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W.P. No. 126-87-01 (A)

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. 416

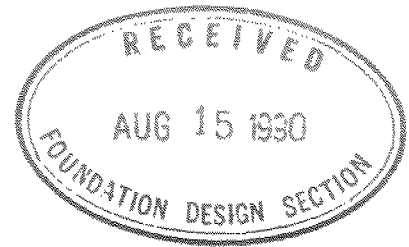
LOCATION PROP. DIAPHRAGM WALL &
SLOPE CUT

=====
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Golder Associates Ltd.
CONSULTING ENGINEERS



REPORT TO
MINISTRY OF TRANSPORTATION ONTARIO

GEOTECHNICAL INVESTIGATION
PROPOSED DIAPHRAGM WALL AND SLOPE CUT
HIGHWAY 416
DISTRICT NO. 9 (OTTAWA)
NEPEAN, ONTARIO
W.P. 126-87-01(A)

Distribution:

- 14 copies - Ministry of Transportation Ontario
Downsview, Ontario
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ABSTRACT

This report presents the results of a geotechnical investigation carried out in the area of a proposed cut along the route of Highway 416, and below the existing CNR tracks, adjacent to the Lynwood subdivision in Nepean, Ontario. The purpose of this investigation was to obtain factual subsurface information at the site as required for the design of proposed diaphragm retaining walls.

The subsurface information indicated that the site is underlain by a deposit of firm to stiff grey sensitive silty clay some 5 m to 15 m in thickness. The upper 2 m to 6 m of this clay deposit has been weathered to a very stiff grey-brown crust. At the south end of the project, the clay is underlain by a deposit of silty sand, sand, and sand and gravel. In the central and northern parts of the site, the clay is underlain by a deposit of glacial till of a sandy silt nature. The bedrock in the site area is dolomitic limestone which is at about 16 m depth at the south end of the site and some 9m to 12 m depth at the north end of the site.

The groundwater level in the overburden is within 1 m of ground surface at the south end of the site and within 4 m at the north end of the site. The water level in the bedrock is generally about 2 m lower than in the overburden.

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1.0 INTRODUCTION

The Ministry of Transportation Ontario (MTO) retained Golder Associates (GA) to carry out a geotechnical investigation along the proposed Highway 416 route at a deep cut section adjacent to the Lynwood subdivision in Nepean, Ontario (See Figure 1). Highway 416 is to enter the Ottawa area as a six lane highway along a route just east of Cedarview Road. It is planned to carry Highway 416 under the main CNR tracks which are immediately south of Baseline Road. The vertical alignment results in a cut section between about 5 and 11 metres below the ground surface in this area. The use of a diaphragm wall as a means of retaining soil in the deeper cut section near the CNR tracks has been examined and discussed in a separate engineering study (GA Report No. 901-1339).

The purpose of this investigation was to determine the soil conditions, the bedrock profile, and the groundwater conditions in the area where the diaphragm wall is proposed. The additional borings put down and the geotechnical information gathered, supplement results of previous investigations thereby providing data which will facilitate the wall design, including the length, depth and location of the walls. The factual information from field and laboratory investigations are presented in this report. Discussions on interpretation of the data and engineering recommendations regarding the geotechnical aspects of the project are contained in GA Report No. 901-1339, ("Engineering Study, Proposed Cut and Railway Underpass, Highway 416, Nepean, Ontario". WP 121-87-00).

2.0 SITE DESCRIPTION AND GEOLOGY

The site is located adjacent to the Lynwood Subdivision, with Cedarview Road to the west, and a green belt area to the east and to the south. The existing CNR tracks run approximately in an east-west direction. The ground surface topography between the CN railway line and south end of the Lynwood subdivision is relatively flat. North of the railway tracks, the ground surface falls off relatively quickly towards Baseline Road.

Previous investigations carried out for MTO and by Golder Associates indicated that the subsurface conditions generally consist of deep deposits of sensitive silty clay underlain by glacial till or sand deposits. The overburden thickness is generally about 9 m to 17 m within the study area. Geological maps show that the bedrock consists of limestone or dolomitic limestone of the Oxford Formation.

3.0 PREVIOUS INVESTIGATIONS

Previous investigations carried out at the site by GA and others are presented in the following reports:

- Geotechnical and Groundwater Study. Proposed Highway 416. Cedarview Road Corridor Near the Lynwood Subdivision. W.P. 146-74-00-3 District 9 (Ottawa) Nepean, Ontario (GA Report to MTO, Report No. 891-2208). January, 1990.
- Foundation Investigation for Bridge Structure. Proposed Highway 416 and CNR Subway. District No. 9, Ottawa, W.P. 126-87-01, Site 3-544 (Acres Report to MTO). February, 1990.

4.0 PROCEDURE

The field work for this investigation was carried out between June 26 and July 15, 1990.* The approximate location of the boreholes put down in this investigation, together with the previous boreholes in the cut area, are shown on Drawing 126-87-01(A)-1. The holes were drilled along three lines along the alignment of the highway, between Station 27+850 and Station 28+200:

- o Ten sampled boreholes and two probe holes along the line for the west wall. Holes were generally located at 20 m spacing intervals.
- o Three sampled boreholes and three probe holes along the centreline of Highway 416. Holes were generally at 40 m spacing intervals.
- o Ten sampled boreholes and two probe holes along the line for the east wall. Holes were generally located at 20 m spacing intervals.

The boreholes and probe holes were advanced to depths ranging from about 9 m to 20 m below ground surface using track mounted CME 55 drill rigs supplied and operated by a local contractor. In all cases, holes were augered to refusal. In addition, rock coring was carried out in eight borings, (at BH's 90-W2, 90-W4, 90-W7, 90-W19, 90-W21, 90-W23, 90-W26 and 90-W29).

* BH 90-W9 was drilled as part of a concurrent investigation program for MTO and was put down on May 4, 1990 (Ref. GA Report No. 901-2115).

Bedrock was cored in BXL size for about 3 m in these borings. In sampled boreholes, standard penetration tests were carried out in the overburden and samples were obtained using conventional 50 mm diameter split-spoon sampling equipment. In-situ vane testing was carried out in selected boreholes within the clay stratum. Standpipes were sealed into selected holes to determine the groundwater levels in the various soil strata and in the bedrock.

The field work was carried out under the full-time supervision of members of our engineering staff who located the boreholes, cleared the borehole locations for buried services, directed the drilling and sampling operations, installed the piezometers, logged the borings, and transported the samples to our office.

The as-drilled borehole locations and elevations of the ground surface at the hole locations were provided by MTO. It is understood that these elevations are referenced to Geodetic datum.

The logs of the borings showing the soil and groundwater conditions encountered are given on the Record of Borehole sheets following the text of this report. Relevant borehole logs from previous boreholes are also provided for reference.

5.0 SUBSURFACE CONDITIONS

As previously indicated, the subsurface conditions are shown on the Record of Borehole sheets and the approximate locations of the boreholes are shown on Drawing 126-87-01(A)-1. The soil profiles along the centreline of the proposed highway, and Section A-A (west of centreline)

and Section B-B (east of centreline) are shown on Drawing 126-87-01(A)-2 and Drawing 126-87-01(A)-3, respectively. The results of laboratory testing are given on Figures 2 to 9, inclusive and on the Record of Borehole sheets.

The following sections of the report presents a discussion on the general subsurface conditions across the site, followed by descriptions of the major soil units, bedrock and groundwater conditions. The boundaries of the soil units described are inferred from observations of auger cuttings and sampling at discrete depth intervals. They represent a transition from one main soil type to another, rather than an exact plane of geological change. Furthermore, conditions can vary between boreholes. Contractors bidding on or undertaking the proposed works should examine the factual results; satisfy themselves as to the adequacy of the information for construction; and, make their own interpretation of the factual data presented as it affects their construction methods, equipment selection, scheduling, and other operations.

5.1 General

The subsurface conditions in the general study area generally consist of sensitive silty clay of variable thickness, overlying discontinuous deposits of silty sand and gravel which in turn overlies dolomitic limestone bedrock of the Oxford Formation. In the area close to the CNR tracks, at the north end of the study area, a stratum of glacial till composed of sandy silt some clay and gravel follows the silty clay layer, and this glacial till stratum overlies bedrock directly. The groundwater level measured in standpipes sealed in the overburden and the bedrock indicates a general pattern of underdrainage. Karst

structures were not encountered at the borehole locations, though localized occurrence for such phenomenon has been reported in the Ottawa area, in particular, at the Queensway Carleton Hospital site. The soil and rock conditions defined in the current investigations are consistent with the results of previous investigations.

During service clearance for drilling in the current 1990 investigations, a gas main, a sanitary sewer and a 1,220 mm diameter watermain were found to be located in the general area of the deep cut section. The approximate locations for these lines are shown on Drawing 126-87-01(A)-1, the borehole location plan.

5.2 Topsoil and Fill

The railway tracks cross the proposed route of Highway 416 on some 1 to 2 m of ballast fill. Access roads north and south of the tracks are built on minor thicknesses of gravel fill. Away from the railway tracks area, the ground surface is generally covered by some 0.2 m to 0.4 m of topsoil.

5.3 Silty Clay

A silty clay stratum was encountered in all of the boreholes put down during the investigation. In general, the thickness of this sensitive silty clay stratum ranged from about 5 m to 15 m. The upper portion of the clay has been weathered to a grey-brown crust. Below the grey-brown crust, the clay is grey in colour. Occasional silty sand and sand seams were encountered in the silty clay stratum.

The weathered grey brown silty clay layer, some 2 m to 6 m thick, is of stiff to very stiff consistency. In-situ vane shear strength testing carried out in the underlying grey silty clay, gave undrained shear strengths ranging from about 30 kPa near the surface to about 60 kPa at depth indicating a generally firm consistency becoming stiff with depth. The ratio of in-situ vane shear strength to remoulded vane shear strength (sensitivity) varied from 3 to 9.

A summary of the Atterberg limit tests on the silty clay are shown on the plasticity charts on Figures 2 to 4 and also on the Record of Borehole sheets. As shown on Figures 2 to 4, the silty clay has, in general, a medium to high plasticity. The measured water content in the grey-brown weathered silty clay (crust) was about 30 percent near the ground surface increasing to 40 to 50 percent near the base of the weathered layer. As such, the water content was at or below the liquid limits. The measured water content of the unweathered sensitive silty clay was typically about 40 percent to 60 percent, and generally exceeded the measured liquid limits. The results of grain size analyses on representative samples are shown on Figure 6.

5.4 Glacial Till

A deposit of glacial till was encountered below the silty clay deposit in the area of the CNR tracks. The composition of the glacial till was variable, though in general, sandy silt was the predominant material with some gravel and clay size material. While cobbles and boulders were not generally encountered in the augering and sampling operations, the presence of cobbles, and to a lesser extent boulders, must be expected in this Ottawa area glacial till material.

Standard penetration tests carried out within the glacial till gave 'N' values of 2 to 29 blows per 300 mm penetration, indicating the till was very loose to compact in relative density. Some of the lower 'N' values may be due to disturbance of the soil prior to sampling.

Atterberg limit test results on the finer portion of a sample of sandy silt till (BH 90-W2, SA-7) are shown on the plasticity chart on Figure 5 and indicate the relatively non plastic nature of the till. Results for grain size analyses on glacial till samples are shown on Figures 7 and 8 and also on the Record of Borehole sheets. It should be noted that the grain size analyses were carried out on samples obtained by a 50 mm diameter split-spoon sampler and the results may not have shown the presence of coarse gravel, cobble or boulder sized material in-situ.

5.5 Sand

Deposits of sand, and sand and gravel, were encountered at the south end of the investigated area, at BH's 90W-9 to 90W-12, at BH 90W-18, and at BH 90W-29 and BH 90W-30. These deposits were encountered beneath the silty clay layer and generally overlaid bedrock. At the above hole locations, sand came up in the hollow stem auger during drilling, while augering well below the groundwater level.

Results for grain size analyses on typical samples are shown on Figure 9 and on the Record of Borehole sheets. The gradation of the sand deposit has been found in previous investigations to be variable and ranging from fine sand with some silt, to fine to coarse sand with some silt and gravel, to sand and gravel. As noted before, the grain size analyses were carried out on samples obtained by a 50 mm diameter split-spoon sampler and the results may not have shown the presence of coarse gravel, cobble or boulder sized material in-situ.

Standard penetration tests carried out in these deposits indicated a variable loose to compact relative density. Some of the lower 'N' values are due to disturbance of the soil prior to sampling.

5.6 Bedrock

The bedrock surface was determined by boreholes where coring was carried out and inferred in boreholes where auger refusal was encountered. As shown on Drawings 126-87-01(A)-2 and 126-87-01(A)-3, the bedrock was relatively level, ranging from elevation 71 m near the south end of the project area to elevation 76 m near the north end.

The bedrock samples obtained from the cored boreholes consisted of fresh, thinly to thickly bedded grey dolomitic limestone bedrock. Some sandstone layers, shale partings and occasional open horizontal joints were observed in the rock core. The dolomitic limestone core was of good quality, as given by the Rock Quality Designation (RQD) values of between 75 percent and 93 percent and total core recovery approaching 100 percent.

