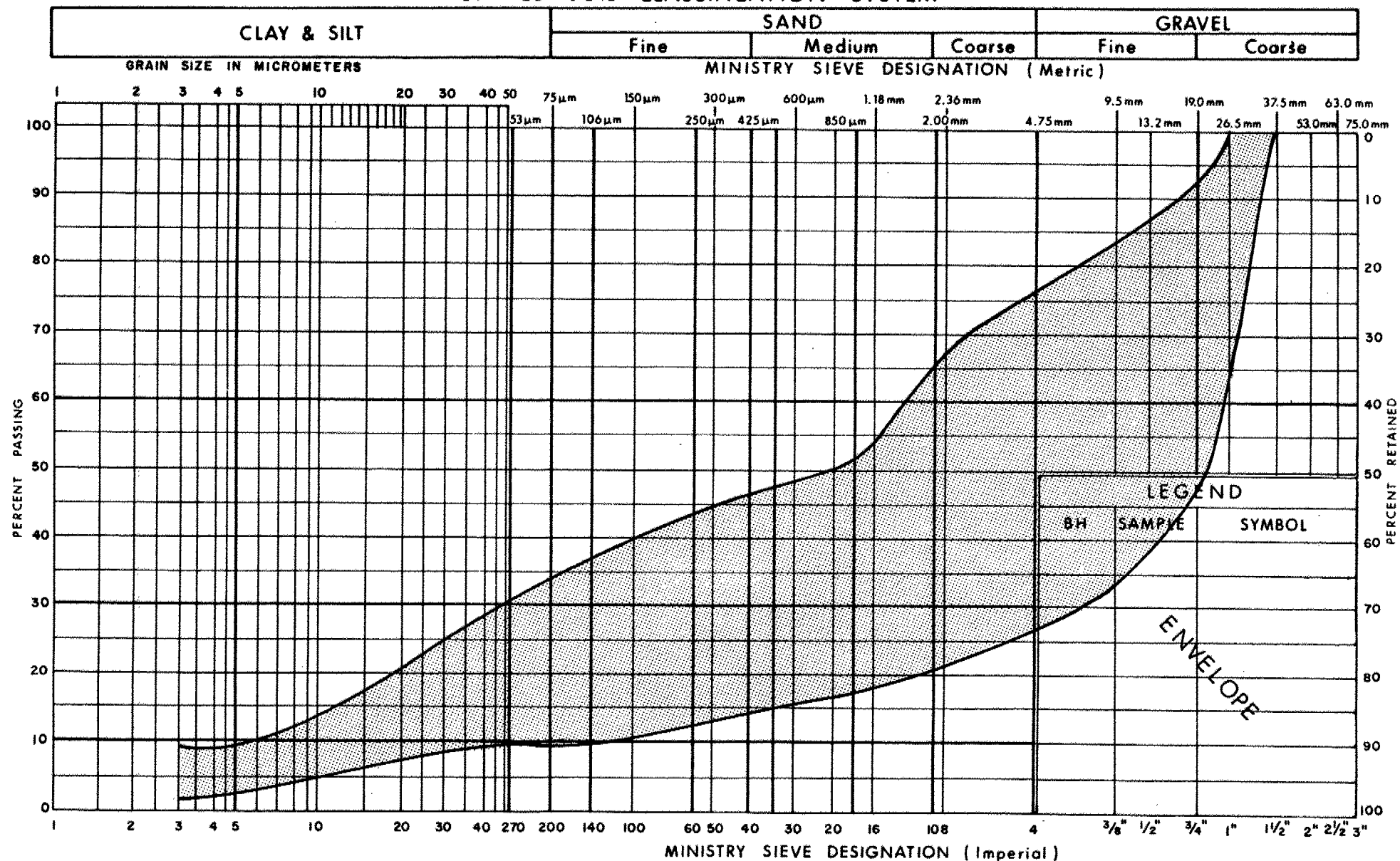
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Ontario

PLASTICITY CHART
MIXTURE OF GRAVEL, SAND, SILT, CLAY
Loose to V Dense

FIG No 1

W P 107-86-01

UNIFIED SOIL CLASSIFICATION SYSTEM



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Communications

GRAIN SIZE DISTRIBUTION
MIXTURE OF GRAVEL, SAND, SILT TR CLAY
Stiff to Hard

FIG No 2

W P 107-86-01



RECORD OF BOREHOLE No 1

METRIC

W P 107-87-01 (71-11001)

