

GEOCRES No. 52A-113DIST. 19 REGION W.P. No. 619-89-02 ACONT. No. W. O. No. STR. SITE No. HWY. No. 11 & 17LOCATION Proposed Retaining Wall
Hwy 11 & 17 at Red River Rd &No of PAGES - Hwy 102

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.REMARKS:



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REMARKS _____

Computer B

WP619891

WP619892

WP619893



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FILE

FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 619-89-02 (A) DIST 19
HWY 11/17 STR SITE N/A

Proposed Retaining Wall
Along Hwy. 11/17 at
Red River Road and Hwy. 102

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FOUNDATION INVESTIGATION REPORT

For

Proposed Retaining Wall

Along Hwy. 11/17 at

Red River Road and Hwy. 102

W.P. 619-89-02 (A), Site No. N/A

District 19, Thunder Bay

INTRODUCTION

This report summarizes the information obtained from a foundation investigation carried out at the above mentioned site where a 203 m long retaining wall is proposed for the N-W ramp from Hwy. 102 to Hwy. 11/17. The fieldwork was carried out on May 31, 1991 and August 23, 1991.

Six boreholes were drilled and sampled in May of 1991 as part of the foundation investigation for a single two span bridge which is proposed to carry the existing Red River Road/Hwy. 102 over the proposed Hwy. 11/17. These boreholes extended down to depths of 2.9 m and 7.7 m below the existing ground surface. The result from one borehole (BH 2) is utilized in this report.

Additional three boreholes (BH RW-1 to RW-3) were advanced and sampled in August of 1991 as part of the foundation investigation for a 203 m long retaining wall along the Hwy. 11/17, by means of a hollow stem augers. These boreholes extended down to a depth of 2.4 m and 3.4 m below the existing ground surface.

This report contains factual information obtained from this investigation pertaining to structure foundation, road cuts approach embankments and related earthworks for the retaining wall structure as shown on Dwg. No. 6198902A-A.

SITE DESCRIPTION

The site is located on the intersection between Hwy. 11/17 (Thunder Bay Expressway) and Red River Road/Hwy. 102 in the City of Thunder Bay. The topography in the immediate area is generally flat to gently undulating. The immediate vicinity of the site is occupied by commercial and residential area.

Bedrock is known to be "Cherty Iron Formation of the Gunflint Formation".

SUBSURFACE CONDITIONS

The subsoil conditions encountered across the site are generally uniform. Clayey silt topsoil was found at all three borehole locations with a maximum thickness of 1.1 m at BH RW-2. A sand fill was encountered at BH 2, which was drilled for the bridge structure, as much as 1.7 m in the existing roadway under a thin layer of asphalt pavement (0.1 m thick). The sand fill was found to be underlain by a thin deposit of clayey silt at BH 2 with a thickness of about 0.3 m. A thin layer of heterogeneous mixture of silt, sand and gravel (non-cohesive till) was encountered underneath these strata at all borehole locations. Thickness of this layer ranges from 0.8 m at BH 2 to 2.5 m at BH RW-3. The bedrock was not cored at this location. However, based on the adjacent borehole information, it appears that these overburden materials are underlain by a Cherty Iron Formation bedrock.

The probable bedrock surface is undulating with an elevation ranging from 239.3 m at BH RW-1 to 241.3 m at BH 2 which are corresponded to 2.4 m and 2.9 m below the existing ground surface, respectively. Bedrock at this location is known to be "Cherty Iron Formation of the Gunflint Formation".

The boundaries between the various soil types, in situ and laboratory test results are shown on the attached Record of Borehole Sheets in the Appendix. The locations and elevations of the boreholes, along with a section showing soil stratigraphy based on borehole data, are shown on Drawing No. 6198902A-A.

A detailed description of the subsurface conditions encountered is given below.

Clayey Silt (Topsoil)

This material was encountered at three borehole locations (BH RW-1 to RW-3) from the ground surface. The thickness of this layer ranges from 0.9 m and BH's RW-1 and 3 to 1.1 m at BH RW-2.

An Atterberg Limit Test was performed on this sample and the result is plotted on Figure 1 and summarized as follows:

<u>Property</u>	<u>(%)</u>
Natural Moisture Content (w)	17
Liquid Limit (w _L)	29
Plastic Limit (w _p)	19
Plasticity Index (I _p)	10

From the plasticity chart, it is evident that the layer can be classified as a clayey silt, trace of sand and gravel and organics with low plasticity (CL).

A Grain Size Distribution test was carried out on this cohesive material. Figure 2 in the Appendix shows the result.

Fill Material

One borehole encountered some fill material whose composition is a compacted sand with gravel. The thickness of this layer is about 1.7 m at BH 2. In this stratum, the 'N' values are about 22 blows/0.3 m indicating a state of compaction described as compact.

Clayey Silt

This stratum was encountered underneath the sand fill material at one borehole location. The thickness of this layer is about 0.3 m at BH 2.

An Atterberg Limit tests was performed on this sample and the result is plotted on Figure 1 and summarized as follows:

<u>Property</u>	<u>(%)</u>
Natural Moisture Content (w)	140.5
Liquid Limit (w_L)	26.0
Plastic Limit (w_p)	18.0
Plasticity Index (I_p)	8.0

From the plasticity chart, it is evident that the layer can be classified as a clayey silt, trace of sand and gravel with low plasticity (CL).

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

This stratum was encountered underneath the sand fill/clayey silt layers at all boreholes. The thickness of this layer ranges from about 0.8 m at BH 2 to 2.5 m at BH RW-3.