5.7 Groundwater

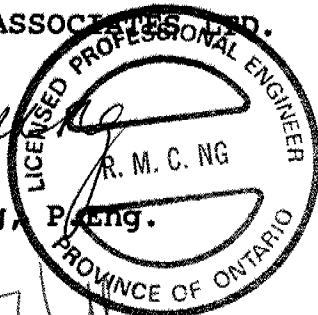
Standpipes were sealed into the overburden deposits and bedrock to determine the groundwater conditions at the site. Details on the installations of the standpipes and the groundwater levels obtained are given on the Record of Borehole sheets. Groundwater level in some of the open holes was noted following completion of drilling.

The groundwater level in the standpipes installed during this investigation was measured on July 27, 1990, about two weeks after completion of drilling. Groundwater levels in the south end of the project measured in standpipes sealed into the sand or into the glacial till were within 1 m of ground surface (groundwater elevation of about 86.5). A standpipe sealed into the bedrock in this area had the water level at 2.2 m depth (elevation 85.0). North of the CNR tracks, standpipes sealed in the glacial till indicated water levels at 2.8 m to 4.3 m depth (elevation 83 to 81), while a standpipe sealed into the bedrock indicated a water level at 5.8 m depth (elevation 79.5).

The measured groundwater levels indicated a general pattern of underdrainage to the bedrock.

GOLDER ASSOCIATES LTD.


R. M. Ng, P.Eng.




F. J. Heffernan, P.Eng.

RMN/FJH/cg

RECORDS OF BOREHOLE SHEETS

August, 1990

901-2256

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 1" 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	RECK CORE
B S	BLOCK SAMPLE	P H	P/H ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	P/M ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
u	l	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	l	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	l	COMPRESSION INDEX
C_s	l	SWELLING INDEX
C_α	l	RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	l	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	l	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	l, %	VOID RATIO	e_{min}	l, %	VOID RATIO IN DENSEST STATE
γ_s	kn/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	l, %	POROSITY	I_D	l	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	l, %	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	l	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	l	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	l	HYDRAULIC GRADIENT
γ_{sat}	kn/m ³	UNIT WEIGHT OF SATURATED SOIL	I_C	l	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	l, %	VOID RATIO IN LOOSEST STATE	j	kn/m ²	SEEPAGE FORCE
γ'	kn/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 372; E 358 836 ORIGINATED BY AC
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
DATUM GEODETIC DATE JUNE 28, 1990 CHECKED BY RN

[illegible]

*3, x5: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 90 - W2 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 348; E 358 848 ORIGINATED BY AC
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core COMPILED BY RN
 DATUM GEODETIC DATE JUNE 28, 1990 CHECKED BY RH

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					
85.5	Ground Surface																
0.0	Topsoil																GR SA SI CL
0.2	Silty clay, occasional silty fine sand seams (weathered crust) Stiff to very stiff Brown		1	SS	11									0			
			2	SS	6									0			
			3	SS	3									0			
			4	SS	2									0			
81.5																	
4.0	Silty clay, occasional sand seams Firm Grey		5	SS	WH*									0			
			6	SS	PM									0			
78.5																	
7.0	Sandy silt, some gravel and clay, occasional cobble (glacial till) Loose Grey		7	SS	9									0			
76.3			8	SS	25/30									0			
9.2	Dolomitic limestone bedrock, fresh, some shale partings, occasional sand- stone layers, trace pyrite Grey		9	RC BXL	Rec** 100% RQD** 84%												
73.4																	
12.1	End of Borehole *Sank under weight of hammer ** Rec: Recovery RQD: Rock Quality Designation																

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

METRIC

W P 126-87-01(A)

LOCATION Co-ords N 5 021 312; E 358 866

ORIGINATED BY AC

DIST 9 HWY 416

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY RN

DATUM _____ GEODETIC _____

DATE JUNE 28, 1990

CHECKED BY RN

[illegible]

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - W4 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 249; E 358 894 ORIGINATED BY AC
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core COMPILED BY RN
 DATUM GEODETTIC DATE JUNE 28, 1990 CHECKED BY RA

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									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
							20 40 60 80 100					WATER CONTENT (%)					
86.3	Ground Surface																
0.0	Topsoil						86										
85.9							Bentonite										
0.4	Silty clay, occ. silty sand seams (weathered crust)																
	Very stiff to stiff		1	SS	10												
	Grey Brown		2	SS	6												
			3	SS	2		84										
82.6			4	SS	1												
3.7	Silty clay, occasional silty sand seams						Water level in standpipe at elevation 82.53 m on July 27, 1990.										
	Firm Grey						+ 6										
81.4							82										
4.9	Silty clay, occ. silt		5	SS	6												
81.0	and sand seams, tr. gravel															2 16 45 37	
5.3	Sandy silt to silty sand, some gravel and clay. Occasional cobble (glacial till)		6	SS	8		Native Backfill										
79.6	Loose Grey		7	SS	6		80										
6.7	Sandy silt, some gravel and clay, occasional cobble (glacial till)		8	SS	19											36 27 30 7	
			9	SS	4												
			10	SS	3		78										
			11	SS	2											11 33 44 12	
							76										
			12	SS	2												
74.9																	
11.4	Dolomitic limestone bedrock, some shale partings, occasional calcite pockets		13	RC BXL	** Rec=100% RQD=86%		Bentonite										
	Grey						74										
							Peastone										
							Standpipe										
72.2																	
14.1	End of Borehole ** Rec: Recovery RQD: Rock Quality						72										

Designation

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

OFFICE REPORT ON SOIL EXPLORATION

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 223; E 358 906 ORIGINATED BY BB
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
DATUM GEODETIC DATE JULY 3, 1990 CHECKED BY RN

[illegible]

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

METRIC

W P 126-87-01(A)

LOCATION Co-ords N 5 021 199; E 358 915

ORIGINATED BY PH

DIST 9 HWY 416

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY RN

DATUM _____ GEODETIC _____

DATE JULY 3, 1990

CHECKED BY AW

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							WATER CONTENT (%)			
								20	40							60	80	100
86.6	Ground Surface																	
0.0	Topsoil																	
0.2	Silty clay, some silty fine sand seams (weathered crust) Grey Brown						86											
84.0																		
2.6	Silty clay Grey						84											
							82											
							80											
79.4																		
7.2	Sandy silt, some gravel and cobble (glacial till) Grey		1	SS	5		78											
	Becoming more silty with depth						76											
74.3	Grey																	
12.3	End of Borehole Refusal to Auger Probable Bedrock						74											
							72											

+3, x5 : Numbers refer to Sensitivity

20
15 - 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - W7

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 181; E 358 923
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core
 DATUM GEODETIC DATE July 9, 1990
 ORIGINATED BY BB
 COMPILED BY RN
 CHECKED BY RH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE ρ_{10}				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				
86.9	Ground Surface															
0.0	Topsoil															
86.4	Fill - silty sand															
0.5	Silty clay, some fine sand seams (weathered crust)															
84.6	Grey Brown		1	SS	5											
2.3	Silty clay, some sand seams															
	Firm Grey		2	SS	PM											
78.8			3	SS	PM											
8.1	Silty sand, some fine to medium gravel															
78.2	Grey															
8.7	Silty clay, some sand seams		4	SS	PM											
	Grey															
75.8																
11.1	Sand and silt, some gravel and clay (glacial till)															
	Very stiff Grey		5	SS	18											
74.1																
12.8	Dolomitic limestone, some shale partings, some coarse sandstone layers, occasional calcite inclusions, trace pyrite		6	RC BXL	* Rec= 100% RQD= 82%											
71.9																
15.0	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

* REC: Recovery
 RQD: Rock Quality Designation

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

21 32 39 8

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 165; E 358 930

ORIGINATED BY PH

DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger

COMPILED BY RN

DATUM GEODETIC DATE July 10, 11, 1990

CHECKED BY Kay

[illegible]

+3, x5: Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

10

RECORD OF BOREHOLE No 90 - W9

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 146; E 358 936 ORIGINATED BY DJS
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
 DATUM Geodetic DATE May 4, 1990 CHECKED BY RA

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	20 40 60 80 100	20 40 60					
87.2	Ground Surface														
0.0	Topsoil														
0.3	Silty clay, occasional sand seams (weathered crust)														
84.5	Grey Brown														
2.7	Silty clay, occasional sand seams and layers														
			1	SS	PM										
			2	SS	PM										
			3	SS	PM										
			4	SS	PM										
			5	SS	PM										
			6	SS	PM										
			7	SS	WH*										
			8	SS	WH*										
77.2															
10.0	Sandy silt and silty sand, some clay and gravel (glacial till)		9	SS	3										
			10	SS	4										
			11	SS	3										
	Loose Grey		12	SS	4										
74.7															
12.5	Sand, fine to coarse trace gravel and silt														
73.6	Compact Grey														
13.6	Sand, fine to coarse, some silt,														
73.2	Compact Grey		13	SS	50/100 mm										
14.0	End of Borehole Refusal to Auger Probable Bedrock *Sank under weight of hammer														

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

METRIC

W P 126-27-01(A)

LOCATION Co-ords N 5 021 126; E 358 947

ORIGINATED BY PH

DIST 9 HWY 416

BOREHOLE TYPE.....Hollow Stem Auger

COMPILED BY _____ RN

DATUM _____ GEODETIC _____

DATE July 11, 12, 1990

CHECKED BY RA

[illegible]

+3, x5: Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - WII

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 110; E 358 953
 DIST 9 HWY 416 BOREHOLE Hollow Stem Auger
 DATUM GEODETIC DATE July 11, 1990
 ORIGINATED BY PH
 COMPILED BY RN
 CHECKED BY KA

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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	Wp	W	Wl		
87.4	Ground Surface																
0.0	Topsoil																
0.2	Silty clay, some fine silty sand seams (weathered crust)					**											
	Stiff Grey																
84.7																	
2.7	Silty clay, some fine silty sand seams and bands																
	Grey																
79.2			1	SS	WH*												
8.2	Silty clay, layered, some fine sand and sandy silt seams, occasional gravel		2	SS	2												
77.9	Grey		3	SS	3												
9.5	Silty fine sand Grey		4	SS	4												
9.8	Silty clay, some fine sand seams Grey																
77.2																	
10.2	Sand, medium to coarse, some gravel, becoming cobblely with depth		5	SS	20												
	Compact Grey																
72.9																	
14.5	End of Borehole Refusal to Auger Probable bedrock																

NOTE: * Sank under weight of hammer
 ** Water level not established

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

RECORD OF BOREHOLE No 90 - W12

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 100; E 358 958
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM Geodetic DATE July 12, 1990
 ORIGINATED BY AC
 COMPILED BY RN
 CHECKED BY R/L

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					
87.6	Ground Surface																
0.0	Topsoil																GR SA SI CL
0.2	Silty clay, occasional silty sand seams (weathered crust)					*											
	Grey Brown						86										
84.9																	
2.7	Silty clay, some silty fine sand layer						84										
	Grey																
							82										
							80										
78.9																	
9.7	Sand, some gravel						78										
							76										
	Grey																
							74										
72.7																	
14.9																	

End of Borehole
 Refusal to Auger
 Probable Bedrock

+³, x⁵: Numbers refer to
 Sensitivity

20
 15-5 (%) STRAIN AT FAILURE
 10

NOTE: *Water level not established

RECORD OF BOREHOLE No 90 - W13

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 373; E 358 869 ORIGINATED BY AC
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
 DATUM GEODETIC DATE JUNE 28, 1990 CHECKED BY RN

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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
85.5	Ground Surface													
0.0	Topsoil													
0.2														
84.8	Sandy silt Brown					*								
0.7	Silty clay, some silty fine sand seams (weathered crust) Grey Brown													
81.5														
4.0	Silty clay, occasional sand seams Grey													
77.3														
8.2	Sandy silt, some gravel and clay (glacial till) Grey													
75.7														
9.8	End of Borehole Refusal to Auger Probable Bedrock *Note: water level not established													

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

RECORD OF BOREHOLE No 90 - W14

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 334; E 358 888
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM GEODETIC DATE JUNE 28, 1990
 ORIGINATED BY AC
 COMPILED BY RN
 CHECKED BY RN

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					
86.0	Ground Surface																
0.0	Fill - mixture of sand silt and gravel																
85.5																	
0.5	Topsoil					*											
85.1																	
0.9	Silty clay, some silty fine sand seams (weathered crust)																
	Grey Brown						84										
82.0																	
4.0	Silty clay, occasional silty fine sand seams						82										
	Grey																
							80										
							78										
77.4																	
8.6	Sandy silt, some gravel and clay (glacial till)						76										
	Grey																
74.9																	
11.1	End of Borehole Refusal to Auger Probable Bedrock						74										
	*Note: Water level not established																
							72										

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - W15 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 316; E 358 894 ORIGINATED BY AC
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
 DATUM GEODETIC DATE JUNE 29, 1990 CHECKED BY RN

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					
86.3	Ground Surface																
0.0	Fill - mixture of sand and gravel						86										
85.8																	
0.5	Topsoil																
0.8	Silty clay, some silty fine sand seams (weathered crust) Grey Brown					*											
							84										
82.3																	
4.0	Silty clay, occasional sand seams Grey						82										
							80										
77.9																	
8.4	Sandy silt, some gravel and clay (glacial till) Loose Grey						78										
							76										
74.7	Dense																
11.6	End of Borehole Refusal to Auger Probable Bedrock *Note: Water level not established						74										
							72										

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

OFFICE REPORT ON SOIL EXPLORATION

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 232; E 358 935 ORIGINATED BY BB
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
DATUM GEODETIC DATE JULY 3, 1990 CHECKED BY RN

[illegible]