LOCATION N 4 792 365.0; E 266 446.8

ORIGINATED BY HS

DIST 4 HWY 8

BOREHOLE TYPE Auger and Core Drill

COMPILED BY BB

DATUM Geodetic

DATE 71-01-08

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
122.2	Ground Surface																
0.0																	
	Mixture of Gravel Sand, Silt trace clay		1	SS	31		122										
							121										
			2	SS	15												
	Occasional Cobbles/ Boulders		3	SS	49		120										
			4	SS	53		119										
	Stiff to Hard		5	SS	19		118										
			6	SS	105	18 cm											
			7	SS	45	0 cm	117										
							116										
			8	SS	141		115										
			9	SS	100	2 cm	114										
			10	SS	100	13 cm	113										
112.5							112										
9.7	Bedrock																
	Queenston Shale		11	RC	90% REC												
111.3																	
10.9	End of Borehole																

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (% STRAIN AT FAILURE)



RECORD OF BOREHOLE No 2

METRIC

W P 107-86-01 [71-11001] LOCATION N 4 792 376.5; E 266 413.5 ORIGINATED BY HS
DIST 4 HWY 8 BOREHOLE TYPE NX and BX Casing, Washbore COMPILED BY BB
DATUM Geodetic DATE 71 02 02 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH					
118.3	Ground Surface													
0.0	Mixture of Gravel, Sand, Silt trace clay Occasional Cobbles/ Boulders Hard		1	SS	39									
116.8			2	RC	100% REC									
1.5	Bedrock		3	RC	95% REC									
	Queenston Shale		4	RC	95% REC									
113.5														
4.8	End of Borehole													

+3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 3

METRIC

W P 107-86-01 LOCATION N 4 792 376.5; E 266 442.0 ORIGINATED BY BB
DIST 4 HWY 8 BOREHOLE TYPE NW Casing, Wash Bore COMPILED BY BB
DATUM Geodetic DATE 87 05 04 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE								
118.5 0.0	Ground Surface														GR SA SI CL		
	Trace Organics — Black		1	SS	20										53 28 16 3		
			2	SS	14										63 21 13 3		
			3	SS	50												
	Mixture of Gravel, Sand, Silt trace clay		4	SS	49												
	Occasional Cobbles/ Boulders		5	SS	60/	15 cm									41 37 18 4		
			6	SS	60/	15 cm											
	Stiff to Hard		7	SS	60/	10 cm									24 41 27 8		
112.3 6.2	Bedrock		8	SS	60/	8 cm											
	Weathered Sound																
	Queenston Shale		9	RC	70% REC												
109.1 9.4	End of Borehole		10	RC	83% REC												

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 4

METRIC

W P 107-86-01 LOCATION N 4 792 382.5; E 266 445.0 ORIGINATED BY BB
DIST 4 HWY 8 BOREHOLE TYPE NW Casing, Wash Bore COMPILED BY BB
DATUM Geodetic DATE 87 05 05 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
120.0	Ground Surface																
0.0																	
	Trace Organics		1	SS	68		119										70 21 7 2
			2	SS	93		118										
	Mixture of Gravel Sand, Silt trace clay		3	SS	76		117										60 23 13 4
	Occasional Cobbles/ Boulders		4	SS	60/	8 cm	116										
							115										
	Hard		5	SS	54/	15 cm	114										59 20 16 5
			6	SS	110/	23 cm	113										
			7	SS	60/	10 cm	112										
							111										
112.4	Bedrock		8	SS	60/	5 cm											
7.6																	
	Weathered Sound																
	Queenston Shale		9	RC	97% REC												
110.0																	
10.0	End of Borehole																

