G.I.-30 SEPT. 1976

GEOCRES No. 40Pg-36

DIST. 3 REGION

W.P. No. 601-92-01

CONT. No.

W. O. No.

STR. SITE No. 35-443

HWY. No. 6

LOCATION Hwy 6 Culvert Extension
Marden Reservoir

No OF PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 601-92-01 DIST 2

HWY 6 STR SITE 35-443

Marden Reservoir Culvert Extension
Stn. 10+939.85

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GEOCRES 40P9-36 DATE MAY 3 1 1994

FOUNDATION INVESTIGATION REPORT

For

Marden Reservoir Culvert Extension

W.P. 601-92-01; Site 35-443, Stn. 10+939.85

Highway 6, District 2, London

INTRODUCTION

This report contains the results of a foundation investigation carried out at the above mentioned site. The field work was carried out between 1993 04 20 and 1993 04 26 and comprised of two sampled boreholes and Dynamic Cone Penetration Test adjacent to these holes.

Boreholes were advanced to a maximum depth of 7.2 m (El. 326.2) below the reservoir water level using a diamond drill.

SITE DESCRIPTION

The site under investigation is located at the crossing of Highway 6 and Marden Reservoir in the Township of Guelph, County of Wellington.

The site under investigation is located in an area where the surface is drumlinized. The topography of the site is generally undulating with the valley running almost at rightangle to the trend of the drumlins. Physiographically, the area is located in the region known as the "Guelph Drumlin Field".

SUBSURFACE CONDITIONS

The underlying subsoil at this site consists of 0.3 m peat underlain by 3.0 m very dense gravelly sand on the upstream side and on the downstream side, it is underlain by 2.4 m dense silty sand followed by 2.3 m very dense gravelly sand. This gravelly sand is underlain by limestone bedrock. For classification purposes, the soils encountered at this site can be divided into three different zones.

a) Silty Sand, Trace Gravel

b) Gravelly Sand, Trace Silt

c) Limestone Bedrock

The soils encountered during the course of the investigation, together with the field and laboratory test results are shown on the Record of Borehole sheets contained in the Appendix of this report. A stratigraphical section is shown on Drawing No. 6019201-A. This drawing also shows the locations and elevations of the borings. Description of the strata encountered are given below.

Silty Sand, Trace Gravel

This silty sand deposit was encountered only on the downstream side immediately below the peat layer at the reservoir bottom. The thickness of this deposit is about 2.4 m and extends to elevation 329.0 m. The Gradation Test carried out on a representative sample is shown on Figure 1. The Standard Penetration Test results vary over a wide range (42 blows/0.3 m to 105 blows/0.3 m) indicating dense to very dense state of denseness.

Gravelly Sand, Trace Silt

This gravelly sand deposit was encountered immediately below the peat layer on the upstream side, however, on the downstream side silty sand layer overlies this stratum. The thickness of this deposit varies from 2.4 m to 3.0 m and extends to elevations 329.0 m to 326.6 m. The Gradation Test results are shown on Figure 2 in an envelope form. These test results indicate that this deposit is predominantly composed of gravel (37% to 41%) and sand (39% to 53%). The Standard Penetration Test results indicate that this deposit is in very dense state of denseness ('N' values 59 blows/0.3 m to over 100 blows/0.3 m).

Limestone Bedrock

The gravelly sand deposit is underlain by limestone bedrock. However, rock coring was not carried out to confirm the bedrock or to assess the quality and type of bedrock.

Groundwater Conditions

The maximum depth of water in the reservoir was observed to be about 1.5 m. The water level may be expected to fluctuate due to the influence of the creek.

DISCUSSION AND RECOMMENDATIONS

General

It is proposed to widen the existing Highway 6 to accommodate two future lanes on either side without altering the median. As a part of the widening, the existing 3.86 m dia. CSP culvert at the crossing of Highway 6 and Marden Reservoir will be extended. The final grade of the road at this location will be maintained at the existing elevation (i.e. 338.3 m).

The existing embankment appears in very good condition. However, minor surface erosion near culvert location as well as distortion of the pipe on the upstream side have been noticed.

The rate of flow through the culvert is relatively slow (less than 0.2 m to 0.3 m per sec.) and there is no noticeable flow in the reservoir area.