+3, x5: Numbers refer to Sensitivity

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 190; E 358 951

ORIGINATED BY BB

DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger

COMPILED BY RN

DATUM GEODETIC DATE JULY 3, 1990

CHECKED BY BN

[illegible]

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - W18

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 124; E 358 979
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM GEODETIC DATE July 5, 1990
 ORIGINATED BY BB
 COMPILED BY RN
 CHECKED BY RAV

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					
87.4	Ground Surface																
0.0	Topsoil																
0.2	Silty clay, occasional silty fine sand, (weathered crust)					*											
	Brown						86										
84.0																	
3.4	Silty clay, occasional silty sand						84										
	Grey																
							82										
							80										
							78										
76.2																	
11.2	Sand, trace silt		1	SS	PM		76										0 93 6 1
	Grey																
							74										
72.4																	
15.0																	

End of Borehole
 Refusal to Auger
 Probable Bedrock

+3, x5: Numbers refer to
 Sensitivity

20
 15 5 (%) STRAIN AT FAILURE
 10

* NOTE: Water level not established

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 363; E 358 937 ORIGINATED BY AC
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger, BXL Rock Core COMPILED BY RN
DATUM GEODETTIC DATE JUNE 29, 1990 CHECKED BY RN

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							WATER CONTENT (%)			
								20 40 60 80 100										
85.3	Ground																	
0.0	Fill - mixture of sand and gravel						Bentonite											
84.9							Native Fill											
0.4	Topsoil																	
84.6																		
0.7	Silty clay occasional sand seam (weathered crust)																	
	Stiff to very stiff		1	SS	13													
	Grey Brown		2	SS	5													
			3	SS	3		82											
80.9																		
4.4	Silty clay, occasional sand seam		4	SS	1		Native Fill											
	Firm Grey																	
			5	SS	PM													
			6	SS	PM													
			7	SS	PM													

End of Borehole








* Rec: Recovery
RQD: Rock Quality Designation

+3, x5: Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 351; E 358 946 ORIGINATED BY AC
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
DATUM GEODETIC DATE JUNE 29, 1990 CHECKED BY AI

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									
								SHEAR STRENGTH kPa						WATER CONTENT (%)						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE												
85.2	Ground Surface					*														
0.0	Fill - mixture of sand and gravel, occasional cobble.																			
84.1							84													
1.1	Topsoil																			
83.7																				
1.5	Silty clay, some silty fine sand seams (weathered crust) Grey Brown																			
80.6							82													
4.6	Silty clay, occasional silty fine sand seams Grey																			
							80													
							78													
							76													
73.8							74													
11.4	Sandy silt, some gravel and clay (glacial till)																			
72.7	Grey																			
12.5	End of Borehole Refusal to Auger Probable Bedrock NOTE: * Water level not established						72													

RECORD OF BOREHOLE No 90 - W21

METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 328; E 358 956
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core
 DATUM Geodetic DATE July 12 and 13, 1990
 ORIGINATED BY PH
 COMPILED BY RN
 CHECKED BY RN

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 Y KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100				
85.1	Ground Surface														
0.0	Topsoil														
0.2	Silty clay, some silty fine sand layer (weathered crust)														
	Very stiff to stiff		1	SS	11										
	Grey Brown		2	SS	7										
82.2			3	SS	1										
2.9	Silty clay, some silty fine sand layer		4	SS	PM										
	Firm Grey		5	SS	PM										
			6	SS	PM										
			7	SS	PM										
76.6			8A	SS	PM										
8.5	Silty clay, some silty fine sand layers, trace gravel		8B	SS	PM										
75.6			9	SS	2										
9.5	Sandy silt to clayey silt, some clay and gravel (glacial till)		10	SS	1										
	Very loose Grey														
73.1															
12.0	Dolomitic Limestone Bedrock, fresh, some shale partings, some coarse sandstone seams, occasional calcite inclusions, trace pyrite		11	RC BXL	Rec=100% RQD=93%										
70.4															
14.7	End of Borehole														

*Rec = Recovery
 RQD = Rock Quality Designation

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

RECORD OF BOREHOLE No 90 - W23 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 263; E 358 983 ORIGINATED BY AC
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core COMPILED BY RN
 DATUM GEODETIC DATE JUNE 26, 1990 CHECKED BY RAJ

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 kPa							WATER CONTENT (%)		
85.8	Ground Surface													GR SA SI CL			
0.0																	
85.4	Topsoil						Bentonite										
0.4	Silty clay, occasional very thin sand seams (weathered crust) Stiff to very stiff Grey Brown		1	SS	7												
			2	SS	5		84										
	Firm		3	SS	2		Native Fill										
82.6																	
3.2	Silty clay, occasional sand seam		4	SS	* WH												
			5	SS	PM		82										
							Water level + 9.3 in standpipe at elevation + 9.3 81.6 m on July 27, 1990										
							+ 8										
							+ 8										
	Grey		6	SS	PM		80										
							+ 9.3										
							+ 9.3										
			7	SS	PM		78										
							+ 9.3										
							+ 8										
			8	SS	PM		76										
	Silty clay and clayey silt, occasional sand seams and gravel Firm to very stiff						+ 8.7										
							+ 7										
74.8			9	SS	PM		Bentonite										
11.0																	
74.2																	
11.6	Clayey silt to silty clay, layered						74										
73.8	Very stiff Grey						Sand Filter										
12.0	Sandy silt, some organics, gravel and clay, occasional cobble (glacial till)		10	SS	2		Standpipe							15 40 31 14			
72.1	Very Loose Grey																
13.7	Dolomitic limestone bedrock, occasional calcite pocket, some shale partings		11	RC BXL	** Rec=100% ROD=75%		72										
70.8							Bentonite										
15.0																	

Continued

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 90 - W23

METRIC

W P 126 87 01(A) LOCATION Co-ords N 5 021 263; E 358 983 ORIGINATED BY AC
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core COMPILED BY RN
 DATUM GEODETIC DATE JUNE 26, 1990 CHECKED BY RW

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		
70.8	Continued															
15.0	Grey		11	RC BXL	Rec=100% ** RQD=75%											
69.2																
16.6	End of Borehole															
	* Sank under weight of hammer															
	** Rec: Recovery															
	RQD: Rock Quality Designation															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 90 - W24 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 239; E 358993
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM GEODETIC DATE JULY 3, 1990
 ORIGINATED BY PH
 COMPILED BY RN
 CHECKED BY *PH*

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	20 40 60 80 100					
86.4	Ground Surface													
0.0 85.9	Topsoil						86							
0.5	Silty clay, some silty fine sand seams (weathered crust). Grey Brown					*								
83.3 3.1	Silty clay Grey						84							
							82							
							80							
							78							
	Some silty fine sand layers. Grey		1	SS	1		76							
							74							
73.3	Trace gravel													
13.1	Sandy silt, some clay and gravel, and occ. silty sand and gravel layers (glacial till). Very Loose Grey		2	SS	3									
72.3														
14.1	End of Borehole Refusal to Auger Probable Bedrock						72							

* NOTE: water level not established

*³, *⁵: Numbers refer to
Sensitivity 20
15 $\frac{1}{5}$ (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 90 - W25 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 222: E 359 001
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM GEODETIC DATE July 4, 1990
 ORIGINATED BY PH
 COMPILED BY RN
 CHECKED BY Ral

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	Wp	W	W _L	20 40 60					
86.3	Ground Surface																
0.0	Topsoil						86										
0.2	Silty clay, occasional silty sand seams (weathered crust)																
	Grey Brown																
83.4							84										
2.9	Silty clay, some silty fine sand seams																
	Grey																
							82										
							80										
							78										
							76										
			1	SS	1												
			2	SS	1		74										
73.1																	
13.2	Sandy silt and clayey silt, some gravel (glacial till)																
72.0	Loose Grey																
14.3	End of Borehole Refusal to Auger Probable Bedrock						72										

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 90 - W26 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 203; E 359 008
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core
 DATUM GEODETIC DATE July 4, 1990
 ORIGINATED BY PH
 COMPILED BY RN
 CHECKED BY AN

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	20 40 60 80 100					
86.9	Ground Surface													
0.0	Topsoil													
0.2	Silty clay, trace sand seams (weathered crust)													
			1	SS	16		86							
			2	SS	7									
	Brown		3	SS	4									
83.8	Becoming Grey													
3.1	Silty clay, trace silty sand seams		4	SS	PM		84							
			5	SS	PM		82							
	Grey		6	SS	PM									
							80							
			7	SS	PM									
78.1							78							
0.8	Silty clay, becoming more silty with depth		8	SS	PM									
			9	SS	PM		76							
			10	SS	PM		74							
72.9	Becoming Sandy													
14.0	Sandy silt, some gravel and trace clay (glacial till)		11	SS	WH*									
71.9	Grey						72							
15.0														

Continued

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

METRIC

W P 126-87-01 (A)

LOCATION Co-ords N 5 021 203; E 359 008

ORIGINATED BY RB

DIST 9 HWY 416

BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core

COMPILED BY RN

DATUM GEODETIC

DATE July 4, 1990

CHECKED BY *RV*

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		W _p W W _L			
71.9	Continued												
15.0	Sandy silt, some gravel and trace clay (glacial till)		12	SS	14		Native Backfill						
71.0	Grey												
15.9	Dolomitic Limestone Bedrock, some shale partings, some coarser sandstone layers		13	RC BXL	** Rec=100% RQD=79%		70 Bentonite Peastone						
68.1	Grey						Standpipe						
18.8	End of Borehole						68						
	* Sank under weight of hammer **Rec = Recovery RQD = Rock Quality Designation						66						

OFFICE REPORT ON SOIL EXPLORATION

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - W27 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 185; E 359 016 ORIGINATED BY PH
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
DATUM GEODETIC DATE July 4, 1990 CHECKED BY RN

[illegible]

Continued

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

+3, x5; Numbers refer to Sensitivity

+3, x5: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 90 - W28 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 168; E 359 023
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM GEODETIC DATE July 5, 1990
 ORIGINATED BY PH
 COMPILED BY RN
 CHECKED BY Rm

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		
71.9	Continued						72										
15.2	Clayey silt to sandy silt, some gravel (glacial till)		2	SS	8												
71.0	Loose Grey																
16.1	End of Borehole Refusal to Auger Probable Bedrock																
							70										
							68										

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 90 - W29 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 150; E 359 032 ORIGINATED BY PH
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core COMPILED BY RN
 DATUM GEODETIC DATE July 15, 1990 CHECKED BY RL

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			20 40 60 80 100						
87.2	Ground Surface												
0.0	Topsoil												
0.2	Silty clay, some silty fine sand seams (weathered crust)												
	Stiff to Very stiff		1	SS	12								
	Grey Brown		2	SS	5								
84.3			3	SS	3								
2.9	Silty clay, some fine sand seams, becoming more silty and sandy with depth.		4	SS	WH*								
			5	SS	1								
	Stiff	Grey	6	SS	PH								
			7	SS	PM								
78.4													
8.8	Silty clay to sandy silt, layered, trace gravel and clay		8	SS	WH*								
77.4	Grey		9	SS	PM								
9.8	Silty clay, some silty fine sand layers		10	SS	PH								
			11	SS	PH								
	Stiff	Grey	12	SS	WH*								
72.9													
14.3	Sand, medium to coarse, some silt, trace gravel.												
72.2	Loose	Grey	13	SS	7								
15.0													

Continued

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - W29 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 150; E 359 032
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger; BXL Rock Core
 DATUM GEODETIC DATE July 15, 1990
 ORIGINATED BY PH
 COMPILED BY RN
 CHECKED BY R/L

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					
72.2	Continued																
15.0	Sand, medium to coarse some silt, trace gravel		14	SS	8		72										6 74 16 4
70.8	Loose Grey						Peastone										
16.4	Dolomitic limestone, fresh, some sand- stone layers, some shale partings.		15	RC BXL	** Rec- 98% RQD- 90%		Standpipe										
	Grey						Bentonite										
67.8							70										
19.4	End of Borehole						Peastone										
	*Sank under weight of hammer																
	** Rec = Recovery RQD = Rock Quality Designation																
							68										
							66										
							64										

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 90 - W30 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 128; E 359 039
 DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger
 DATUM GEODETIC DATE July 15, 1990
 ORIGINATED BY AC
 COMPILED BY RN
 CHECKED BY RA

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			20	40	60	80	100			
87.4	Ground Surface													
0.0	Topsoil													GR SA SI CL
0.2	Silty clay, some fine sand seams (weathered crust)				*									
85.3	Grey Brown					86								
2.1	Silty clay, some fine sand seams, trace to some fine gravel					84								
	Grey					82								
						80								
						78								
						76								
74.1			1	SS	7									
13.3	Sand, fine to coarse, trace silt		2	SS	PM	74								
	Loose Grey													
72.4														
15.0														

Continued

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 90 - W30 METRIC

W P 126-87-01(A) LOCATION Co-ords N 5 021 128; E 359 039 ORIGINATED BY AC
DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RN
DATUM GEODETIC DATE July 15, 1990 CHECKED BY RN

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	Wp W WL	20 40 60				
72.4	Continued													
15.0	Sand, fine to coarse, trace silt		3	SS	PH		72							
70.9	Loose Grey													
16.5	End of Borehole Refusal to Auger Probable Bedrock						70							
	* Note: Water level not established						68							

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE SHEETS
FROM PREVIOUS INVESTIGATIONS

August, 1990

901-2256

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	POCK CORE
B S	BLOCK SAMPLE	P H	T/N ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T/N ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
U	%	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		COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c		COMPRESSION INDEX
C_s		SWELLING INDEX
C_α		RATE OF SECONDARY CONSOLIDATION
c_v	m ² /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v		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_r		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						

RECORD OF BOREHOLE No. 89-2

METRIC

W.P. 146-74-00-3

LOCATION

Co-ords N 5 021 168; E 358 762

DIST 9 HWY 416

BOREHOLE TYPE

Hollow Stem Auger, BXL Rock Core

ORIGINATED BY P.H.