Atterberg Limit tests were performed on these samples and the results are plotted on Figure 3 and summarized as follows:

<u>Property</u>	<u>Range (%)</u>	<u>Average (%)</u>
Natural Moisture Content (w)	8.0 - 12.5	10.6
Liquid Limit (w_L)	16.0 - 22.0	19.8
Plastic Limit (w_p)	13.0 - 18.0	16.8
Plasticity Index (I_p)	2.0 - 4.0	3.0

From the plasticity chart, it is evident that the layer can be classified as a heterogeneous mixture of silt, sand and gravel trace of clay (CL-ML or ML).

Grain Size Distribution tests were carried out on this material as shown in Figure 4 in the Appendix. This layer is basically non-plastic. In this stratum, the 'N' values in general range from 49 to over 100 blows/0.3 m indicating a state of compaction described as dense to very dense.

Groundwater Conditions

Groundwater conditions were observed through the measurement of water level in the open boreholes and in a piezometer installed at BH RW-3. The groundwater level in both open boreholes after completion and piezometer was found to range from depths of 1.5 m to 1.8 m below the existing ground surface which correspond to an approximate elevation of 242.3 m at BH RW-3 and 242.4 at BH 2, respectively. It should be noted that the groundwater level in BH's RW-1 and RW-2 was dry to the probable bedrock surface after completion. However, it is likely that the groundwater level is subject to seasonal fluctuations.

DISCUSSION AND RECOMMENDATIONS

It is proposed to construct a 203 m long retaining wall along the N-W ramp from Red River Road/Hwy. 102 to Hwy. 11/17, ranging in height from about 1.5 m at Station 18+725 to about 4.5 m at Station 18+928 (from North abutment of proposed Hwy. 11/17 underpass structure). The existing ground surface at the site ranges from about 241.7 m at Station 18+725 to about 244.5 m at Station 18+928 with a proposed highway grade of 242.5 m and 243.0 m, respectively. However, it should be noted that since a 1.5 m deep drainage ditch should be constructed outside of shoulder in front of proposed retaining wall, the bottom elevation of drainage ditch ranges from 241.0 m at Station 18+725 to 241.5 m at Station 18+928 adjacent to the bridge abutment.

Recommendations pertaining to the foundation of the new retaining wall and related earth works are summarized as follows:

Retaining Wall Foundation

In consideration of the shallow bedrock from the proposed Hwy. 11/17 grade and drainage ditch at this location, spread footings can be founded on bedrock surface. However, it should be noted that since some depression of bedrock surface was found to exist at this location, three stepped footings are recommended to be found at elevation of about 240.3 m between Station 18+725 and 18+800 and at the elevation of about 240.8 m between Stations 18 + 800 and 18 + 900, and the elevation of about 241.3 m between Stations 18+900 and 18+928. The existing overburden material should be excavated down to the bedrock surface and the rock surface should be cleaned before the excavation is backfilled with lean concrete to the proposed footing elevations.

For the purpose of the O.H.B.D.C., the following value is recommended:

Factored Bearing Capacity at U.L.S. : 1500 kPa

Footing Elevations: 240.3 m between Sta.'s 18+725 & 18+800

240.8 m between Sta.'s 18+800 & 18+900

241.3 m between Sta.'s 18+900 & 18+928

The design of shallow footing founded on unyielding type of medium such as bedrock, will not be governed by settlement since the bearing capacity at S.L.S. Type II is much larger than the factored bearing capacity at the U.L.S.

Alternatives, such as Reinforced Earth Retaining Wall or Geo-Crete Wall can be also considered at this location. However, it should be noted that if any alternatives are considered, this office will provide further information.

OTHER CONSIDERATIONS

Lateral Earth Pressure

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

Design parameters of the soil are given below for purpose of the O.H.B.D.C.:

	<u>Granular 'A'</u>	<u>Granular 'B'</u>
Angle of Internal Friction (ϕ)	35	30
Unit Weight (kN/m^3), γ	22.8	21.2
Coefficient of Active Earth Pressure (K_a)	0.27	0.33
Coefficient of Earth Pressure at Rest (K_o)	0.43	0.5

Lateral pressures should be computed in accordance with Section 6.6.1.2.1 of the code. A yielding foundation condition may be assumed. Sliding resistance may be computed by assuming a coefficient of friction of 0.7 between underside of footings and the founding bedrock. Weep holes in the retaining wall should be designed to drain any accumulation of water in the backfill.

The backfill beyond the granular wedge as illustrated on OPSD 803 series can consist of acceptable borrow material as defined in OPSS 212.05.

Dewatering

The footings for the structure should be constructed in dry condition. Based on the subsurface investigation, for the spread footing foundation, the excavations will extend down to the maximum 1.9 m below the groundwater level. It is therefore recommended to construct an oversized excavation comprised of perimeter ditches with a properly filtered sump pump discharge system similar to that shown in Figure 5.

Ramp Approaches and Excavations

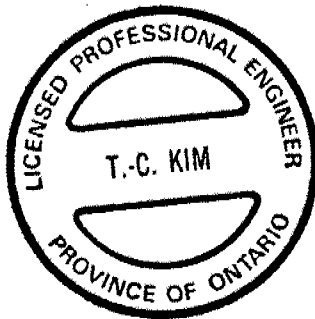
All organics and softened material should be stripped from the plan limits of the immediate ramp approach embankments prior to placement of any fill.

