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GEOCRES No. 31D-261

DIST. 6 REGION

W.P. No. 160-74-38 (N.R.)

CONT. No. 85-56

W. O. No.

STR. SITE No.

HWY. No. 404

LOCATION Bogart Creek Culvert

No of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

ENGINEERING MATERIALS OFFICE

SOIL MECHANICS SECTION

CONT 85-56

WP 160-74-38 DIST 6

HWY 404 STR SITE N/A

Bogart Creek Bridge
2.4 Miles North of Regional Road 15

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SAMPLE DISPOSITION NOTICE

TYPE	DISCARD AFTER	RECOMM. BY
JARS	Sept. 30, 78	BL
TUBES	~~Sept~~ N/A	
ROCK CORES	N/A	

GEOCRES 31D - 261

DATE AUG 0 3 1978

FOUNDATION INVESTIGATION REPORT

For

Bogart Creek Bridge
2.4 Miles North of Regional Road 15
W.P. 160-74-38, Site N/A
Hwy. 404, District 6, Toronto

INTRODUCTION

This report contains the results of the foundation investigation carried out from June 27, 1978 to June 29, 1978 by the Soil Mechanics Section at the above mentioned site. The fieldwork consisted of seven sampled boreholes and six dynamic cone penetration tests. The boreholes were advanced by means of solid stem augers to depths ranging from 6.5 feet to 41.5 feet.

SITE DESCRIPTION AND GEOLOGY

The site is located 2.4 miles north of Regional Road 15, approximately 0.65 miles west of Woodbine Avenue in the Township of Whitchurch, County of York, in the Regional Municipality of York.

Bogart Creek originates about 4 miles to the southeast and flows in a northwesterly direction towards Newmarket where it joins the Holland River. At the time of the field investigation the depth of water in the creek varied from 0.5 to 1.5 feet. The creek bed is approximately 10 feet wide and 2 to 3 feet below the average ground surface with almost vertical banks.

The topography of the site is rising to the north and east away from Bogart Creek. Immediately east of the site location the flow of the creek is interrupted by a log dam. This dam results in the formation of a small shallow pond east of the site.

Land in the site vicinity is wooded with some scattered cleared areas.

The area is situated in the region known as the Schomberg Clay Plains. The clay deposits were laid over a drumlinized till

plain with the smaller drumlins completely covered. Average depth of clay deposits are 15 feet, although deeper deposits have been found.

SUBSURFACE CONDITIONS

General

Generally, uniform conditions prevail over the site. Underlying a thin veneer of topsoil up to one foot in depth is a 5 to 7 foot thick deposit of compact to dense gravelly sand with some silt. This granular deposit is underlain by an extensive deposit of glacial till which was not fully penetrated during the field investigation. This glacial deposit is generally cohesionless and very dense although pockets were encountered where the deposit is cohesive and hard in consistency.

Detailed descriptions of the various soil strata encountered are shown in the Record of Borehole Sheets. The locations and elevations of the borings, as well as one stratigraphical section, based on borehole data, are shown on Drawing No. 1607438-A.

Following is a description of the various subsoil types encountered.

Gravelly Sand, Some Silt

This deposit encountered immediately below a thin veneer of topsoil, is estimated to be 5 to 7 feet thick. The results of grain size distribution testing performed on representative samples from this deposit are shown in envelope form on Figure 1. The composition of the deposit is described as gravelly sand with some silt.

Standard Penetration Test 'N' values ranging from 9 to 39 blows per foot indicate that the deposit has a loose to dense relative density.

Glacial Till

This deposit was encountered immediately below the gravelly sand and was not explored to its full depth but proven to extend to a thickness of up to 34 feet. The results of grain size distribution testing performed on representative samples from this

deposit are plotted on Figure 1. The deposit is composed of zones of a basically non-plastic heterogeneous mixture of silt, sand and gravel and zones of a cohesive heterogeneous mixture of clayey silt, sand and gravel. A transition exists between the non-plastic and cohesive zones and as such the delineation of zones are difficult to establish. However, the thickness of the zones are estimated to be in the order of 10 to 20 feet thick with non-plastic zones generally occurring in the upper portion of the deposit.