DATUM Geodetic

DATE

June 27 and 28, 1989

COMPILED BY A.C.

CHECKED BY A.C.

CORE SAMPLES TO BE TAKEN FROM 1.0 TO 11.1 METRES

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	UNIF. WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PROJ.	NUMBER	TYPE			20	40	60					
87.3	Ground Surface													
0.0	Sand and gravel													
86.9	occasional cobble													GR SA SI CL
0.4	Topsoil													
0.8	Silty clay, some silty fine sand seams (weathered crust)		1	SS	7									
			2	SS	5									
84.2	Very stiff to stiff	Grey Brown												
3.1	Silty clay, some silty fine sand seams, trace gravel		3	TW	PH									
			4	SS	1									
82.6		Grey												
4.7	Sand, fine, some silt, some sandy silt layers		5	SS	9	Native								
			6	SS	15									
	Compact	Grey	7	SS	16									
80.3														
7.0	Sandy silt, trace to some gravel and clay, some fine sand and clayey silt layers		8	SS	19									
			9	SS	14									
			10	SS	6									
			11	SS	19									
			12	SS	64									
	Loose to very dense	Grey												
76.2			13	SS	52									
11.1	Dolomitic limestone bedrock, fresh, thin to thickly bedded, some sandstone layers and shale partings occasional weathered horizontal joint		14	BXL	RQD=71%	Bentonite								
			15	BXL	RQD=71%	Silica Sand								
			16	BXL	RQD=98%									
	Continued													

*REC: Recovery

RQD: Rock Quality Designation

3, x 5: Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10



Ministry
of
Transportation
Ontario

RECORD OF BOREHOLE No. 89-2

METRIC

W P 146-74- 00-3

LOCATION

Co-ords N 5 021 168; E 358 762

DIST 9 HWY 416

BOREHOLE TYPE

Hollow Stem Auger BXL Rock Core

ORIGINATED BY P.H.

DATUM Geodetic

DATE

June 27 and 28, 1989

COMPILED BY A.C.

CHECKED BY A.C.

SOIL PROFILE

SAMPLES

GROUND WATER
CONDITIONS

ELEVATION SCALE

DYNAMIC CONE PENETRATION
RESISTANCE PLOT

20 40 60 80 100

PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT

Wp W WL

SHEAR STRENGTH σ_p

○ UNCONFINED * FIELD VANE

● QUICK TRIAXIAL x LAB VANE

20 40 60 80 100

WATER CONTENT (%)

20 40 60

UNIT WEIGHT
Y

REMARKS
&
GRAIN SIZE
DISTRIBUTION
(%)

GR SA SI CL

ELEV
DEPTH

DESCRIPTION

SIRAI PLOT

NUMBER

TYPE

'N' VALUES

Continued
Dolomitic limestone
bedrock, fresh, thin to
thickly bedded, some
sandstone layers and
shale partings,
occasional weathered
horizontal joint

16

RC

REC=

100%

BXL

RQD=

98%

17

RC

REC=

100%

BXL

RQD=

98%

71.0

Standpipe

16.3 End of Borehole

71

*REC: Recovery
RQD: Rock Quality Designation

OFFICE RECORD OF SOIL EXPLORATION

RECORD OF BOREHOLE No 101

METRIC

W P 126-87-01

LOCATION Coords N 5 021 267.4 ; E 358 878.3

ORIGINATED BY RH

DIST 9 HWY 416

BOREHOLE TYPE Hollow stem auger, BX rock core

COMPILED BY RH

DATUM Geodetic

DATE November 2, 3, 1989

CHECKED BY JTB

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT		UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	*N VALUES			20 40 60 80 100	20 40 60 80 100	W _p W _L	W _p W _L			
86.6	Ground Level				26/12/89								
0.0	Gravelly silty sand	1	SS	9		86					17.8	21 50 23 6	
85.7	Possible Fill Brown	2	SS	6		85							
0.9	Silty Clay, occasional thin layers of silty fine sand to fine sand, moist to wet, medium to high plasticity CI-CH (Marine Deposit)	3	TW	PH		84							
		4	TW	PH		83							
		5	TW	PH		82							
	Very stiff, becoming soft to firm with depth	6	TW	PH		81							
		7	TW	PH		80							
79.6	Gray	8	TW	PH		79							
7.0	Sand and silt, with some gravel and some clay; wet, low plasticity to non-plastic, rapid dilatancy SM-ML (Till)	9	SS	5		78							
		10	TW	PH		77							
		11	SS	5		76							
75.3	Loose Dark Gray					75							
11.3	Limestone bedrock with frequent dolomite beddings, occasional calcite-filled vugs and shaly partings, very strong, fresh	12	RC	REC		74							
			BXL	100%							RQD = 86%		
2.3	Gray	13	RC	REC		73					RQD = 95%		
			BXL	100%									
4.3	End of borehole												

*For RC samples, numbers represent Core Recovery.

*For RC samples, numbers represent Core Recovery.

METRIC

W P 126-87-01

LOCATION Coords N 5 021 272.9 : E 358 914.9

ORIGINATED BY RH

DIST 9 MWY 416

BOREHOLE TYPE Hollow stem auger, 8X rock core

COMPILED BY RH

DATUM Geodetic

DATE November 3, 1989

CHECKED BY JGR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		UNIT WEIGHT Y KN/m ³	REMARKS GRAIN SIZE DISTRIBUTION (%)		
ELEV. DEPTH	DESCRIPTION	STRAT. PROF.	NUMBER	TYPE	*N VALUES			20 40 60 80 100				WATER CONTENT (%)	
								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL * LAB VANE				20 40 60	
86.4	Ground Level					78/12/88							
85.5	Gravelly silty sand (Possible Fill) Brown		1	SS	7		86						
0.9	Silty clay, occasional thin layers of silty fine sand to fine sand, moist to wet, medium to high plasticity CI-CH (Marine Deposit)		2	SS	9		85						
			3	TW	PH		84		13				
			4	TW	PH		83						
							82		5				
			5	TW	PH		81						
	Very stiff, becoming firm with depth		6	TW	PH		80						
79.4	Grav						79		3				
7.0	Sand and silt with some gravel and some clay, wet, low plasticity to non- plastic, rapid dilatancy SM-ML (Till)		7	TW	PH		78						
			8	SS	22		77						
	Very loose to compact		9	SS	2		76						
74.2	Dark Gray					100/5 cm	75						
12.2	Limestone bedrock with frequent dolomite beddings, occasional calcite-filled vugs and shaly partings, very strong, fresh		11	RC BXU	100%		74				RQD = 57%		
			12	RC BXU	100%		73				RQD = 84%		
71.5	Gray		13	RC BXU	100%		72				RQD = 87%		
14.9	End of borehole												
*For RC samples, numbers represent Core Recovery.													

OFFICE REPORT ON SOIL EXPLORATION

*3, *5: Numbers refer to Sensitivity

15 \diamond 5 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 106

METRIC

P 126-87-01

LOCATION Coords N 5 021 291.1 : E 358 871.9

DIST 9 HWY 416

BOREHOLE TYPE Hollow stem auger, BX rock core

ORIGINATED BY RH

DATUM Geodetic

DATE November 7, 8, 1989

COMPILED BY RH

CHECKED BY CAB

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE			20 40 60 80 100	20 40 60 80 100			
85.5	Ground Level									
0.0	Silty clay, occasional thin layers of silty fine sand to fine sand, moist to wet, medium to high plasticity CI-CH (Marine Deposit)	1	SS	7	85				17.3	CU Triaxial Test See Fig. 2 0 8 55 37
		2	TP	PH	84					
		3	TP	PH	83					
		4	TP	PH	82					
		5	TP	PH	81					
		6	TP	PH	80					
		7	TP	PH	79					
		8	TP	PH	78					
		9	TP	PH	77					
		10	TP	PH	76					
78.6	Grav	11	TP	PH	75					RQD = 84%
6.9	Sand and silt with some gravel and some clay, wet, low plasticity to nonplastic SM-ML (Till)	12	SS	3	74					
		13	SS	7						
		14	SS	7						
	Very loose	15	SS	29						
75.5	to compact Dark Grav									
10.0	Limestone bedrock with frequent dolomite beddings, occasional shaly partings, very strong, fresh	16	RC	REC						
			BXL	100%						
73.3	Gray	17	BXL	100%						
12.2	End of borehole									

*For RC samples,
numbers represent
Core Recovery.

3, 5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 107

METRIC

W.P. 126-87-01

LOCATION Coords N 5 021 296.9 : E 358 904.4

ORIGINATED BY BH

DIST 9 HWY 416

BOREHOLE TYPE Hollow stem auger, BX rock core

COMPILED BY BH

DATUM Canadian

DATE November 8, 1989

CHECKED BY BH

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC SOLE PENETRATION RESISTANCE PLT		WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE			20 40 60 80 100	20 40 60			
85.1	Ground Level			8/12/89						
0.0	Silty clay, occasional thin layers of silty fine sand to fine sand, moist to wet, medium to high plasticity	1	SS 3		85				16.5	GR SA S CL
		2	TW PH		84					
	CI-CH (Marine Deposit)	3	TW PH		83					
		4	TW PH		82					
		5	TW PH		81					
		6	SS 5		80					
		7	SS 5		79					
		8	SS 100		78					
78.9	Firm Gray				77				27.0	18 24 49 9
6.2	Sand and silt with some gravel and some clay, wet, low plasticity to nonplastic, rapid dilatancy	9	RC REC		76					
	SM-ML (Till)				75					
					74					
74.5	Loose Dark Gray									
10.6	Limestone bedrock with frequent dolomite beddings, occasional shaly partings, very strong									
71.0	Frash									
12.1	End of borehole									

*For RC samples, numbers represent Core Recovery.

*3, 4 : Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 109

METRIC

W F 126-87-01

LOCATION Coords N 5 021 305.8 ; E 358 964.3

ORIGINATED BY RH

DIST 9

HWY 416

BOREHOLE TYPE Hollow stem auger, BX rock core

COMPILED BY RH

DATUM Geodetic

DATE November 9, 10, 1989

CHECKED BY TJB

SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		WATER CONTENT (%)		UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE			SHEAR STRENGTH σ_{ps}		Wp	N		
84.5	Ground Level					UNCONFINED	FIELD VANE				
						QUICK TRIAXIAL	LAB VANE				
0.0	Silty clay; occasional thin layers of silty fine sand to fine sand, moist to wet, medium to high plasticity	1	SS 2		84						0 1 56 43
		2	TW PH		83						
		3	TW PH		82						
	CI-CH (Marine Deposit)	4	TW PH		81					17.2	
	Stiff, becoming soft to firm with depth	5	TW PM		80					17.2	
		6	TW PH		79						
		7	TW PH		78						
		8	SS 1		77						
		9	TW PM		76						
74.5	Gray	10	SS 1		75						
10.0	Sand and silt with some gravel and some clay, wet, low plasticity to non-plastic	11	SS 1		74						
72.6	SM-ML (Till)	12	RC REC		73						
11.9	Very loose Dark Gray	13	RC REC		72						
	Limestone bedrock with frequent dolomite beddings, occasional shaly partings, very strong, fresh				71						
70.1	Gray										
14.4	End of borehole										

*For RC samples, numbers represent Core Recovery.