No stability problems are anticipated for the proposed temporary and permanent embankments and cuts using MTO current standards.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of M. Iampietro, Student Engineer. The equipment was owned and operated by Dominion Soil Investigation Inc., Thunder Bay.

This report was written by T.C. Kim, Senior Foundation Engineer and reviewed by M. Devata, Chief Foundation Engineer.



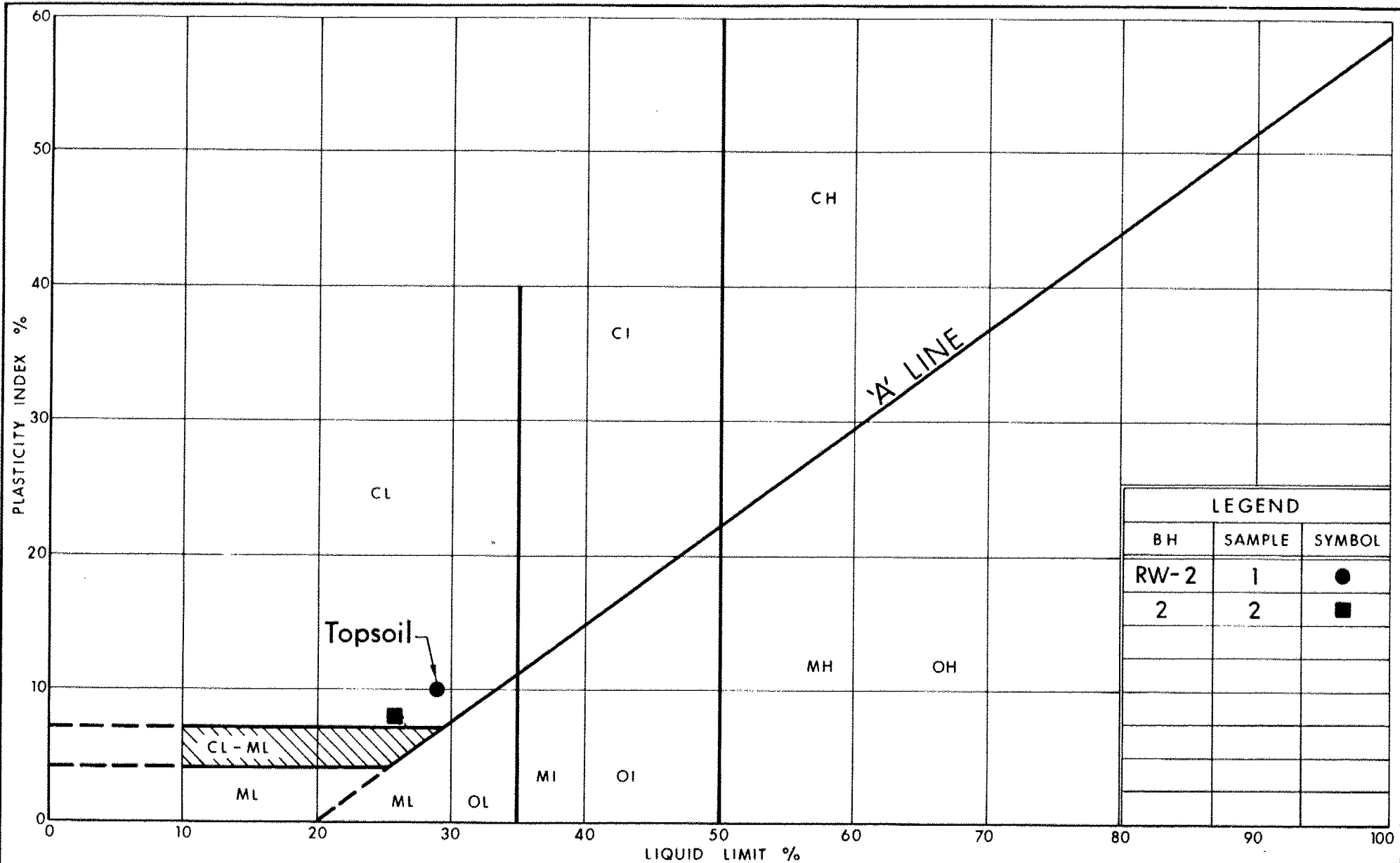
Tae. C. Kim
Tae. C. Kim, P. Eng.