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 5

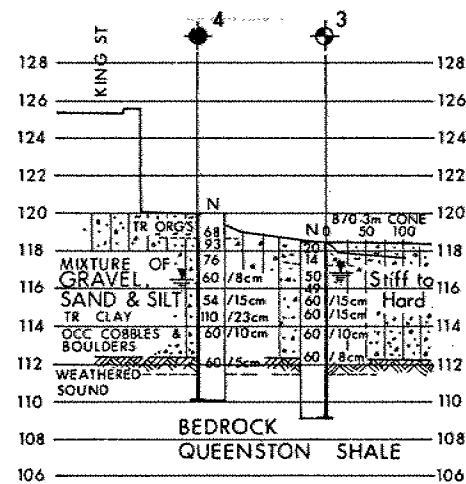
METRIC

W P 107-86-01 LOCATION N 4 792 386.5; E 266 423.5
DIST 4 HWY 8 BOREHOLE TYPE NW Casing, Washbore
DATUM Geodetic DATE 87 05 07
ORIGINATED BY BB
COMPILED BY BB
CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
120.0	Ground Surface																
0.0																	
	trace organics		1	SS	25		119										
	Mixture of Gravel Sand, Silt trace clay Occasional Cobbles/ Boulders Very Stiff to Hard		2	SS	35		118										74 16 8 2
			3	SS	82											21.9	26 13 51 10
116.9	Bedrock		4	SS	60/73	cm	117										17 15 53 15
3.1	Weathered Sound		5	SS	60/70	cm	116										
	Queenston Shale		6	RC	100% REC		115										
114.7																	
5.3	End of Borehole																

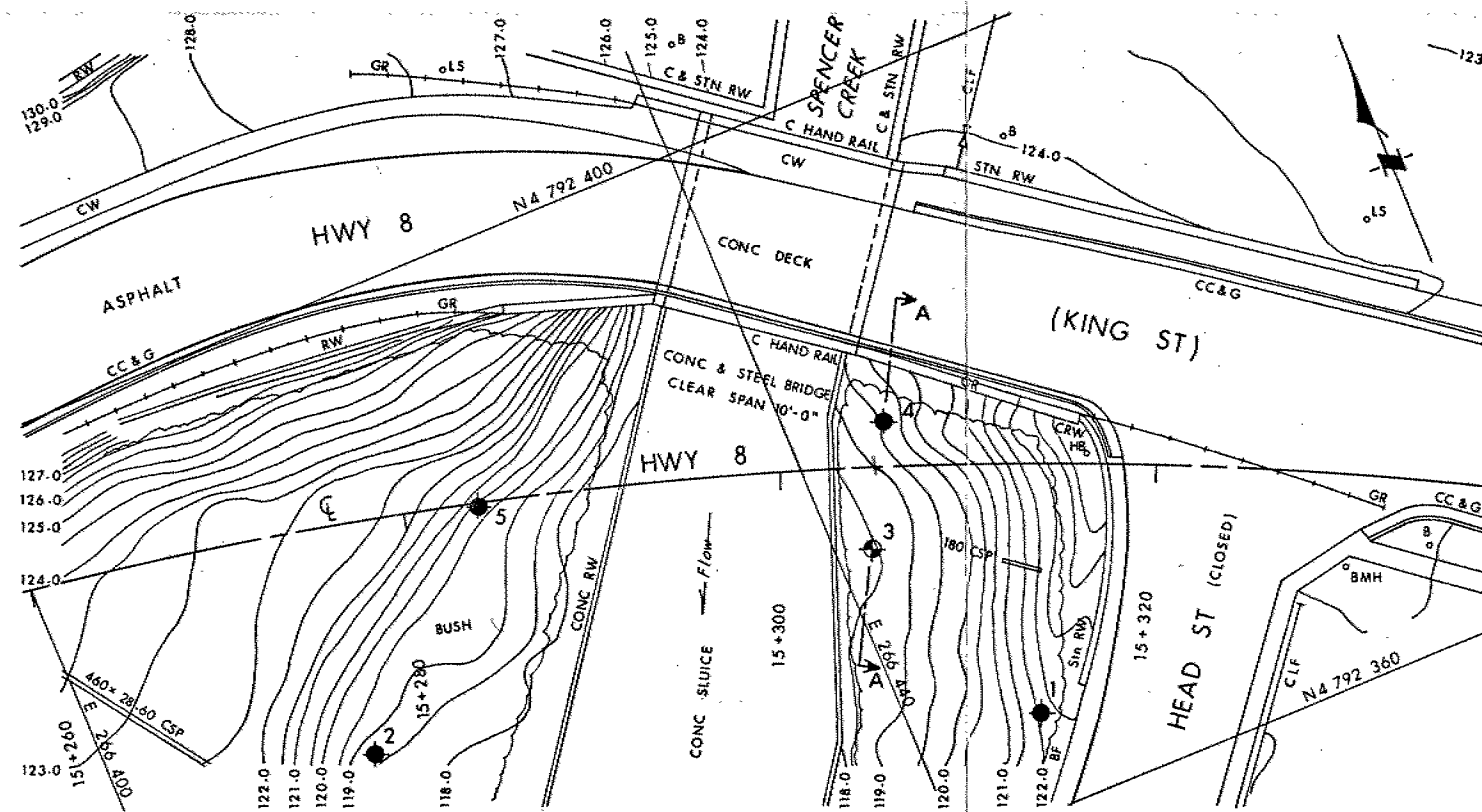
*³, x⁵: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