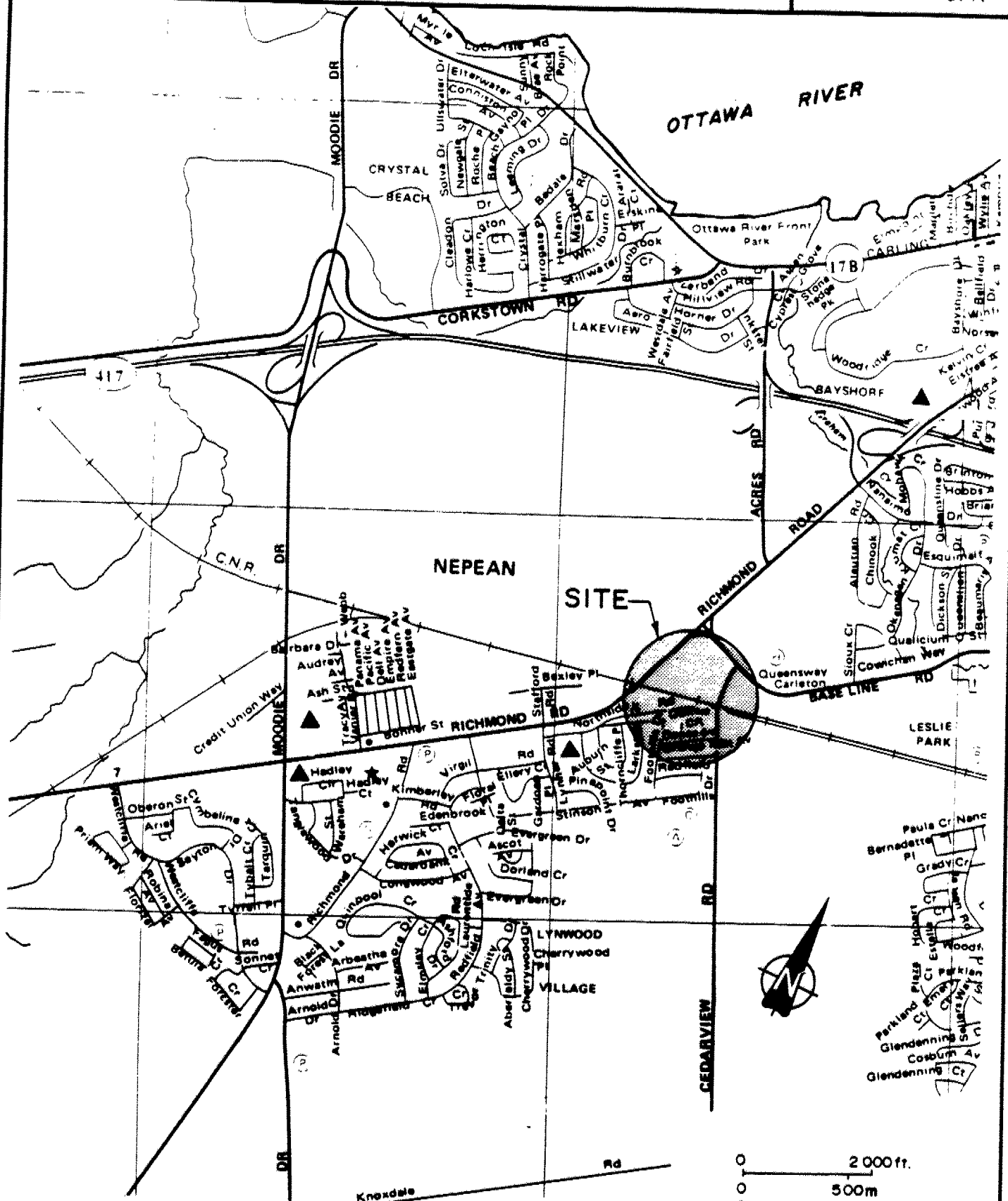
+3, +5; Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

SITE LOCATION PLAN

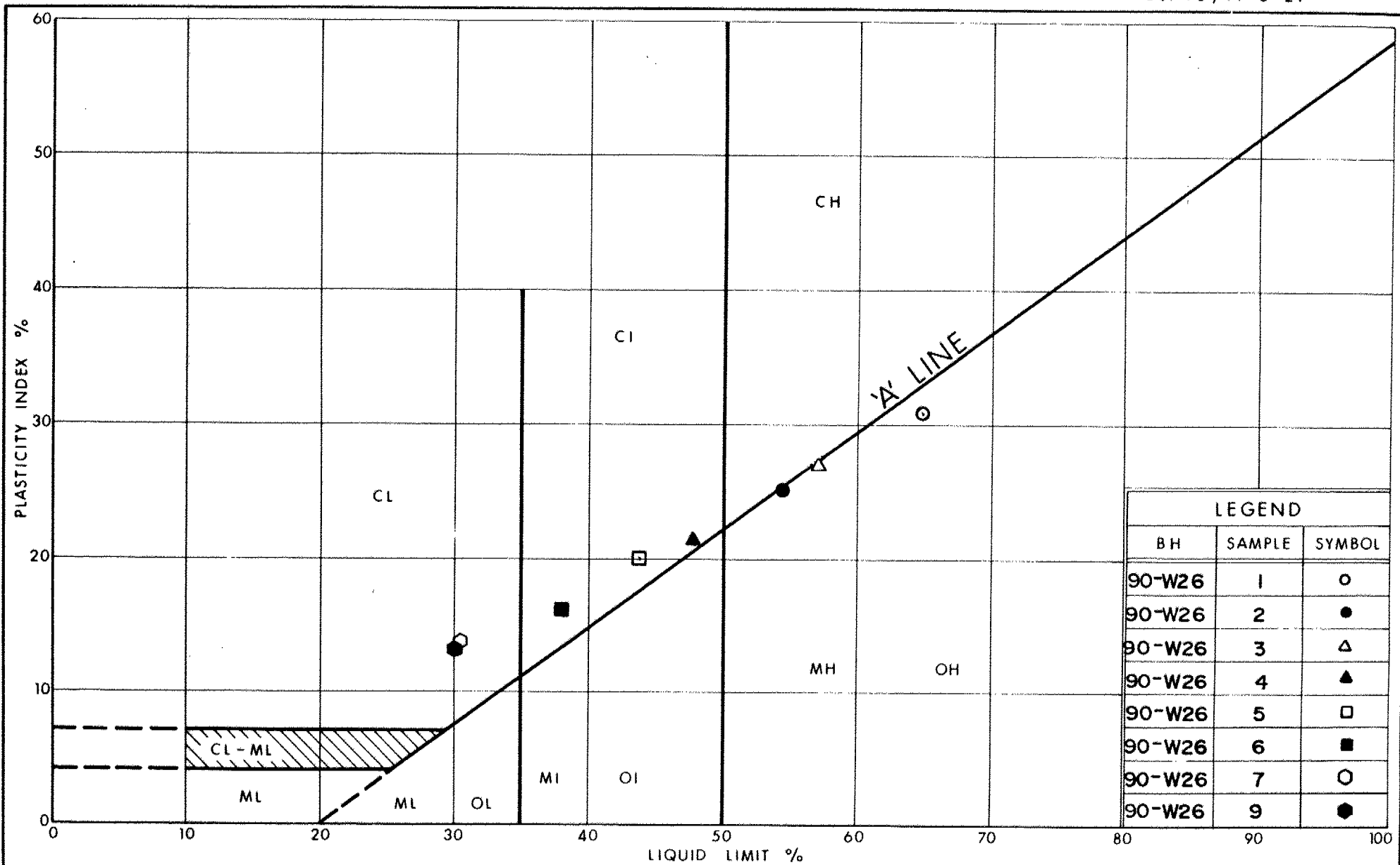
FIGURE 1
WP 126-87-01 A



Date JUNE 12, 1990.
Project 901-2256

Golder Associates

Drawn R.B.C.
Chkd. *[Signature]*



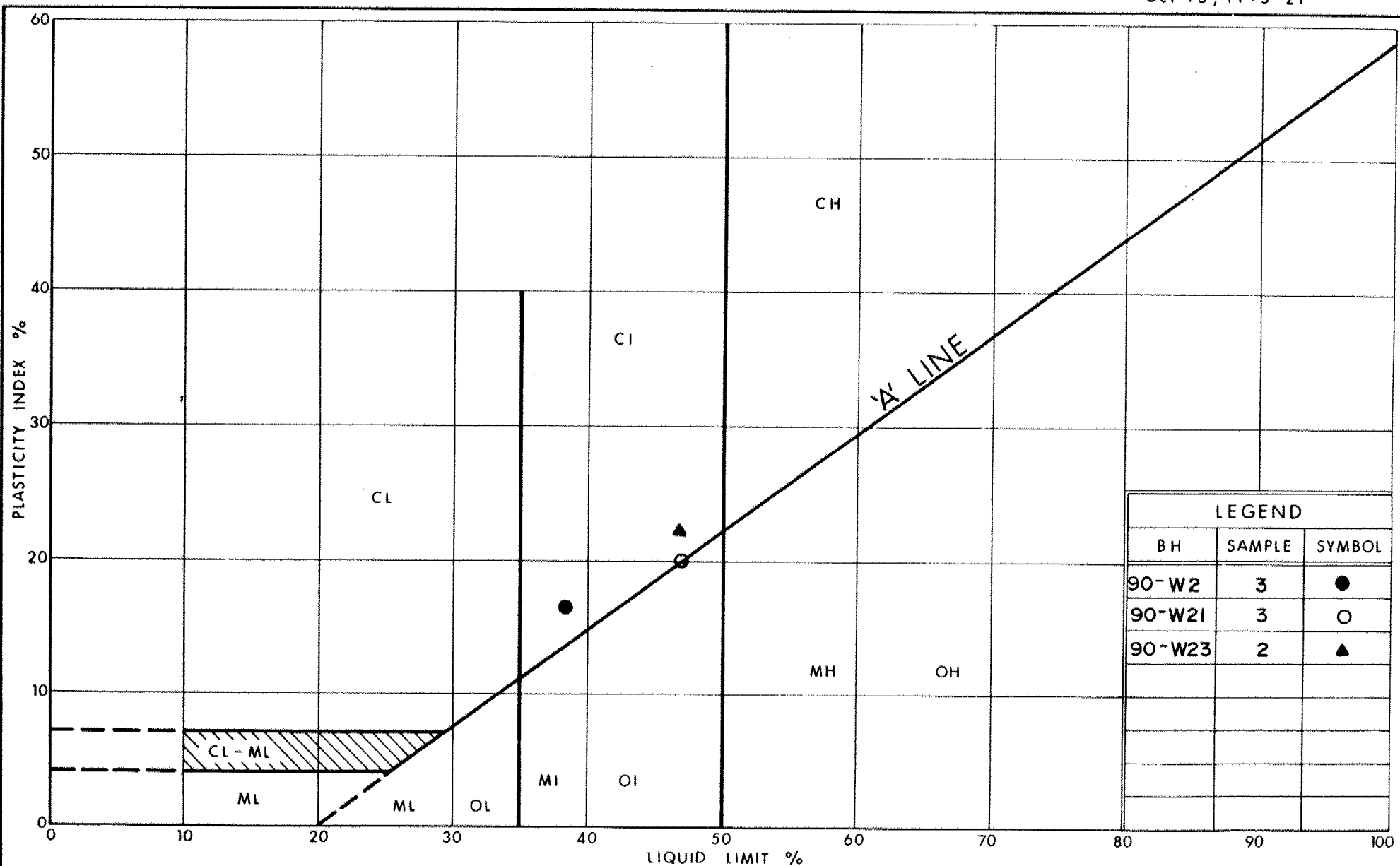
Ontario

Ministry of
Transportation

PLASTICITY CHART SILTY CLAY, some silty sand seams

FIG No 2

W P 126-87-01A

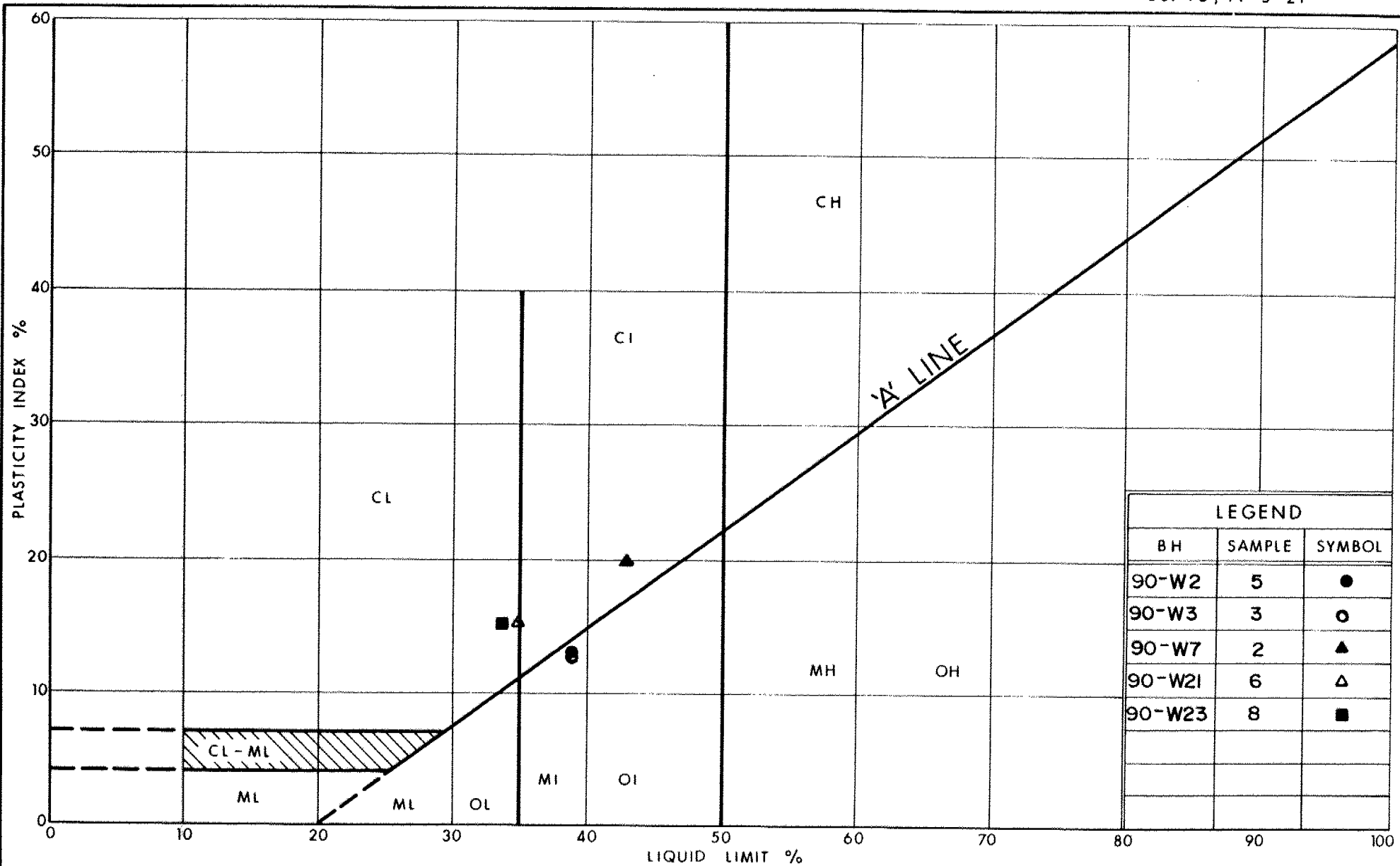


Ministry of
Transportation
Ontario

PLASTICITY CHART
SILTY CLAY, some silty sand seams
(Weathered Crust)