Senior Foundation Engineer

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Chief Foundation Engineer

APPENDIX



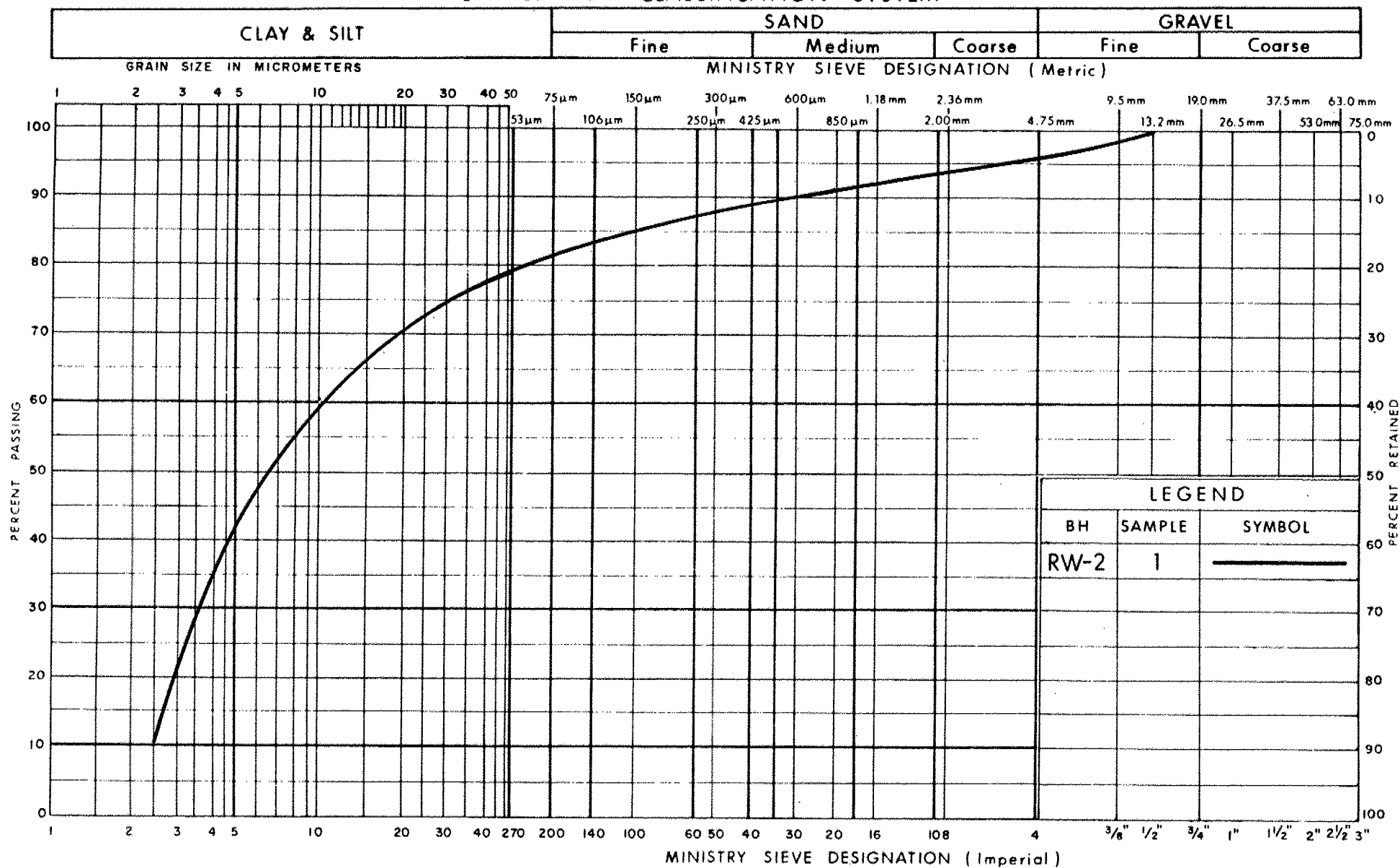
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PLASTICITY CHART CLAYEY SILT (Topsoil)