Construction of Embankment

The maximum height of fill is expected to be about 6.5 m. No major stability problems are anticipated for the embankment constructed with 2 horizontal to 1 vertical side slopes. The fill should consist of well compacted acceptable material. However, the underwater portion of the fill should consists of granular material up to the high water level. The peat as well as any spongy or soft areas observed within the base width of the embankment should be removed before placing the fill. The benching for the embankment shall be carried out in accordance with OPSD 208.01 dated 1988 12 01. Rip-rap should be provided to a height of 1.0 m above the high flood level.

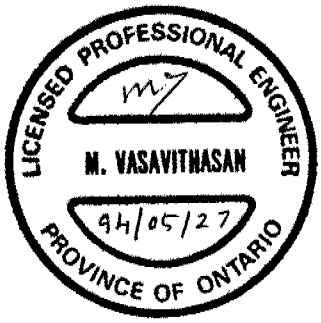
The nature of the soil encountered at this site will impose great difficulty to drive sheet pile. Considering the depth of water (1.5 m) and the rate of flow through the culvert (less than 0.2 m to 0.3 m/sec), coffer dam consisting of sand bags and clay puddle may be constructed. Dewatering may be carried out from the sumps located along the periphery of the coffer dam.

In order to avoid any flooding of upstream and to maintain the continuity of the flow, a pipe to carry sufficient water may be placed within the existing culvert and sealed with clay puddle at the entry.

If, any environmental restrictions are imposed on placing clay puddle in the reservoir or flow of water cannot be restricted, the culvert extension may be constructed under the prevailing water level. If construction is carried out under water, the bedding material consists of crushed stone containing particle size not finer than 75 μm is recommended.

MISCELLANEOUS

The field work for this investigation was carried out under the supervision of M. Vasavithasan. The equipment used was owned and operated by Master Soil Investigation Ltd. This report was prepared by M. Vasavithasan, Foundation Engineer and reviewed by P. Payer, Senior Foundation Engineer and approved by M. Devata, Chief Foundation Engineer.