FIG No 3

W P 126 - 87 - 01 A



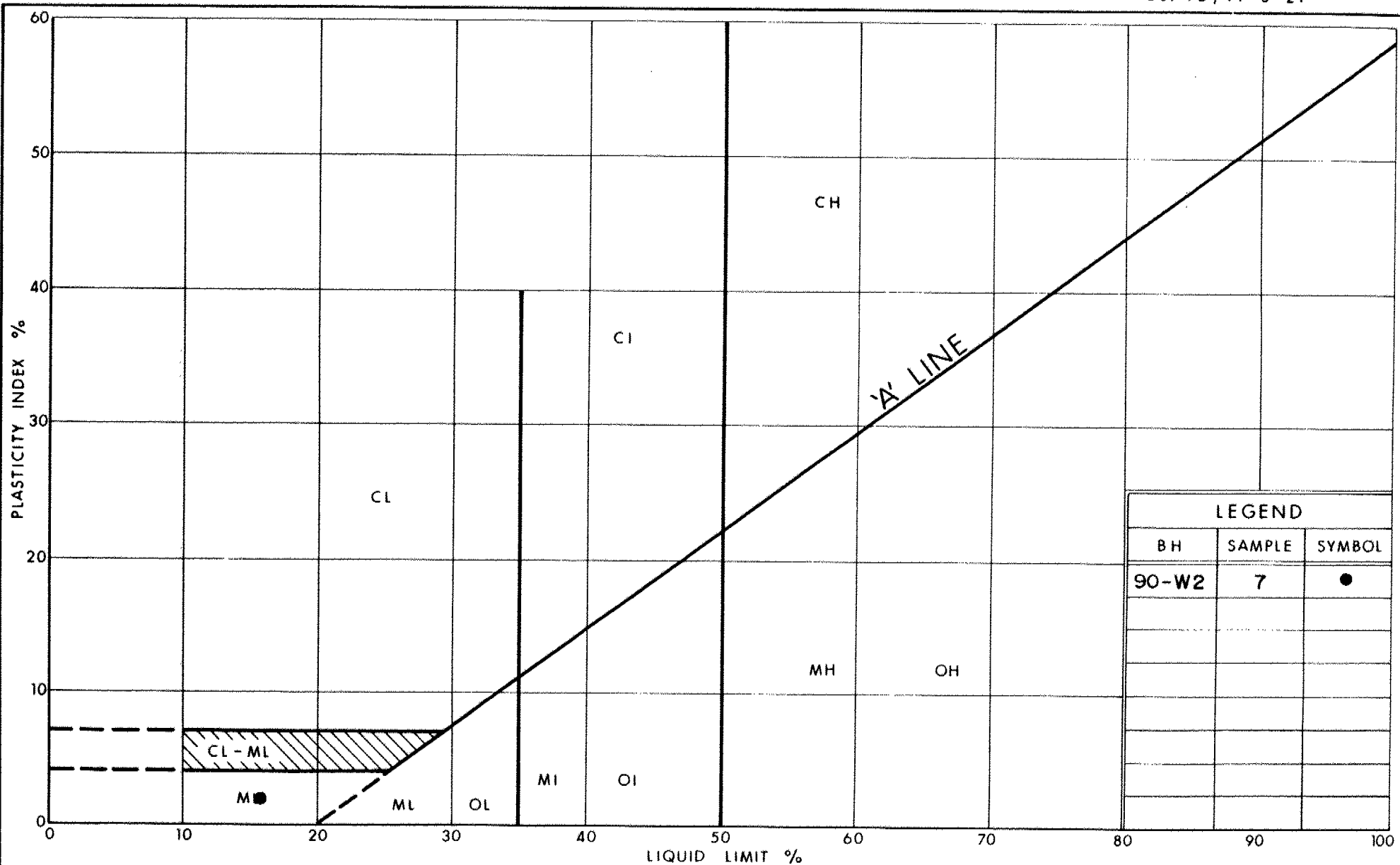
Ministry of
Transportation

Ontario

PLASTICITY CHART SILTY CLAY, some silty sand seams

FIG No 4

W P 126-87-01A



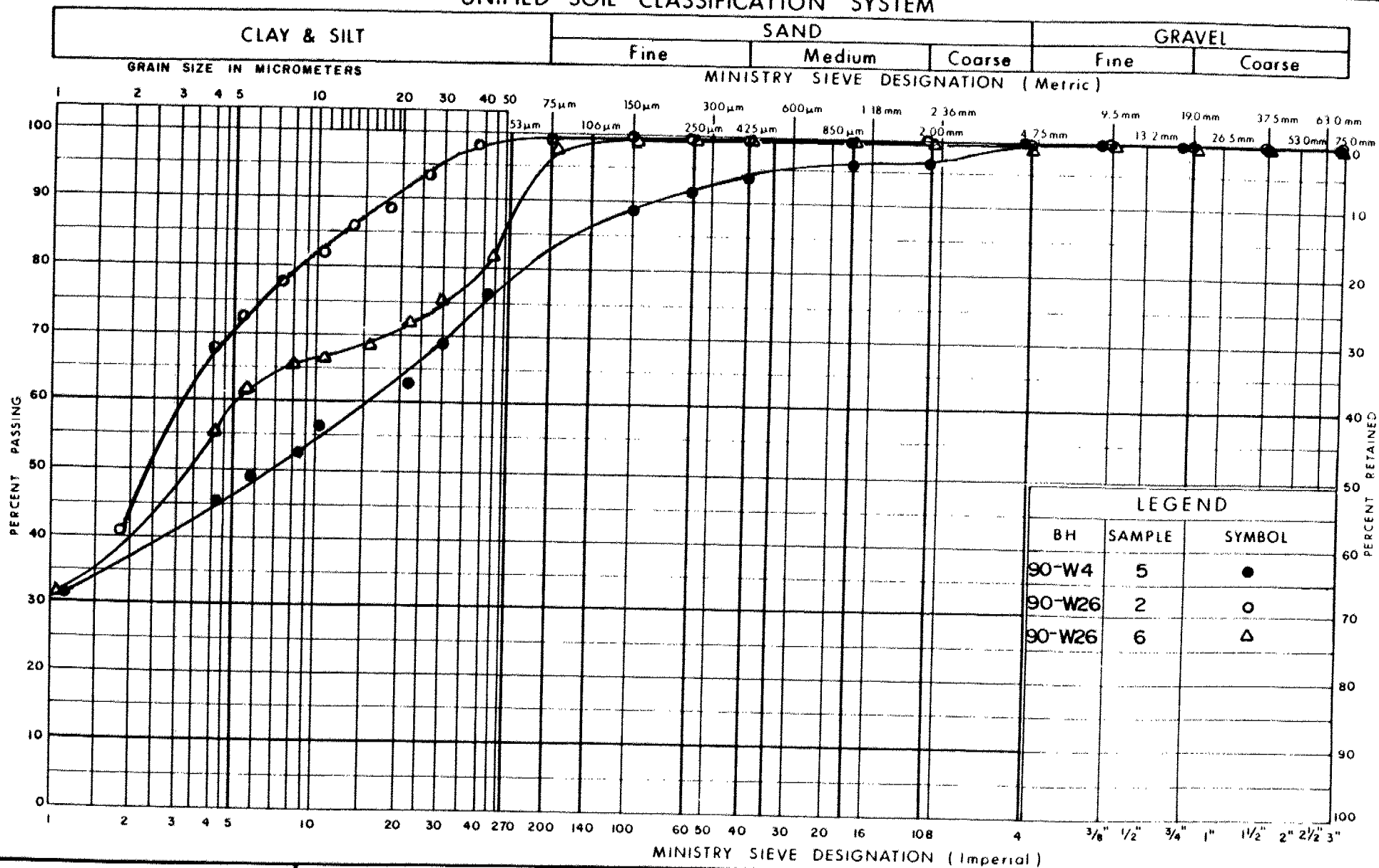
Ministry of
Transportation

Ontario

PLASTICITY CHART
SANDY SILT, some gravel and clay (GLACIAL TILL)

FIG No 5
 W P 126-87-01A

UNIFIED SOIL CLASSIFICATION SYSTEM



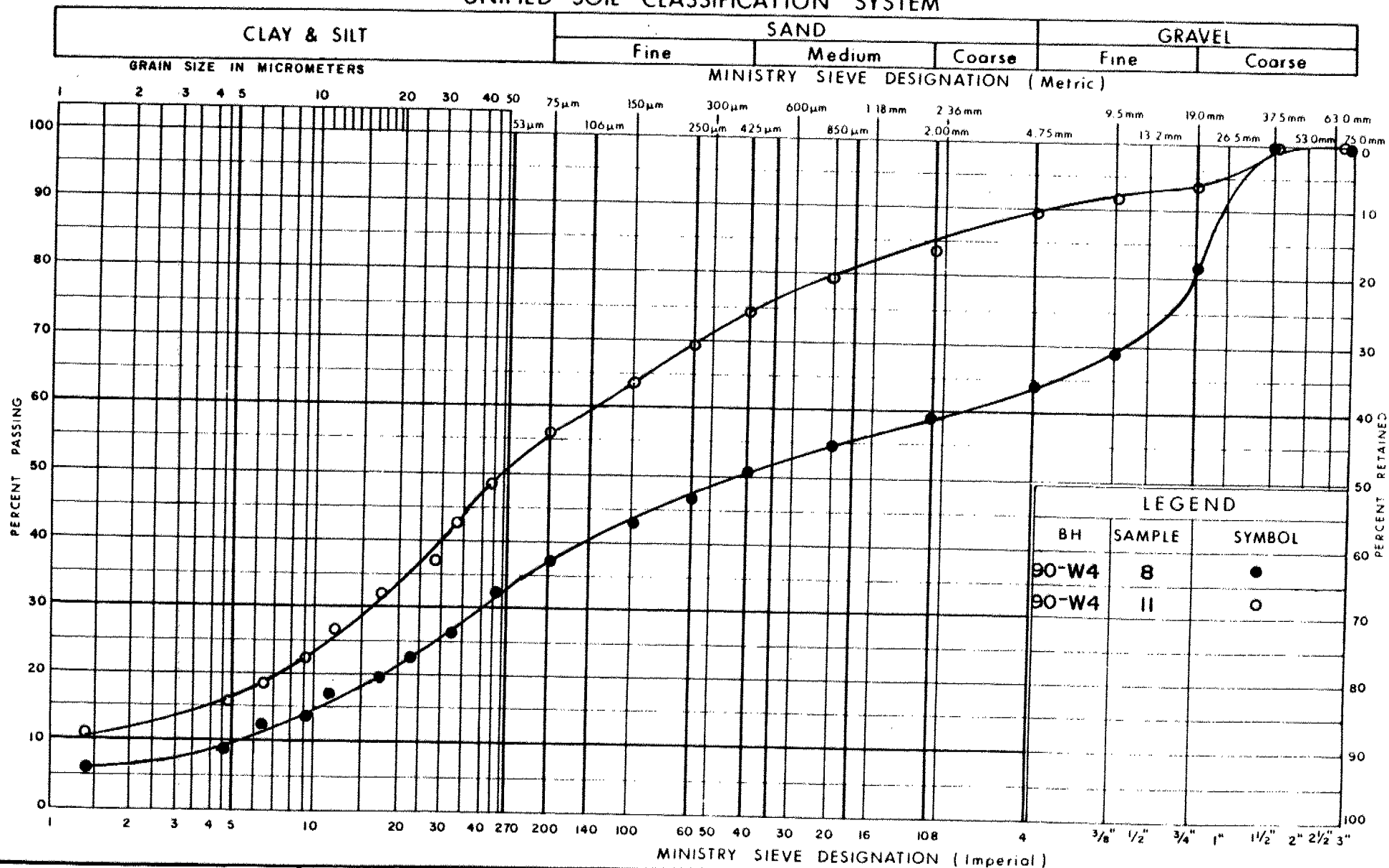
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SILTY CLAY, some silty sand seams