FIG No 1

W P 619-89-02A

UNIFIED SOIL CLASSIFICATION SYSTEM

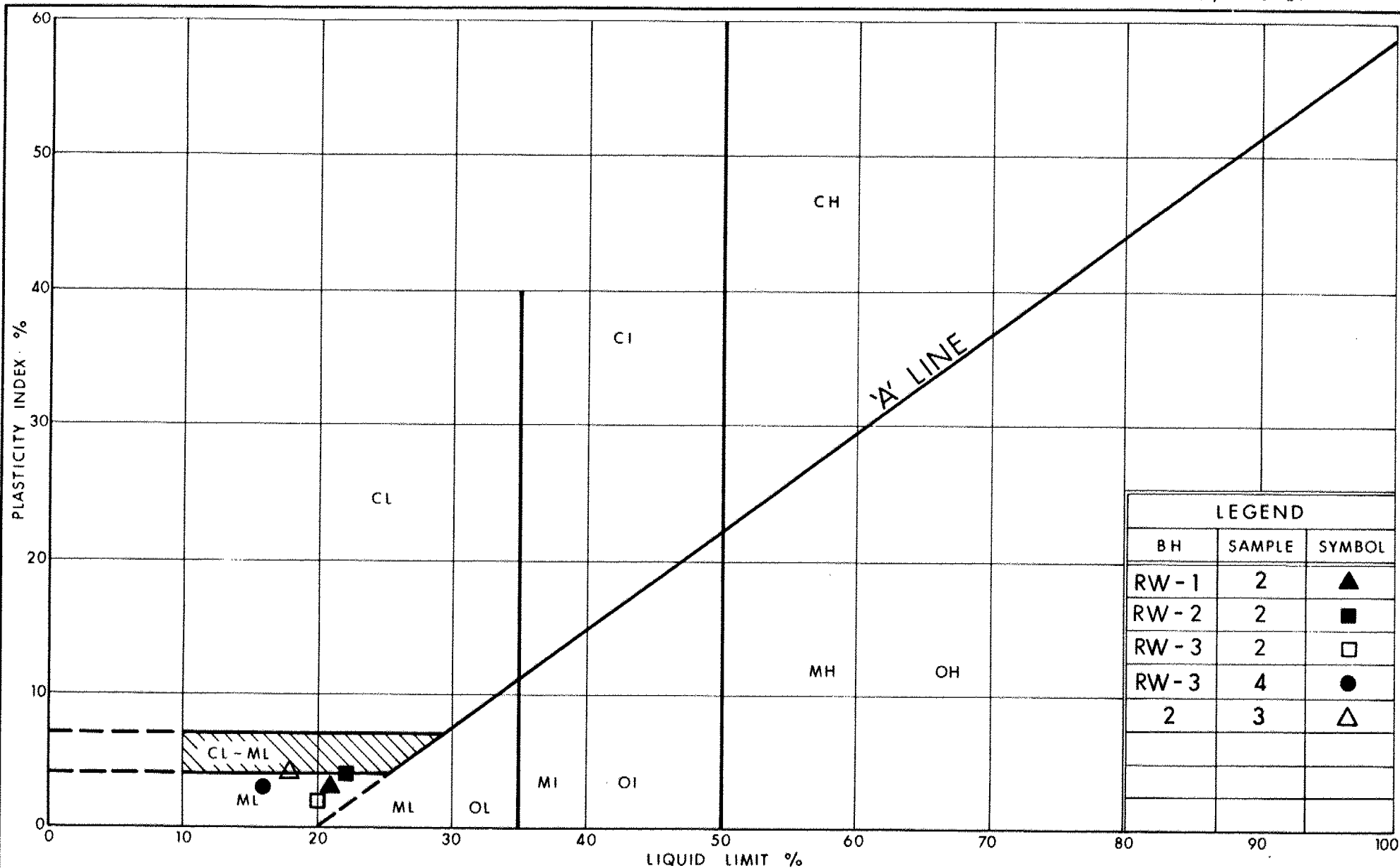


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GRAIN SIZE DISTRIBUTION
CLAYEY SILT (Topsoil)

FIG No 2

W P 619-89-02A



Ontario

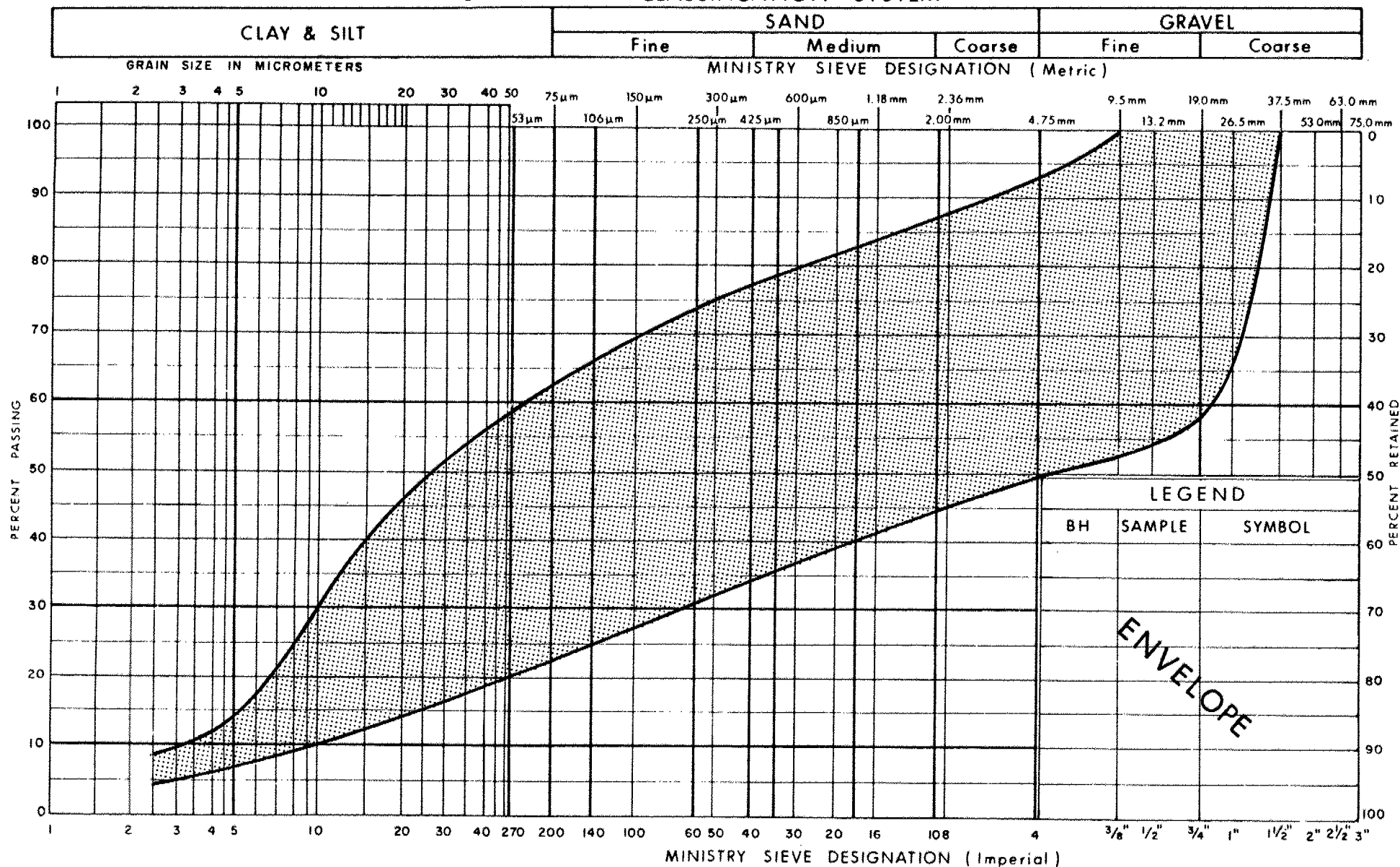
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PLASTICITY CHART HET MIXTURE OF SILT, SAND & GRAVEL, TRACE OF CLAY (Non-Cohesive Glacial Till)