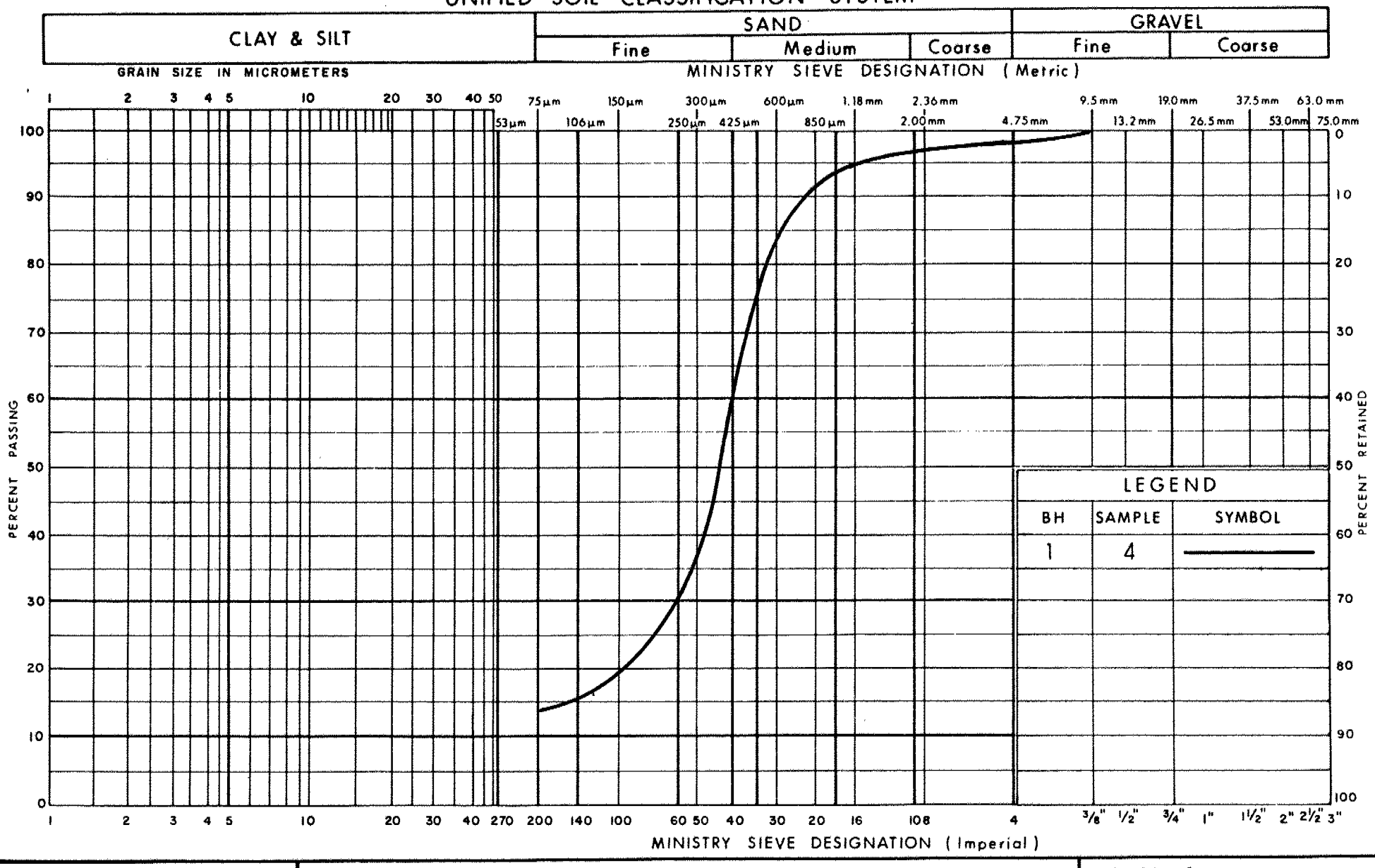


M. Vasavithasan, P.Eng.
Foundation Engineer

M. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

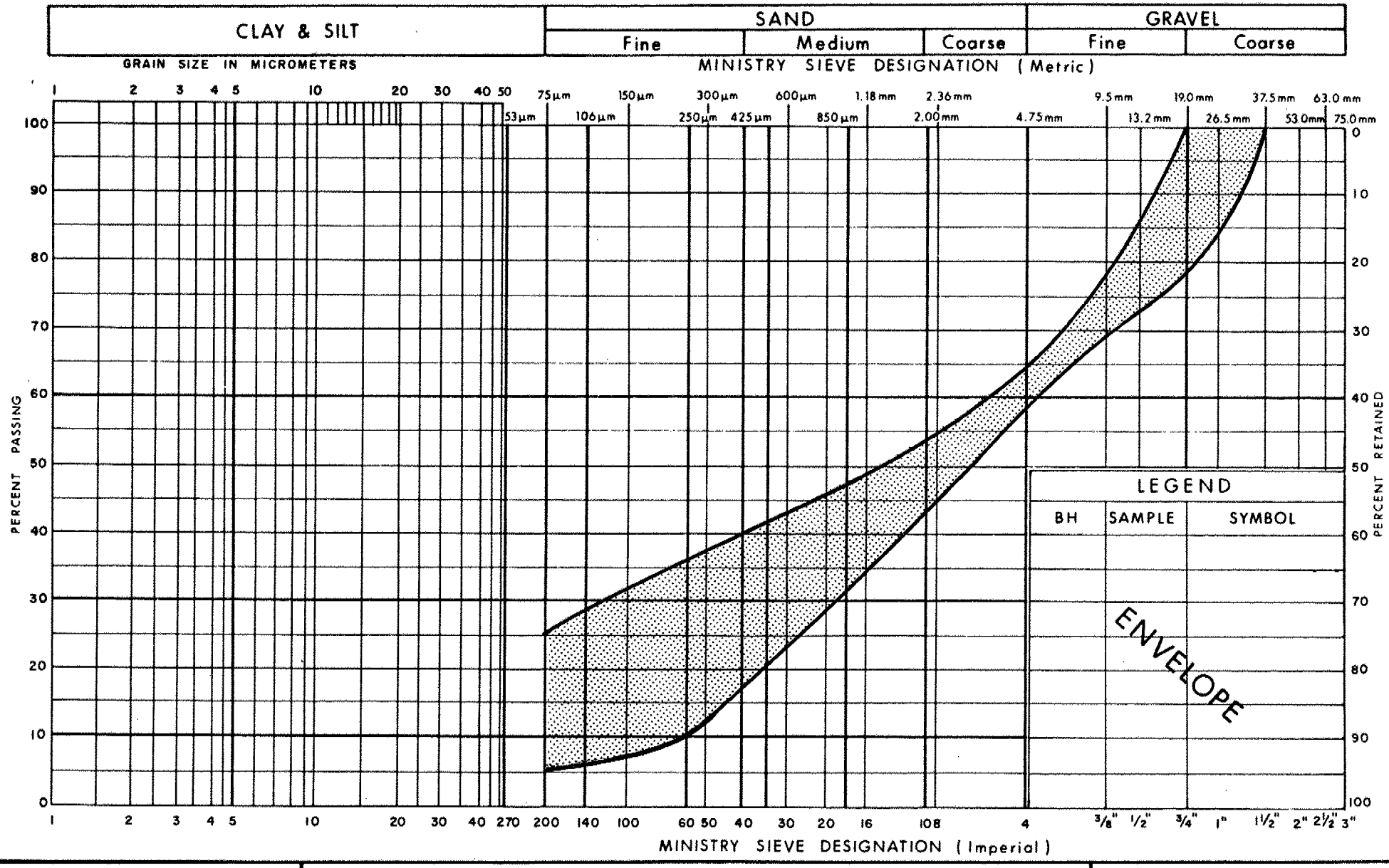
SILTY SAND, TRACE OF GRAVEL

FIG No 1

W P 601-92-01

78 12 M

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION
GRAVELLY SAND, SOME / TRACE SILT

FIG No 2
W P 601 - 92 - 01

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 (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

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

MECHANICAL PROPERTIES OF SOIL

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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

e	1,%	VOID RATIO
n	1,%	POROSITY
w	1,%	WATER CONTENT
S_r	%	DEGREE OF SATURATION
w_L	%	LIQUID LIMIT
w_P	%	PLASTIC LIMIT
w_S	%	SHRINKAGE LIMIT
I_P	%	PLASTICITY INDEX = $w_L - w_P$
I_L	1	LIQUIDITY INDEX = $\frac{w - w_P}{I_P}$
I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_P}$
e_{max}	1,%	VOID RATIO IN LOOSEST STATE

e_{min}	1,%	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	n PERCENT - DIAMETER
C_U	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDRAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE

RECORD OF BOREHOLE No 1 — 1 OF 1 — METRIC

W.P. 601-92-01 LOCATION Sta. 10+936.8, o/s 30.3m Rt C/L Hwy 6 ORIGINATED BY M V

DIST 2 HWY 6 BOREHOLE TYPE CONE TEST & NW CASING COMPILED BY M V

DATUM GEODETIC DATE 93 04 21 CHECKED BY M V

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
333.4	Reservoir Water Level										
0.0	WATER						333				
331.9	Reservoir Bottom						332				
1.5	Peat										
	Silt, Trace of Sand & Gravel		1	SS	21						
			2	SS	105		331				
	SILTY SAND, Trace of Gravel,										
	Occasional Gravel Layers,		3	SS	44		330				
	Dense to Very Dense										
329.0			4	SS	42		329				2 85 (13)
4.4			5	SS	67			120/25cm			
	GRAVELLY SAND, Trace of Silt,		6	SS	86		328				41 53 (6)
	Very Dense		7	SS	106	/15cm	327				
326.6											
326.2	Probable LIMESTONE BEDROCK										
7.2	End of Borehole										