FIG No 6

W P 126-87-01A

UNIFIED SOIL CLASSIFICATION SYSTEM



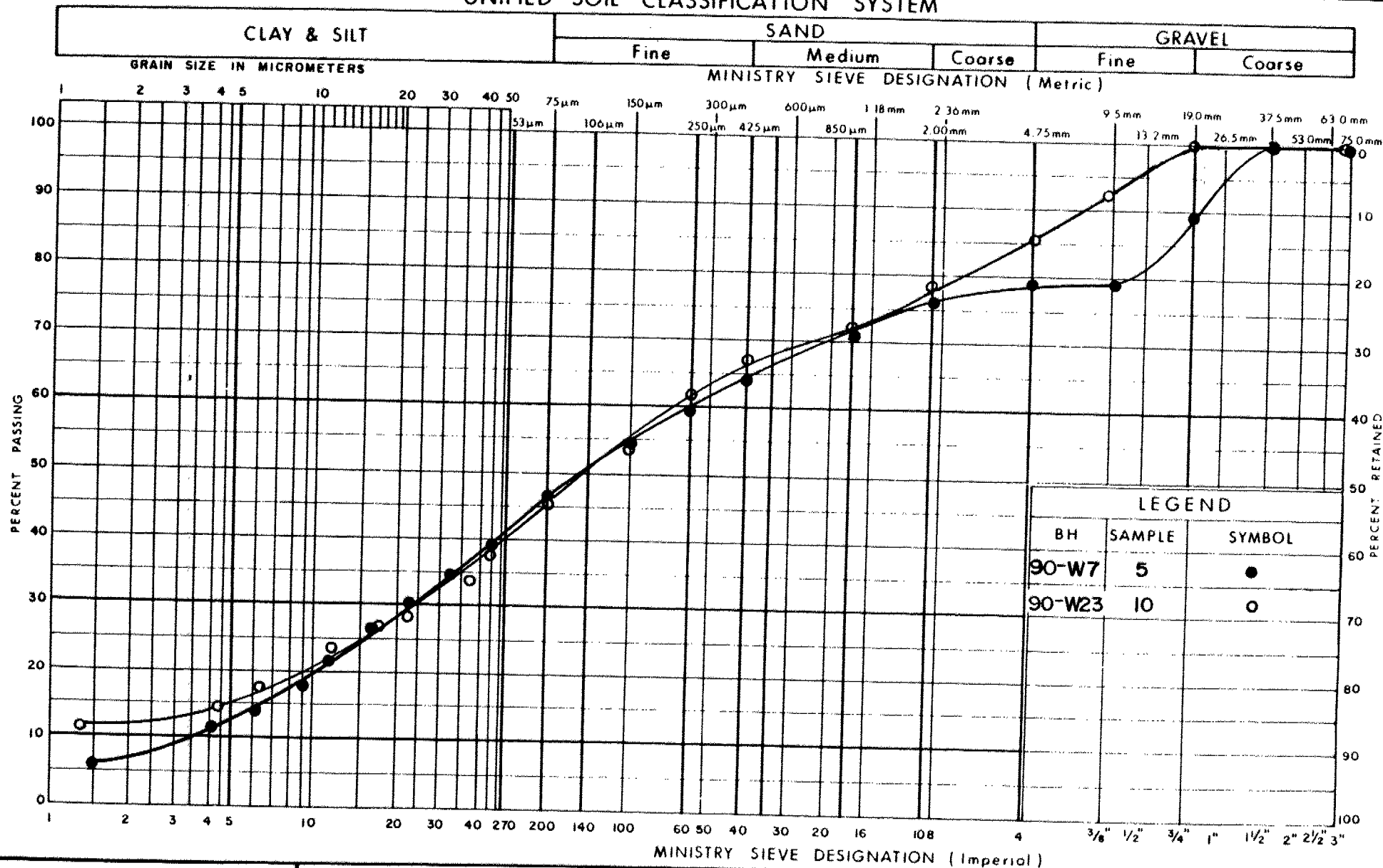
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SANDY SILT, some gravel and clay
(GLACIAL TILL)

FIG No 7

W P 126-87-01A

UNIFIED SOIL CLASSIFICATION SYSTEM



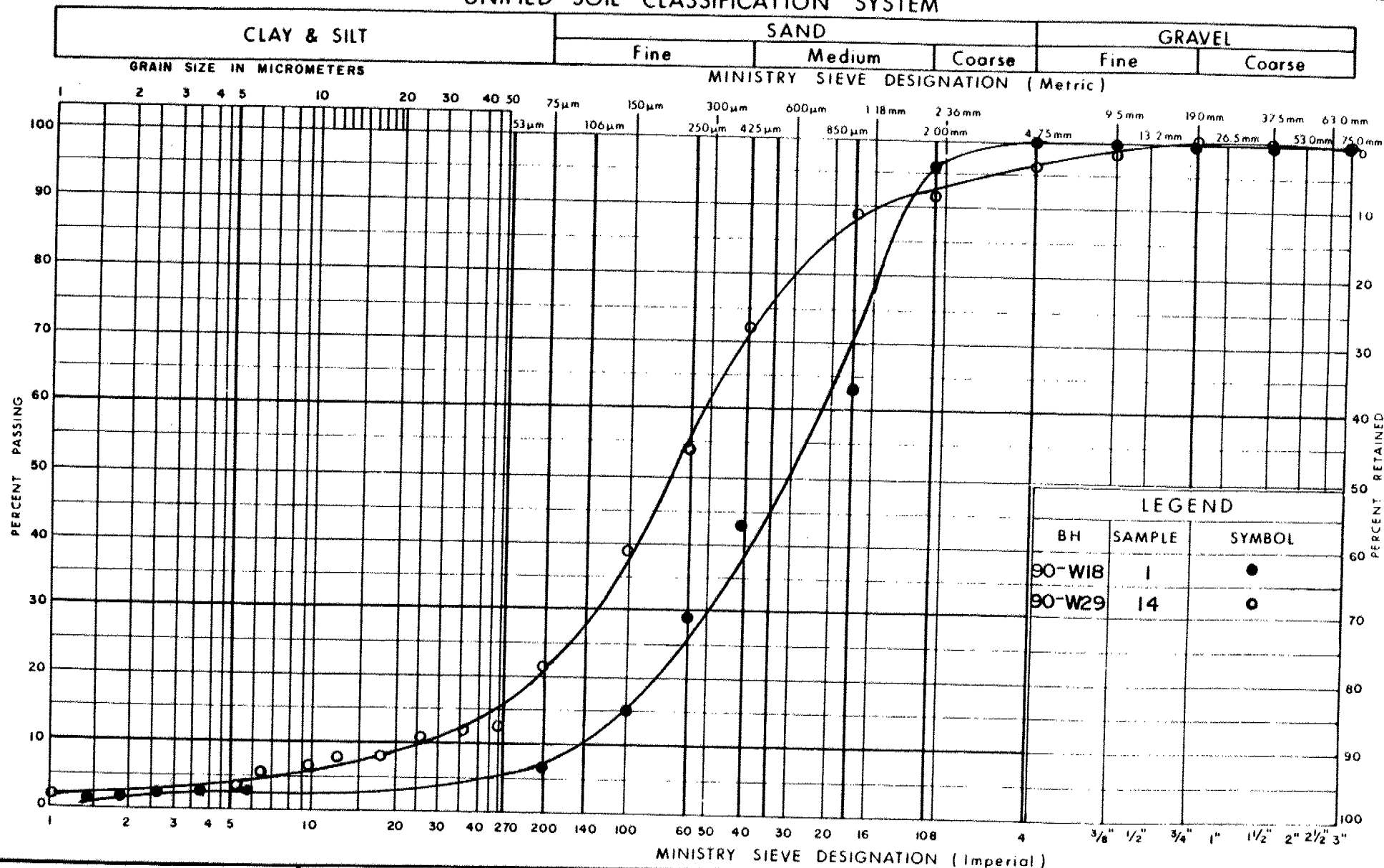
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SAND AND SILT, some gravel and some clay
(GLACIAL TILL)

FIG No 8

W P 126 - 87 - 01A

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

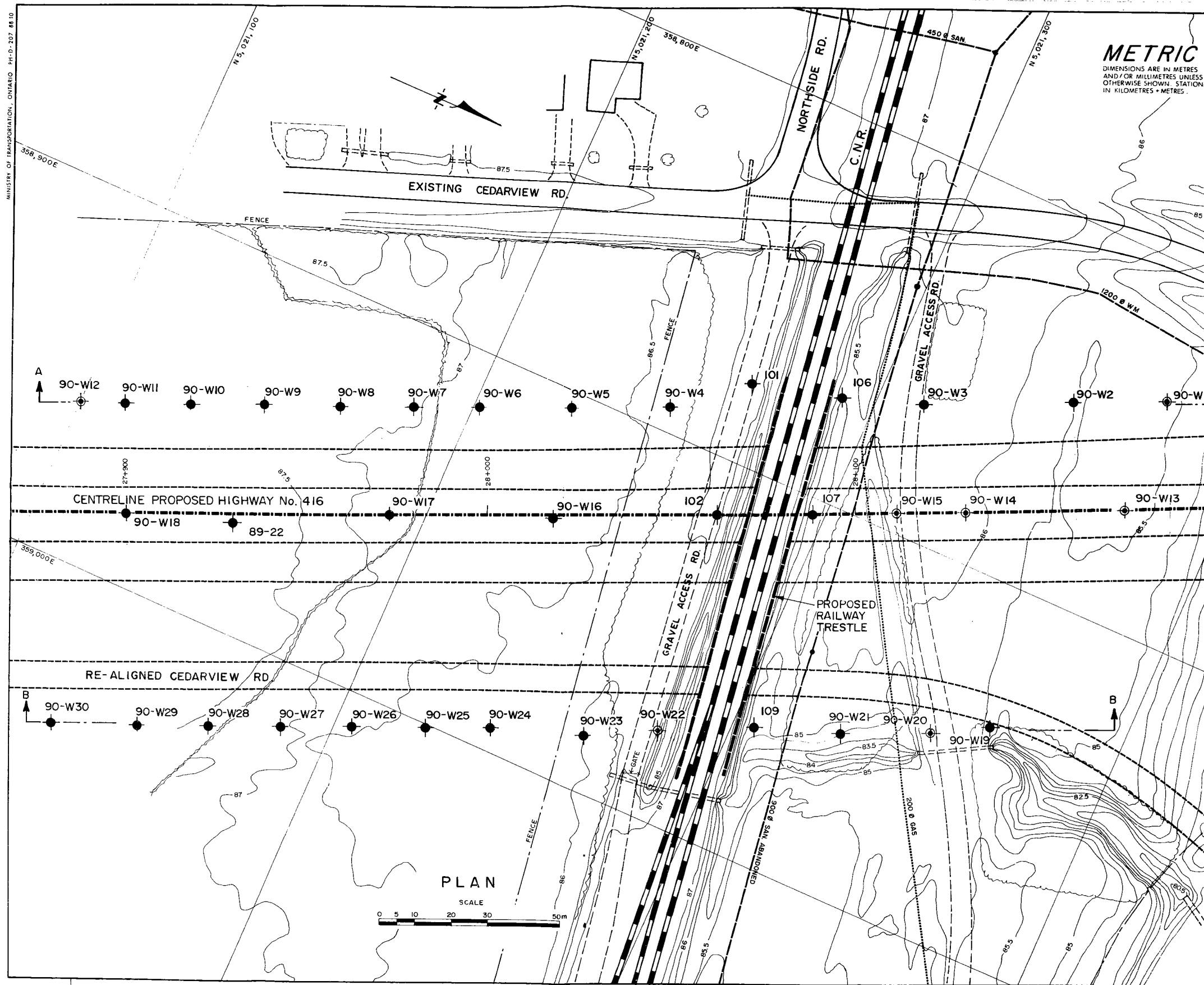
GRAIN SIZE DISTRIBUTION

SAND, trace gravel and silt

FIG No 9

W P 126-87-01A

OVERSIZE DRAWING(S)



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

CONT No
WP No 126-87-01(A)

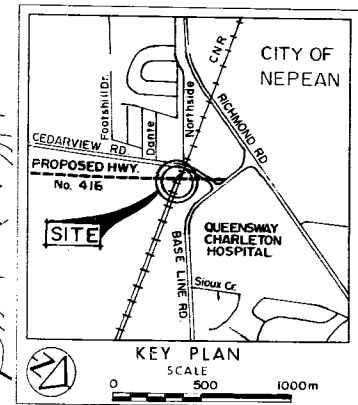


HIGHWAY No. 416 CUT WALL

SHEET

BORE HOLE LOCATIONS

GOLDER ASSOCIATES LTD.
CONSULTING ENGINEERS



- LEGEND**
- Bore Hole
 - ⊙ Probe Hole
 - ⊙ 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
- Note: BH. 101, BH. 102, BH. 106, BH. 107 and BH. 109 were put down by Acres (1989).

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
90-W1	85.5	5,021,372	358,836
90-W2	85.5	5,021,348	358,848
90-W3	86.2	5,021,312	358,866
90-W4	86.3	5,021,249	358,894
90-W5	86.8	5,021,223	358,906
90-W6	86.6	5,021,193	358,915
90-W7	86.9	5,021,181	358,923
90-W8	87.3	5,021,165	358,930
90-W9	87.2	5,021,146	358,936
90-W10	87.4	5,021,126	358,947
90-W11	87.4	5,021,110	358,953
90-W12	87.6	5,021,100	358,958
90-W13	85.5	5,021,373	358,869
90-W14	86.0	5,021,334	358,888
90-W15	86.3	5,021,316	358,894
90-W16	86.6	5,021,232	358,935
90-W17	86.8	5,021,190	358,951
90-W18	87.4	5,021,124	358,979
90-W19	85.3	5,021,363	358,937
90-W20	85.2	5,021,351	358,946
90-W21	85.1	5,021,328	358,956
90-W22	86.5	5,021,281	358,977
90-W23	85.8	5,021,263	358,983
90-W24	86.4	5,021,239	358,993
90-W25	86.3	5,021,222	359,001
90-W26	86.9	5,021,203	359,008
90-W27	87.1	5,021,185	359,016
90-W28	87.1	5,021,168	359,023
90-W29	87.2	5,021,150	359,032
90-W30	87.4	5,021,128	359,039
89-22	87.3	5,021,152	358,971
101	86.6	5,021,267	358,878
102	86.4	5,021,273	358,915
106	85.5	5,021,291	358,872
107	85.1	5,021,297	358,904
109	84.5	5,021,306	358,964

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 Farm 100.