FIG No 3

W P 619-89-02A

UNIFIED SOIL CLASSIFICATION SYSTEM

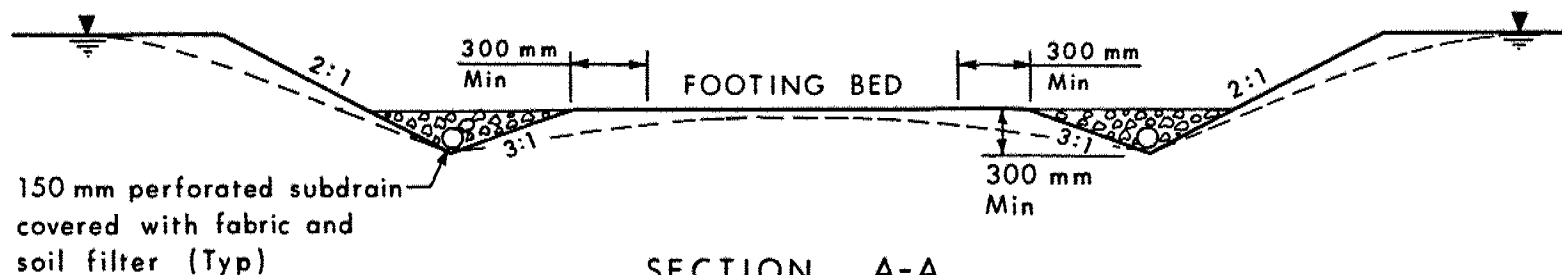
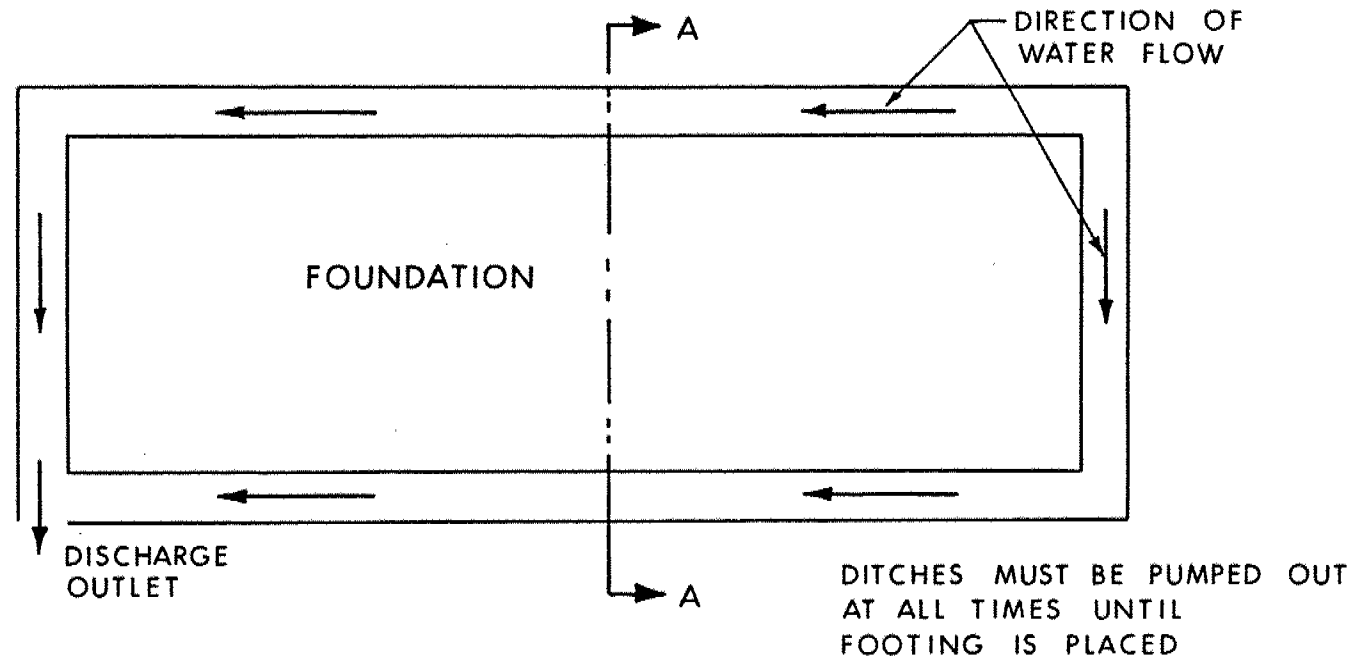


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GRAIN SIZE DISTRIBUTION
 HET MIXTURE OF SILT, SAND & GRAVEL,
 TRACE OF CLAY (Non-Cohesive Glacial Till)

FIG No 4

W P 619-89-02A



SECTION A-A
(NTS)
DEWATERING SCHEME - PERIMETER DITCHES

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

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

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

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 = $\frac{w_L - w_p}{w - w_p}$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{\max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m^3	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No RW-1 1 OF 1 METRIC