Note:
Below El. 326.6 Borehole
Was Advanced With Tri-Cone

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

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

RECORD OF BOREHOLE No 2 — 1 OF 1 — METRIC

W.P. 601-92-01 LOCATION Sta. 10+943.2, o/s 22.5m Lt C/L Hwy 6 ORIGINATED BY M V

DIST 2 HWY 6 BOREHOLE TYPE CONE TEST & NW CASING COMPILED BY M V

DATUM GEODETIC DATE 93 04 23 CHECKED BY M V

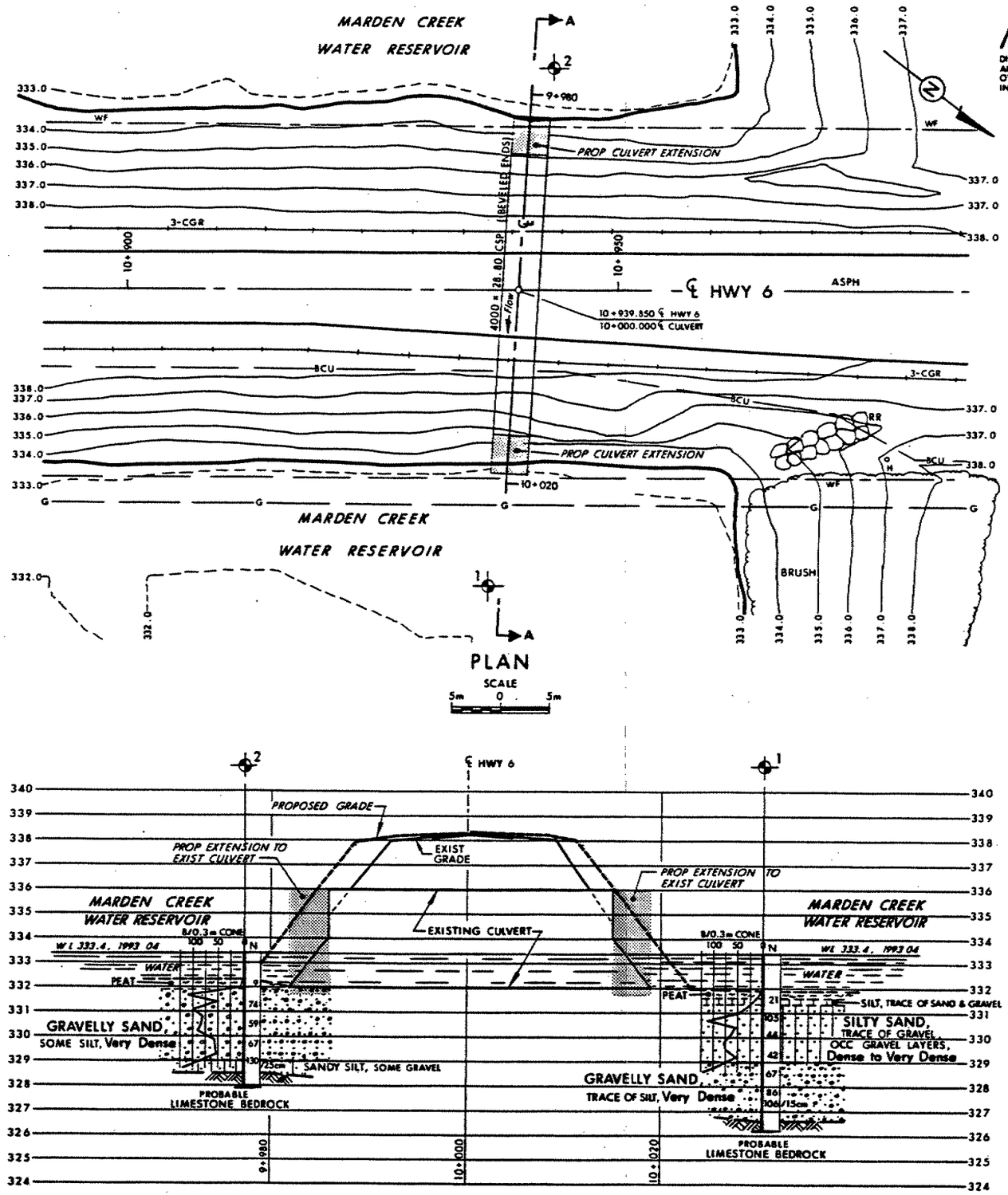
SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, + FIELD VANE, • QUICK TRIAXIAL, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
333.4	Reservoir Water Level										
0.0	Water						333				
332.3	Reservoir Bottom										
1.1	Peat		1	SS	9		332				
			2	SS	74						38 48 (14)
	GRAVELLY SAND, Some Silt, Very Dense		3	SS	59		331				
			4	SS	67		330				37 39 (24)
			5	SS	130 /25cm		329	120/28cm			17 31 (52)
328.5	Sandy Silt, Some Gravel										
4.9	Probable LIMESTONE BEDROCK						328				
327.9											
5.5	End of Borehole										

Note:
Below El. 328.5 Borehole Was Advanced With Tri-Cone

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION, ONTARIO FH-0-207 88 10



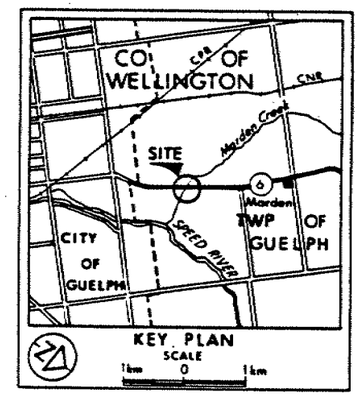
METRIC

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

CONT No
WP No 601-92-01

MARDEN RESERVOIR
CULVERT EXTENSION
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)
- WL at time of investigation 1993 04

No	ELEVATION	STATION	OFFSET (℄ HWY 6)
1	333.4	10+936.8	30.3m RT
2	333.4	10+943.2	22.5m LT

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 GC 2.01 of OPS Gen.Cond.