REV	DATE	BY	DESCRIPTION
Geocres No 3165-176			
HWY No 416			DIST 9
SUBMD RN [CHECKED] DATE JULY 20/90			SITE
DRAWN MW [CHECKED] APPROVED			DWG 1268701A-1

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

CONT No
WP No 126-87-01(A)

HIGHWAY No. 416 CUT WALL

SOIL STRATA

SHEET

GOLDER ASSOCIATES LTD.
CONSULTING ENGINEERS

SEE DWG. No. 1268701A-1

KEY PLAN
SCALE

LEGEND

- Bore Hole
- Probe Hole
- 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
1907 and 1911
- Standpipe Piezometer

Note: BH. 102 and BH. 107 were put down
by Acres (1989)

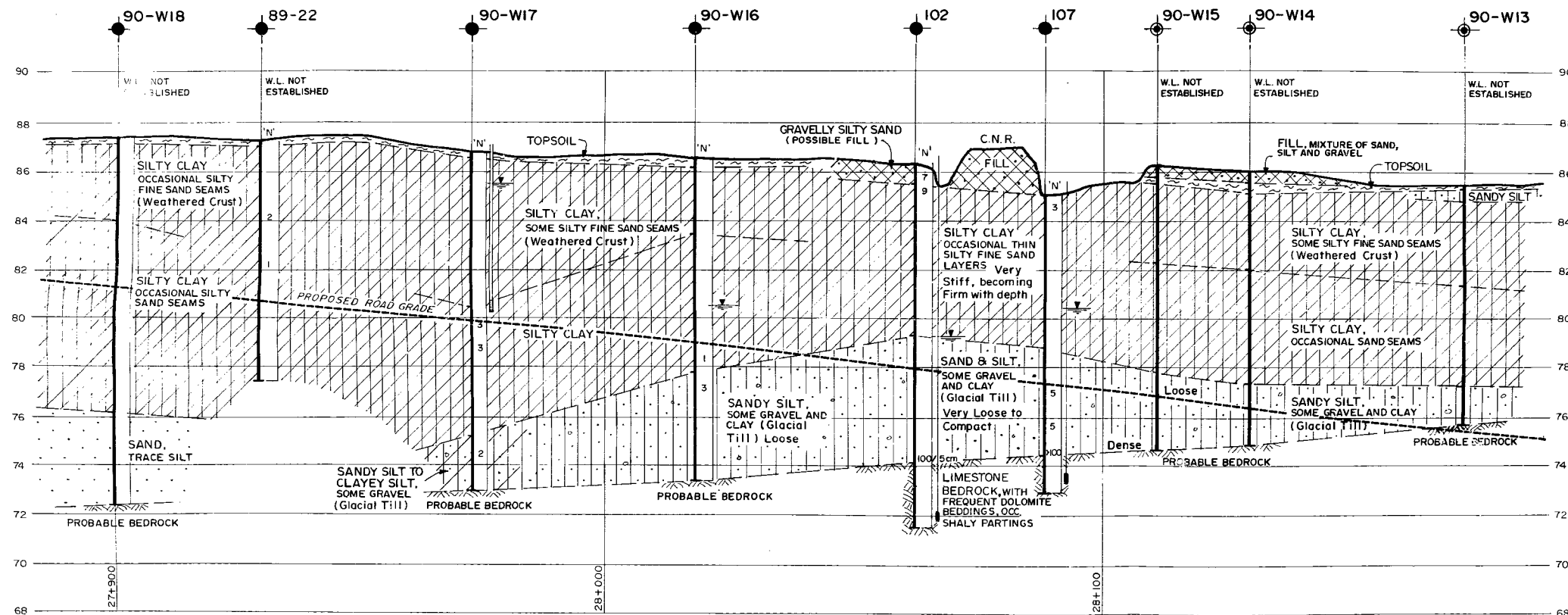
No	ELEVATION	CO-ORDINATES	EAST
90-W13	85.5	5,021,373	358,869
90-W14	86.0	5,021,334	358,868
90-W15	86.3	5,021,316	358,894
90-W16	86.6	5,021,232	358,935
90-W17	86.8	5,021,190	358,951
90-W18	87.4	5,021,124	358,975
89-22	87.3	5,021,152	358,971
102	86.4	5,021,273	358,915
107	85.1	5,021,297	358,904

NOTE

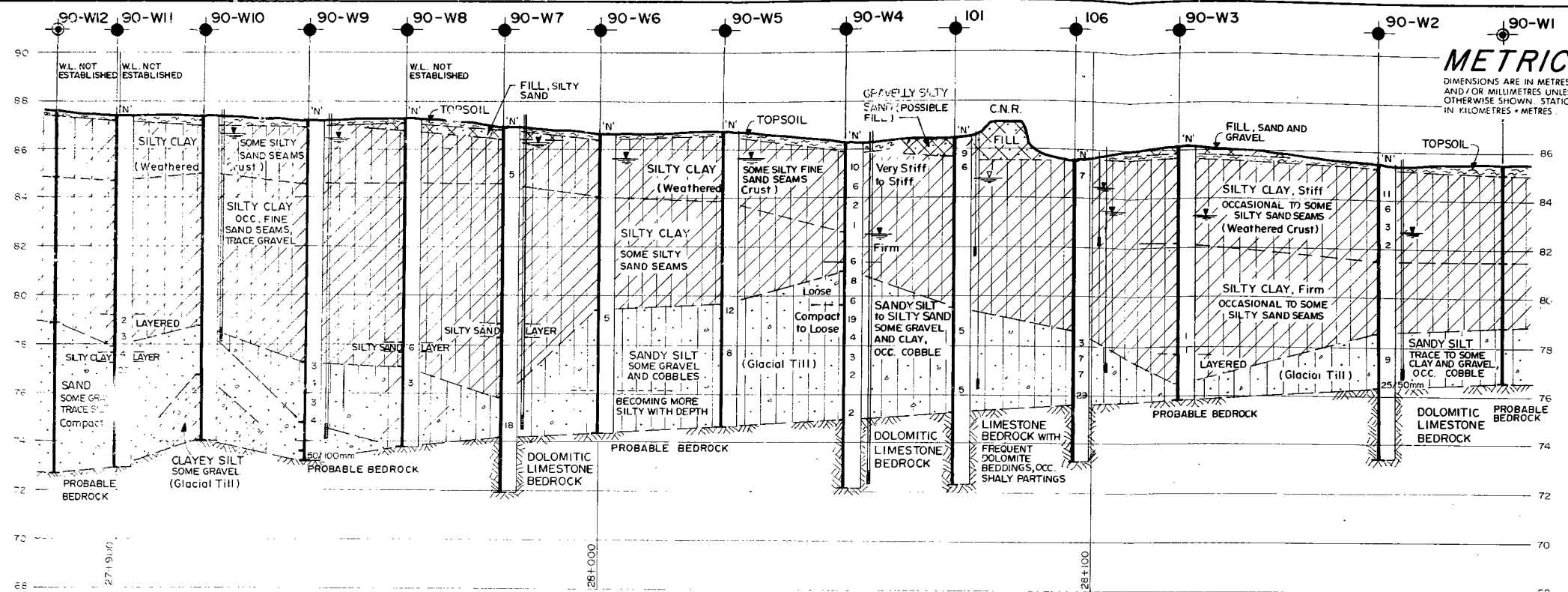
The boundaries between soil strata have been established
only at Bore Hole locations. Between Bore Holes the
boundaries are assumed from geological evidence.

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

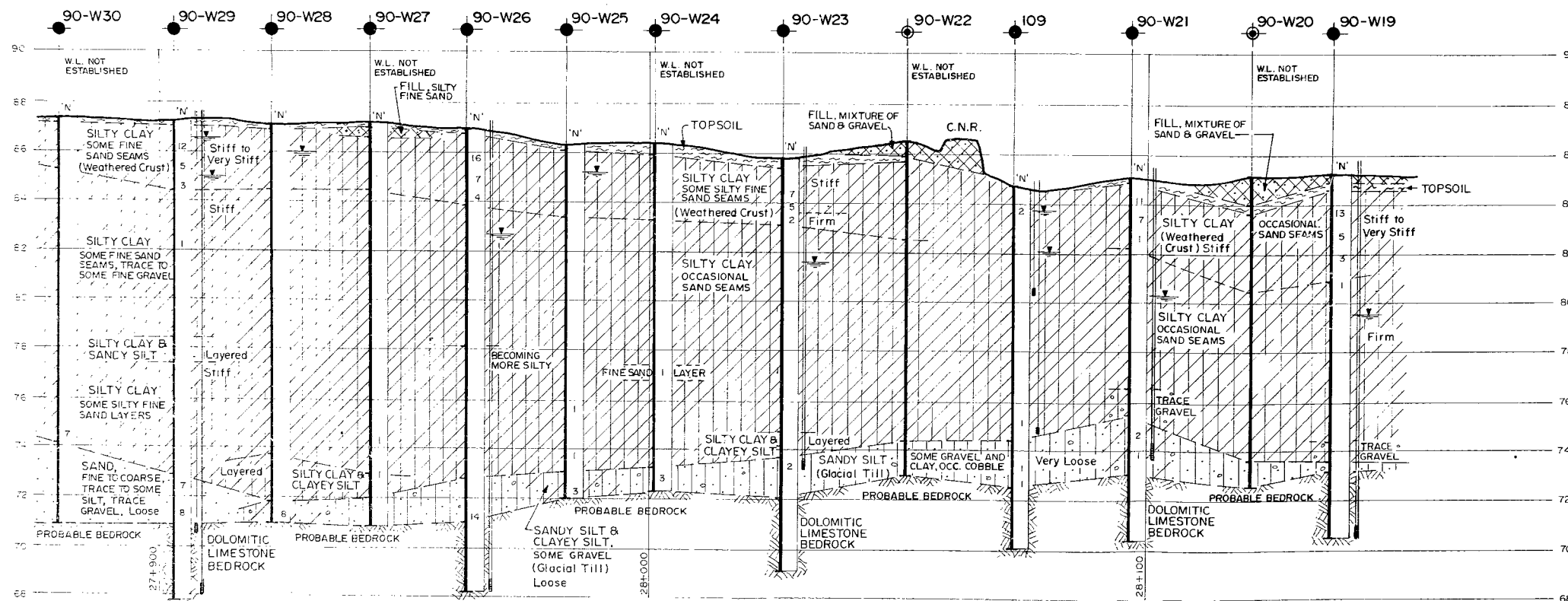
REV	DATE	BY	DESCRIPTION
1			
Geocres No 3165-176			
HWY No 416			
SUBM'D RN [CHECKED] DATE AUG 10/90 SITE			
DRAWN MW [CHECKED] APPROVED DWG 1268701A-2			



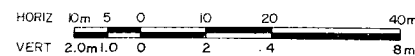
NOTE: FOR PLAN REFER TO
DWG. No. 1268701A-1



SECTION A-A



SECTION B-B

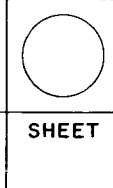


NOTE: FOR PLAN REFER TO DWG. No. 1268701A-1

CONT No
WP No 126-87-01(A)

HIGHWAY No. 416 CUT WALL

SOIL STRATA



GOLDER ASSOCIATES LTD.
CONSULTING ENGINEERS

SEE DWG. No. 1268701A-1

KEY PLAN
SCALE

LEGEND

- Bore Hole
- Probe Hole
- 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 06 and 07, and 89 11
- Standpipe
- Piezometer

Note: BH. 101, BH. 106 and BH. 109 were put down by Acres (1989)

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
90-W1	85.5	5,021,372	358,836
90-W2	85.5	5,021,348	358,848
90-W3	86.2	5,021,312	358,866
90-W4	86.3	5,021,249	358,894
90-W5	86.8	5,021,223	358,906
90-W6	86.6	5,021,199	358,915
90-W7	86.9	5,021,181	358,923
90-W8	87.3	5,021,165	358,930
90-W9	87.2	5,021,146	358,936
90-W10	87.4	5,021,126	358,947
90-W11	87.4	5,021,110	358,953
90-W12	87.6	5,021,100	358,958
90-W19	85.3	5,021,363	358,937
90-W20	85.2	5,021,351	358,946
90-W21	85.1	5,021,328	358,956
90-W22	86.5	5,021,281	358,977
90-W23	85.8	5,021,263	358,983
90-W24	86.4	5,021,239	358,993
90-W25	86.3	5,021,222	359,001
90-W26	86.9	5,021,203	359,008
90-W27	87.1	5,021,185	359,016
90-W28	87.1	5,021,168	359,023
90-W29	87.2	5,021,150	359,032
90-W30	87.4	5,021,128	359,039
101	86.6	5,021,267	358,878
106	85.5	5,021,291	358,872
109	84.5	5,021,306	358,964

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			
2			
3			
4			
5			
6			
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8			
9			
10			

Geocres No 31G5-176

HWY No 416	SUBMD RN	CHECKED	DATE AUG. 9/90	SITE	9
DRAWN MW	CHECKED	APPROVED		DWG 1268701A-3	