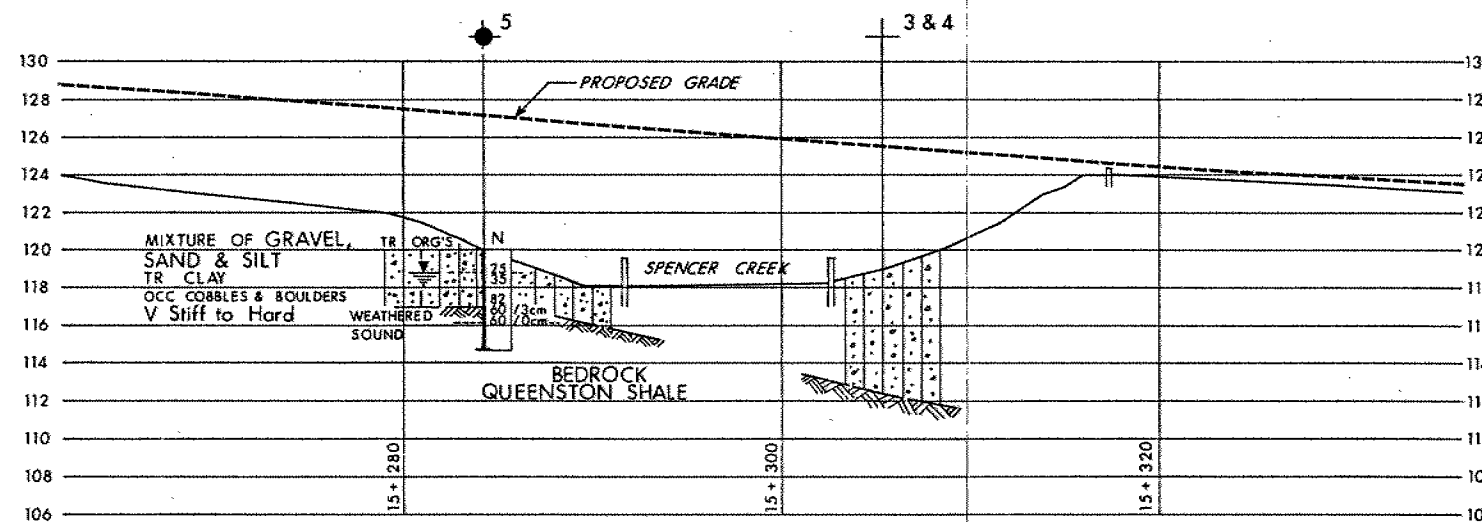
SECTION A-A

SCALE
4m 2 0 4m



PLAN

SCALE
4m 2 0 4m



PROFILE HWY 8

SCALE
4m 2 0 4m

NOTE

BH 1 & 2 For Information only
Ref to Record of Borehole
For Subsoil Information

METRIC

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

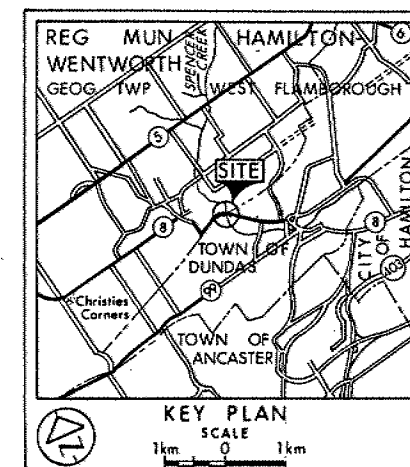
CONT No
WP No 107-86-01

SPENCER CREEK

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



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 87 05

No	ELEVATION	CO-ORDINATES NORTH	EAST
3	118.5	4 792 376.5	266 442.0
4	120.0	4 792 382.5	266 445.0
5	120.0	4 792 386.5	266 423.5

71 01 08
71 02 02

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
1			

Geocres No 30M5-157

HWY No 8	DIST 4
SUBMD BB	CHECKED
DRAWN DT	CHECKED

DATE 87 09 22 SITE 36-140
DWG 1078601-A