Based on Standard Penetration Test 'N' values ranging from 33 to over 100 blows per foot in the cohesive zone, the consistency of the zone is estimated to be hard. In the non-plastic zones the range of 'N' values is 69 to over 100 blows per foot which indicates a very dense relative density.

Groundwater Conditions

The water level was observed by measuring in the open boreholes during the duration of the investigation. The water level was found to vary from 1 to 3 feet below the existing ground surface which corresponds to elevation 859 to 864. The water level in the creek was found to vary from elevation 859 to 866 which corresponds to the groundwater elevation observed in the boreholes.

DISCUSSION AND RECOMMENDATIONS

The proposed crossing of Hwy. 404 and Bogart Creek will be located 700 feet south of Sutton Road and approximately 3500 feet west of Woodbine Avenue. At this location it is proposed to construct Hwy. 404 as a four lane divided highway with a median width of about 100 feet. Here, Bogart Creek gently winds in a generally northwest direction through generally flat and wooded terrain.

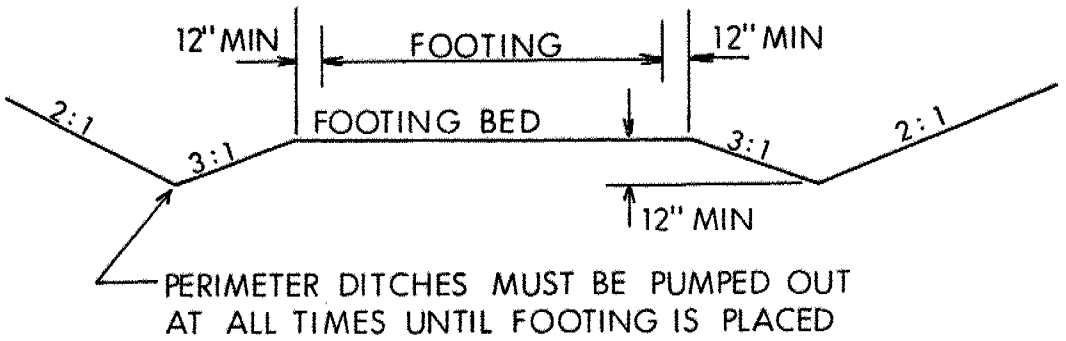
To accommodate the north and southbound lanes of Hwy. 404 and in addition, the Hwy. 404/Sutton Road Ramps W-S and S-E,W which are also crossing Bogart Creek at this location, it is proposed to construct a 560 foot long concrete box culvert. The proposed profile grade of Hwy. 404 is at about elevation 897, requiring embankment fill heights in the order of 32 feet above the average existing ground level.

Subsoil conditions at the site consist of a thin veneer of topsoil overlying 5 to 7 feet of loose to dense gravelly sand with some silt. Underlying this granular deposit is a glacial till being very dense where the deposit is non-plastic and hard where it is cohesive. The groundwater level was found to be 1 to 3 feet below the existing ground surface which corresponds to the water level in the creek.

The following recommendations pertain to the design and construction of the culvert and approaches.

Culvert

The subsoil conditions are such that the proposed concrete box culvert can be supported within the competent deposit of gravelly sand with some silt. The topsoil should be removed entirely below the base of the culvert foundation. For design purposes a modulus of subgrade reaction of 35 tsf/ft. may be used. In order to construct the footings in the dry and to prevent boiling of the base of the footing it will be necessary to employ a temporary dewatering scheme. This could be accomplished by means of an oversize excavation with perimeter drains as shown in the following sketch.



OVERSIZE EXCAVATION WITH PERIMETER DRAINS

The Hydrology Office should be contacted for the necessary recommendations to prevent piping along the culvert.

The culvert may be designed as an open type supported on spread footings. The water level requires that the invert elevation be located at elevation 858± to 865± at the upstream end. The base of the footing should be provided with a minimum of four feet of earth cover for frost protection purposes. The invert level and frost requirements dictate that the base of the footings would be at or below elevation 854 to 861. Subsoil conditions at this elevation consist of a very dense glacial till, composed of a heterogeneous mixture of silt, sand and gravel. Footings located within the glacial till deposit can be designed using an allowable bearing pressure of 4.0 tsf. For the open type culvert supported on spread footings a dewatering scheme will be necessary to prevent 'boiling' of the footing excavations and subsequent loss of bearing pressure. This could be accomplished by means of an oversize excavation with perimeter drains as discussed previously.