REV.	DATE	BY	DESCRIPTION

Geocres No 40P9-38

HWY No 6			DIST 2
SUBMD MV	CHECKED	DATE 1996 02 04	SITE 35-443
DRAWN RS	CHECKED		DWG 6019201-A

REF No E-153-6-6A, 1993 06

M E M O R A N D U M

Ontario

To: A. Ho
Head, Structural Section
Southwestern Region

Date: May 27, 1993

Attn: Antony Fediw

From: Foundation Design Section
Room 315, Central Building
Downsview

Re: Marden Reservoir Culvert Extension
W.P. 601-92-01, Site 35-443, Stn 10+939
Highway 6, District 3, Stratford

The fieldwork for this project was commenced on 1993 04 20 and completed on 1993 04 26. Since the fieldwork and the laboratory tests have been completed, an advanced recommendation is submitted to enable you to proceed with the design. In the absence of the E-plan, the final foundation investigation report cannot be submitted and we will require at least six weeks from the date of receiving the E-plan. However, the Record of Borehole Sheets as well as the grain size distribution curves are attached to this memo.

Fieldwork comprised of two sampled boreholes and Dynamic Cone Penetration Test adjacent to these holes.

It is proposed to widen the existing Highway 6 to accommodate two future lanes on either side without altering the median. As a part of the widening, the existing 3.86 m dia. CSP culvert at the crossing of Hwy 6 and Marden Reservoir will be extended. The final grade of the road at this location will be maintained at the existing elevation (ie 338.3).

The existing embankment appear in very good condition. However, minor surface erosion near culvert location as well as distortion of the pipe on the upstream side have been noticed.

The rate of flow through the culvert is relatively slow (less than 0.2 to 0.3 m/sec) and there is no noticeable flow in the reservoir area.

The borings at this site indicate presence of 0.3 m peat underlain by 3.4 m very dense gravelly sand on the upstream side and on the downstream side, it is underlain by 2.4 m dense silty sand followed by 2.3 m very dense gravelly sand. This gravelly sand is underlain by limestone bedrock. However, the bedrock was not confirmed by coring.

The maximum depth of water was observed to be about 1.5 m and fluctuation may be expected due to the influence of the creek.

The maximum height of fill is expected to be about 6.5 m. No major stability problems are anticipated for the embankment constructed with 2 horizontal to 1 vertical side slopes. The fill should consist of well compacted acceptable material. However, the under water portion of the fill should consist of granular material up to the high water level. The peat as well as any spongy or soft areas observed within the base width of the embankment should be removed before placing the fill. The benching for the embankment shall be carried out in accordance with OPSD 208.01 dated 1988 12 01. Rip-rap should be provided to a height of 1.0 m above the high flood level.

The nature of the soil encountered at this site will impose great difficulty to drive sheet pile. In addition, the construction of a coffer dam may create a number of environmental problems. In order to avoid these problems, the culvert extensions should be constructed under the prevailing water level.

It is also recommended that the bedding material consists of crushed stone containing particle sizes not finer than 75 μm.

M. Vasavithasan, P. Eng.
Foundation Engineer

for

P. Payer, P. Eng.
Senior Foundation Engineer

PP/MV/jb

RECORD OF BOREHOLE No 1 — 1 OF 1 — METRIC

W.P. 601 - 92 - 01 LOCATION ORIGINATED BY M V

DIST 3 HWY 6 BOREHOLE TYPE CONE TEST & NW CASING COMPILED BY M V

DATUM GEODETIC DATE 93 04 21 CHECKED BY M V

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
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331.9	Reservoir Bottom										
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			3	SS	44		330				
328.9			4	SS	42						2 85 (13)
4.5			5	SS	67		329	120/25cm			
	GRAVELLY SAND, Trace of Silt, Very Dense		6	SS	86		328				41 53 (6)
			7	SS	106/15cm		327				
326.6											
326.2	Probable LIMESTONE BEDROCK										
7.2	End of Borehole										