W.P. 619-89-02A LOCATION Sta 18+730.0; o/s 25.0m Lt. from E of Hwy 11/17 ORIGINATED BY MI
 DIST 19 HWY 11/17 BOREHOLE TYPE HS Auger, Cone Test COMPILED BY AD
 DATUM Geodetic DATE 91 08 23 CHECKED BY TCK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
241.7	Ground Surface												
0.0	Reddish Brown Clayey Silt, trace of organics (Topsoil)					DRY *							
240.8			1	SS	12								
0.9	Heterogeneous Mixture of Silt, Sand and Gravel, trace of clay Compact to Very Dense (Glacial Till)		2	SS	67								20 42 32 6
239.3			3	SS	100	/8cm		100/28cm					
2.4	End of Borehole at probable Bedrock												
	* Borehole Dry upon completion												

RECORD OF BOREHOLE No RW-2 1 OF 1 METRIC

W.P. 619-89-02A LOCATION Sta 18+830.0; o/s 25.0m Lt. from E of Hwy 11/17 ORIGINATED BY MI
DIST 19 HWY 11/17 BOREHOLE TYPE HS Auger COMPILED BY AD
DATUM Geodetic DATE 91 08 23 CHECKED BY TCK

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					
243.7	Ground Surface															
0.0	Reddish Brown Clayey Silt, trace of sand and gravel, some organics (Topsoil)		1	SS	53	DRY *										4 15 65 15
242.6			2	SS	100											49 27 19 5
1.1	Heterogeneous Mixture of Silt, Sand and Gravel, trace of clay Very Dense (Glacial Till)		3	SS	100	/28cm										
240.8																
2.9	End of Borehole at probable Bedrock															
	* Borehole Dry upon completion															

RECORD OF BOREHOLE No RW-3 1 OF 1 METRIC

W.P. 619-89-02A LOCATION Sta 18+910.0; o/s 40.0m Lt. from E of Hwy 11/17 ORIGINATED BY MI
 DIST 19 HWY 11/17 BOREHOLE TYPE HS Auger, Cone Test COMPILED BY AD
 DATUM Geodetic DATE 91 08 23 CHECKED BY TCK

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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40						60	80
243.8	Ground Surface															
0.0	Clayey Silt, some organics (Topsoil)															
242.9	Dark Brown															
0.9	Reddish Brown		1	SS	15											
	Heterogeneous Mixture of Silt, Sand and Gravel, trace of clay, occasional silt layers Compact to Very Dense (Glacial Till)		2	SS	75											
	Silt Brown		3	SS	88											
	Grey		4	SS	100											
240.4	End of Borehole at probable Bedrock															
3.4																

91 08 25
 * GROUND WATER CONDITIONS

PIEZO. NO.	GROUND WATER ELEVATION (Metres)
1	242.3

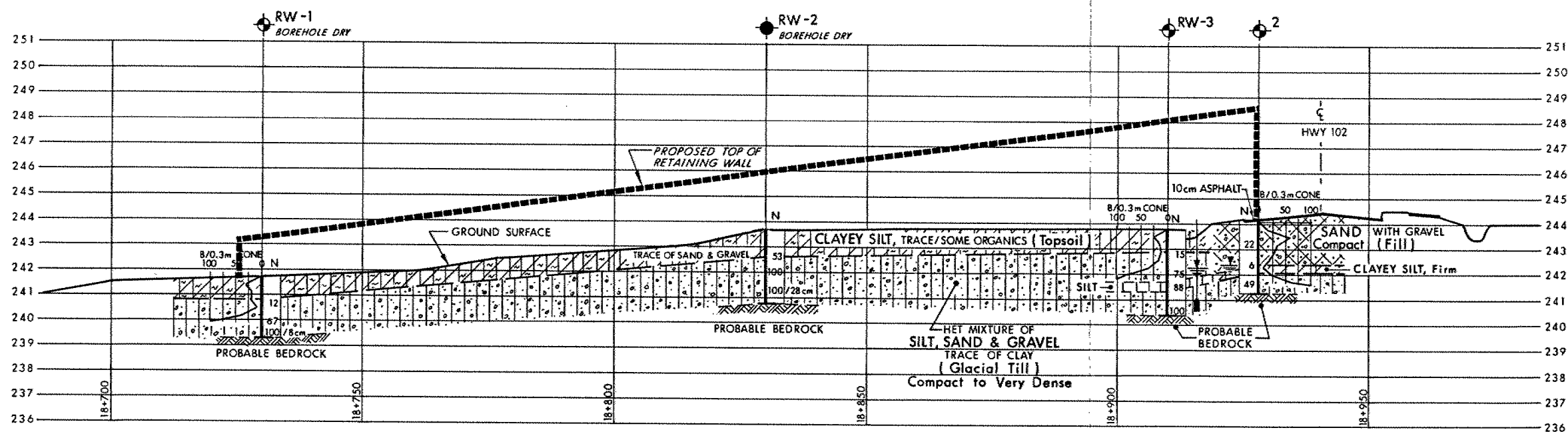
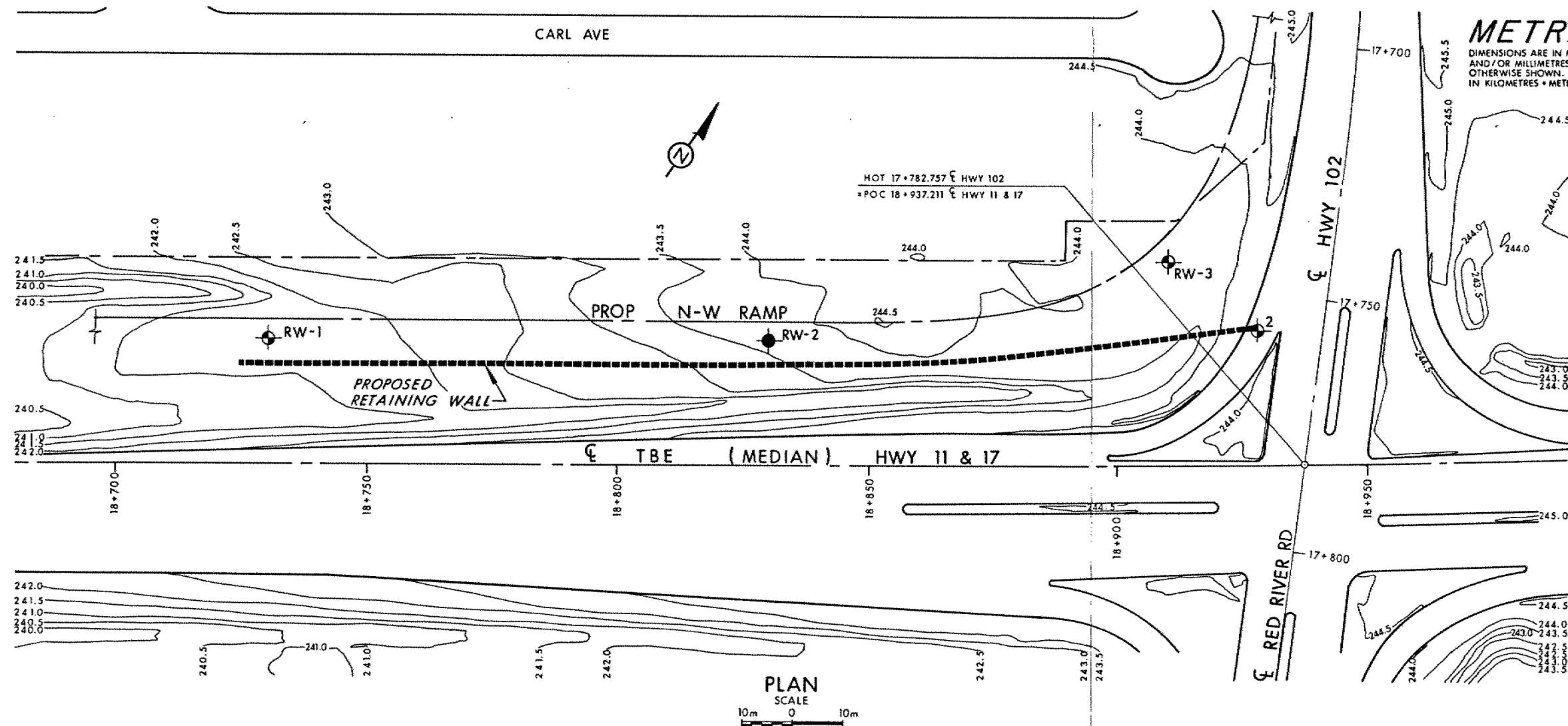
RECORD OF BOREHOLE No 2*