Culvert: Miscellaneous Considerations

For estimating the earth pressure on the culvert wall a coefficient of active earth pressure of Ka=0.3 may be used if some movement at the top of the wall is permitted, whereas if no movement at the top of the wall is anticipated, a coefficient of earth pressure at rest of Ko=0.5 may be used for design purposes.

To estimate the horizontal resistance to sliding the following values are suggested.

1. Between rough concrete and the gravelly sand or non-cohesive glacial till
   A coefficient of friction of 0.6

2. Between rough concrete and the cohesive glacial till
   A sliding resistance of 2000 psf

Stability Considerations

The profile grade of Hwy. 404 at Bogart Creek dictates that a fill height of up to 32 feet above the average ground surface will be required.

No stability problems are anticipated with fill heights up to 32 feet and 2:1 side slopes if the embankments are constructed in accordance with current M.T.C. standards.

MISCELLANEOUS

The fieldwork for the investigation was carried out under the supervision of Mr. D. Crawford, Student Technician, using equipment rented from Atcost Soil Drilling Inc., Toronto.

This report was written by Mr. M. MacLean, Project Engineer, with the assistance of Mr. D. Crawford and was reviewed by Mr. M. Devata, Supervising Engineer

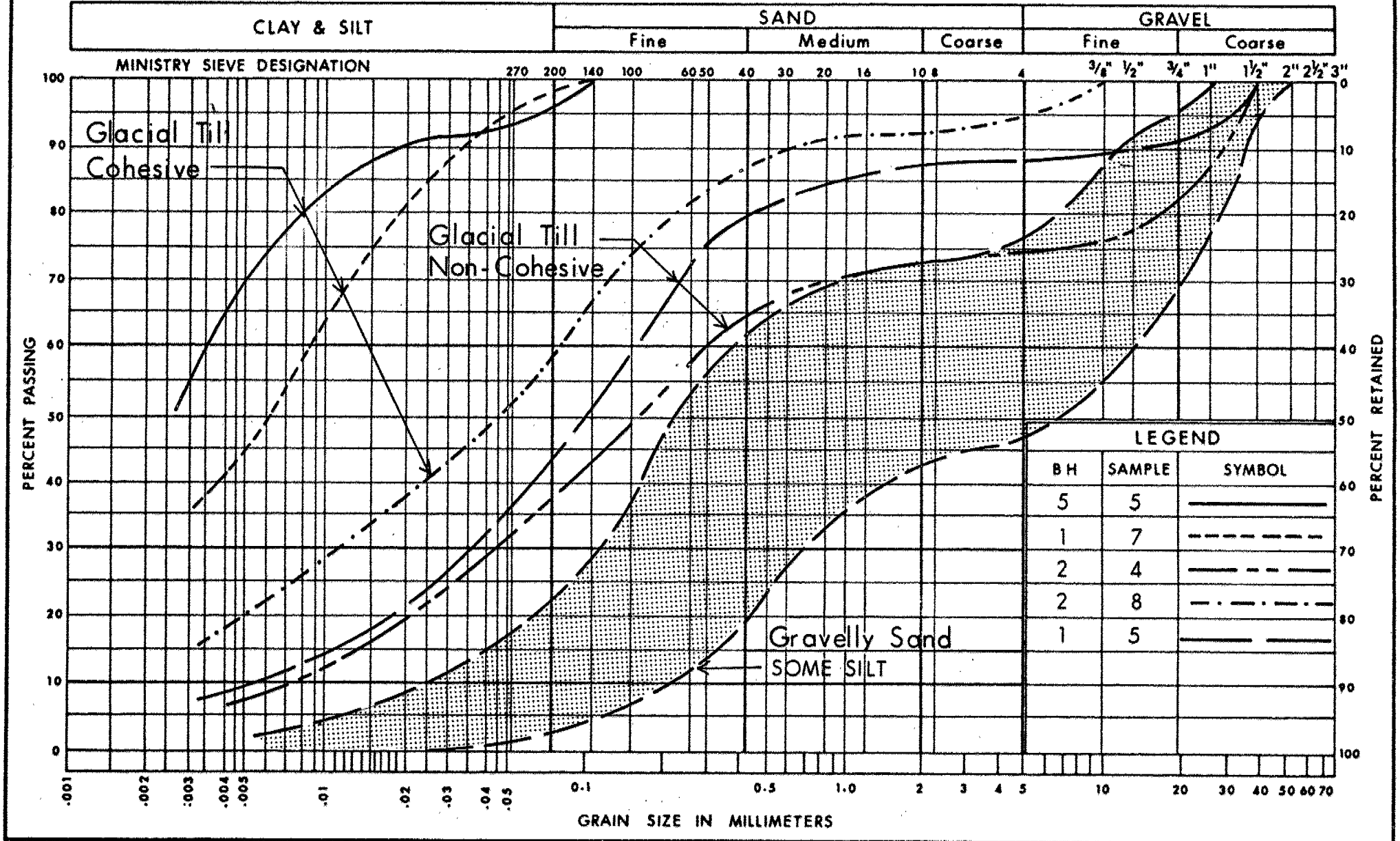
M. MacLean, P. Eng.
Project Engineer

M. Devata, P. Eng.
Supervising Engineer

July, 1978

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

FIG No 1
W P 160-74-38

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HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W P 160-74-38 LOCATION Coords. N 16,005,411; E 1,022,293 ORIGINATED BY D.C.

DIST 6 HWY 404 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY D.C.

DATUM Geodetic DATE June 29, 1978 CHECKED BY

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 (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
866.6	Ground Surface										
0.0	Topsoil		1	SS	4						
0.8	Gravelly Sand Some Silt Compact		2	SS	22	▼					44 41 13 2
858.3			3	SS	26		860				
8.3	Glacial Till Heterogeneous Mixture Silt, Sand and Gravel Very Dense		4	SS	100/ 4"						
			5	SS	85/ 6"				o		11 44 39 6
			6	SS	100/ 5"		850				