Note: Below El: 326.6 Borehole Was Advanced With Tri-Cone

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 2 1 OF 1 METRIC

W.P. 601 - 92 - 01 LOCATION ORIGINATED BY M V

DIST 3 HWY 6 BOREHOLE TYPE CONE TEST & NW CASING COMPILED BY M V

DATUM GEODETIC DATE 93 04 23 CHECKED BY M V

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
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			3	SS	59						
			4	SS	67		330				37 39 (24)
			5	SS	103	/25cm	329	120/ 28cm			17 31 (52)
328.5	Sandy Silt, Some Gravel										
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327.9											
5.5	End of Borehole										

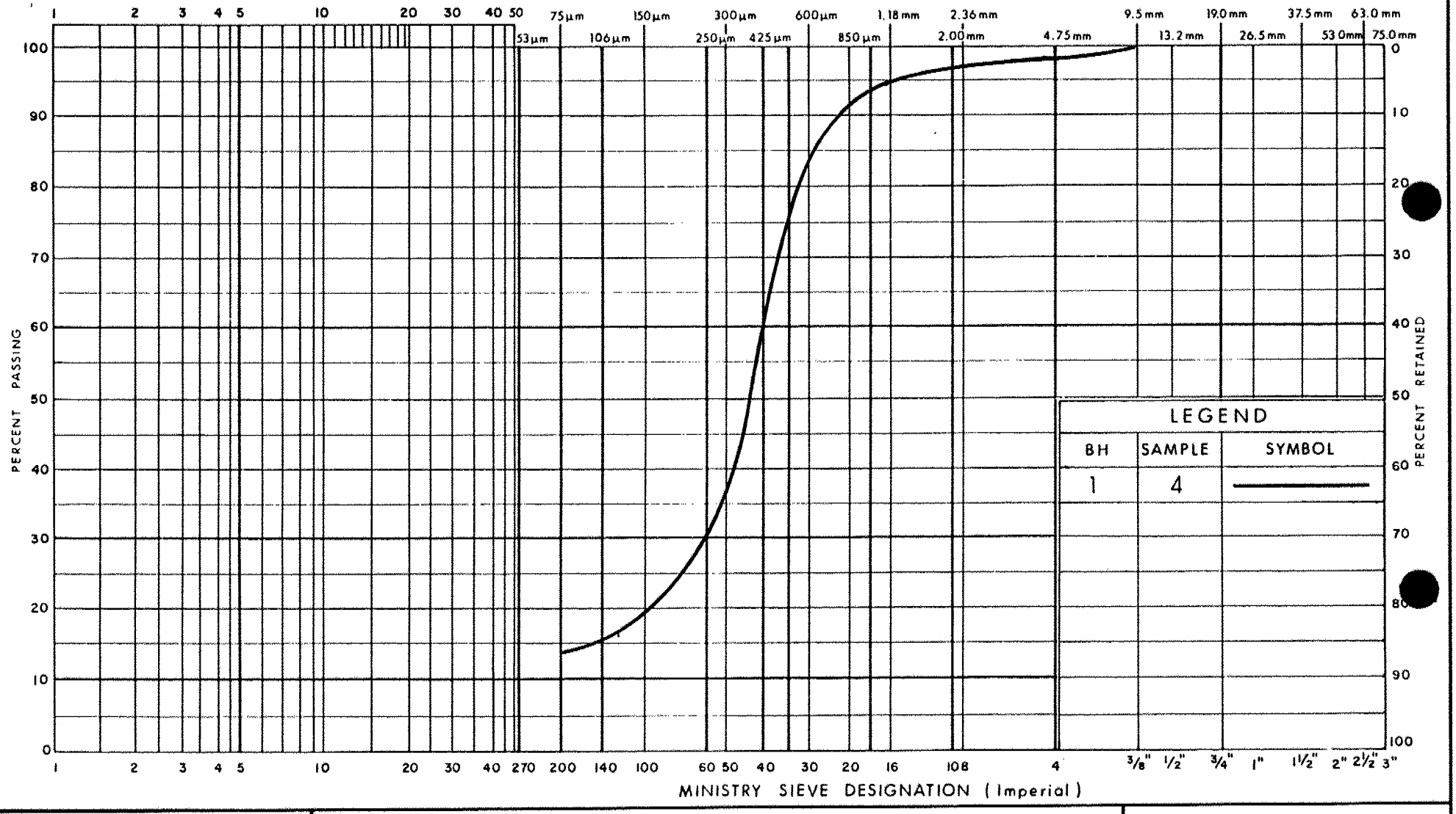
Note:
Below El: 328.5 Borehole
Was Advanced With Tri-Cone