1 OF 1

METRIC

W.P. 619-89-02 LOCATION Sta 18+928.0; o/s 26.5m Lt. from C of Hwy 11/17 ORIGINATED BY MI
DIST 19 HWY 11/17 BOREHOLE TYPE HS Auger, Cone Test COMPILED BY MI
DATUM Geodectic DATE 91 05 31 CHECKED BY TK

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 w _p w w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
244.2	Ground Surface									
0.0	Asphalt									
0.1	Brown									
	Sand with Gravel Compact (Fill)		1	SS	22					
242.4			2	SS	6					
1.8	Clayey Silt, Firm									
2.1	Het. Mixture of Silt, Sand and Gravel, trace of clay Dense		3	SS	49					
241.3	(Glacial Till)									6 31 60 3
2.9	End of Borehole at Probable Bedrock									
<p>* This borehole was driven for the bridge structure at the interchange between Hwy 11/17 and Red River Road/Hwy 102.</p>										



SECTION ALONG PROPOSED RETAINING WALL

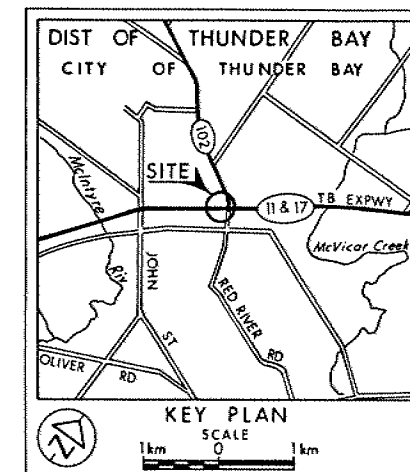
NOTE: STATIONS SHOWN ON THE SECTION ARE FROM C (MEDIAN) HWY 11 & 17

CONT No
WP No 619-89-02A

PROPOSED RETAINING WALL
(AT RED RIVER RD / HWY 102)
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 at time of investigation 1991 05 and 1991 08
- PIEZOMETER

No	ELEVATION	STATION	OFFSET
RW-1	241.7	18+730.0	25.0mLT
RW-2	243.7	18+830.0	25.0mLT
RW-3	243.8	18+910.0	40.0mLT
2	244.2	18+928.0	26.5mLT

NOTE

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

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

REV	DATE	BY	DESCRIPTION
Geocres No 52A-113			
HWY No 11 & 17 (TBE)			DIST 19
SUBMD TCK	CHECKED	DATE 1992 02 16	SITE
DRAWN RS	CHECKED	APPROVED	DWG 6198902A-A