	Heterogeneous Mixture Clayey Silt, Sand and Gravel Hard		7	SS	100/ 6"				o		0 3 63 34
840.1			8	SS	100/ 2"						
26.5	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

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HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W P 160-74-38 LOCATION Coords. N 16,005,419; E 1,022,196 ORIGINATED BY D.C.

DIST 6 HWY 404 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY D.C.

DATUM Geodetic DATE June 28, 1978 CHECKED BY

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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
865.9	Ground Surface										
0.0	Topsoil		1	SS	9						
0.8	Gravelly Sand Some Silt Compact		2	SS	10	▼					
858.9			3	SS	10		860				
7.0	Glacial Till Heterogeneous Mixture Silt, Sand and Gravel		4	SS	95				○		25 38 31 6
			5	SS	110/5"						
	Very Dense		6	SS	100/4"		850				
	Heterogeneous Mixture Clayey Silt, Sand and Gravel		7	SS	100/3"						
	Hard		8	SS	100/4"		840		○		5 36 47 12
834.4			9	SS	100/6"						
31.5	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

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HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

W P 160-74-38 LOCATION Coords. N 16,005,378; E 1,022,102 ORIGINATED BY D.C.

DIST 6 HWY 404 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY D.C.

DATUM Geodetic DATE June 28, 1978 CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
865.9	Ground Surface						
0.0	Topsoil		1	SS	8		
0.8	Gravelly Sand Some Silt Compact		2	SS	34		
857.9			3	SS	20		860
8.0	Glacial Till Heterogeneous Mixture Silt, Sand and Gravel Very Dense		4	SS	86		
			5	SS	100/ 6"		
			6	SS	100/ 5"		850
			7	SS	100/ 3"		
			8	SS	95/ 6"		840
	Heterogeneous Mixture Clayey Silt, Sand and Gravel Hard		9	SS	100/ 5"		
			10	SS	66		830
824.4	Very Dense		11	SS	100/ 5"		
41.5	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT Wp | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L

WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

38 48 13 1

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

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

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RECORD OF BOREHOLE No 4

W P 160-74-38 LOCATION Coords. N 16,005,403; E 1,021,994 ORIGINATED BY D.C.

DIST 6 HWY 404 BOREHOLE TYPE Solid Stem Auger and Cone Test COMPILED BY D.C.