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

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



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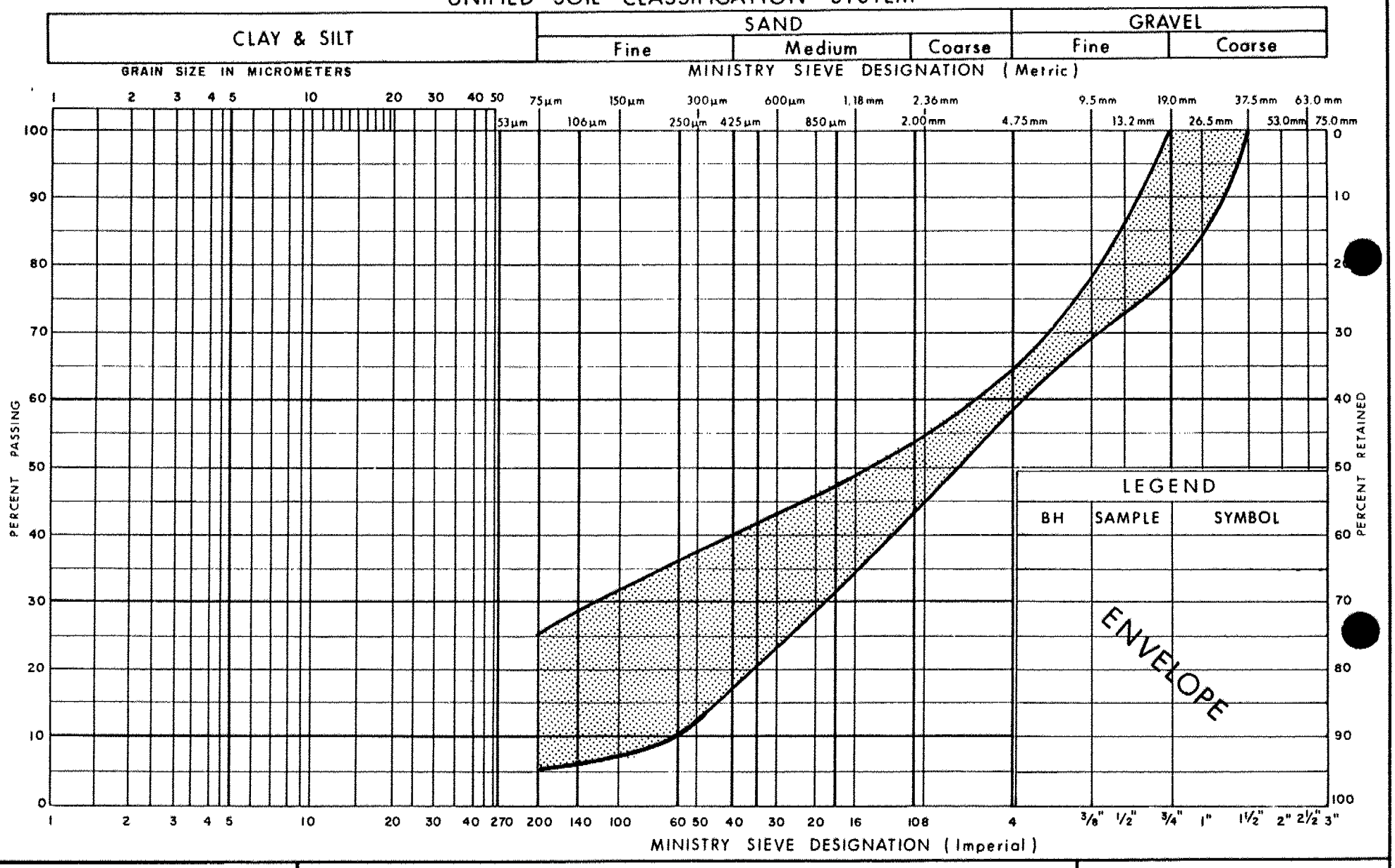
GRAIN SIZE DISTRIBUTION

SILTY SAND, TRACE OF GRAVEL

FIG No 1

W P 601-92-01

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

GRAVELLY SAND, SOME / TRACE SILT

FIG No 2

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COUNTY OF WELLINGTON

TOWNSHIP OF GUELPH