DATUM Geodetic DATE June 28, 1978 CHECKED BY

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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
864.3	Ground Surface										
V.O.	Topsoil										
0.8	Gravelly Sand Some Silt Compact		1	SS	5						
			2	SS	23		860		○		24 55 20 1
856.8			3	SS	28						
7.5	Glacial Till Heterogeneous Mixture Silt, Sand and Gravel Very Dense		4	SS	98/ 6"				○		13 34 47 6
			5	SS	100/ 5"						
			6	SS	100/ 6"		850		⊖		
	Heterogeneous Mixture Clayey Silt, Sand and Gravel Hard		7	SS	100/ 4"						
			8	SS	100/ 5"		840		○		
832.8			9	SS	100/ 5"						
31.5	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

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

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HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

W P 160-74-38 LOCATION Coords. N 16,005,377; E 1,021,904 ORIGINATED BY D.C.

DIST 6 HWY 404 BOREHOLE TYPE Solid Stem Augers and Cone Test COMPILED BY D.C.

DATUM Geodetic DATE June 27, 1978 CHECKED BY

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 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
862.7	Ground Surface										
0.0	Topsoil										
0.8	Gravelly Sand Some Silt		1	SS	3						
			2	SS	9	▼	860				
855.7	Loose to Compact										
7.0	Heterogeneous Mixture Silt, Sand & Gravel Very Dense		3	SS	19						
			4	SS	69						
			5	SS	33		850				0 6 54 40
	Glacial Till Heterogeneous Mixture Clayey Silt, Sand and Gravel		6	SS	69						
			7	SS	138						
	Hard						840				
			8	SS	100/ 5"						
831.2			9	SS	100/ 6"						
31.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 (%) STRAIN AT FAILURE

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HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6

W P 160-74-38 LOCATION Coords. N 16,005,397; E 1,021,768 ORIGINATED BY D.C.

DIST 6 HWY 404 BOREHOLE TYPE Solid Stem Augers and Cone Test COMPILED BY D.C.

DATUM Geodetic DATE June 27, 1978 CHECKED BY LP

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 (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT WL — WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
861.7	Ground Surface										
0.0	Topsoil		1	SS	7		860				
0.8	Gravelly Sand Some Silt Dense		2	SS	39						37 47 14 2
854.7			3	SS	25						
7.0	Heterogeneous Mixture Clayey Silt, Sand and Gravel Hard		4	SS	96		850				
			5	SS	68						
	Glacial Till		6	SS	148						
			7	SS	100/ 4"		840				
	Heterogeneous Mixture Silt, Sand and Gravel Very Dense		8	SS	105/ 6"						
			9	SS	100/ 5"		830				
	Gravelly Sand Very Dense		10	SS	100/ 5"						53 43 (4)
820.2	Het. Mix. Cl.Silt, Sand & Gravel, Hard		11	SS	100/ 5"						
41.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

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

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HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7

W P 160-74-38 LOCATION Coords. N 16,005,433; E 1,022,177 ORIGINATED BY D.C.

DIST 6 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY D.C.

DATUM Geodetic DATE June 29, 1978 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (○ UNCONFINED, ✱ QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT Wp / NATURAL MOISTURE CONTENT W / LIQUID LIMIT Wl — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
863.2 / 0.0	Ground Surface Topsoil										
0.8	Gravelly Sand Some Silt		1	SS	14	▼	860				
856.7	Compact to Dense		2	SS	>32						
6.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity

15 ◇ 5 (20, 10) (%) STRAIN AT FAILURE

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

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

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER THEY ARE CONSOLIDATED (C) OR NOT (U)
ISOTROPICALLY (I) OR NOT (A)
AND SHEARED DRAINED (D) OR UNDRAINED (U)
WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS)
EG. $\overline{CIU}$ = CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENT
UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS ARE IN COMPRESSION

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ	COEFFICIENT OF FRICTION
δ	ANGLE OF WALL FRICTION
k_o	COEFFICIENT OF EARTH PRESSURE AT REST
k_A	COEFFICIENT OF ACTIVE EARTH PRESSURE
k_p	COEFFICIENT OF PASSIVE EARTH PRESSURE
i	ANGLE OF INCLINATION OF SURCHARGE
w	SLOPE ANGLE-BACKFACE OF WALL
β	ANGLE OF SLOPE
N_γ, N_q, N_c	BEARING CAPACITY FACTORS
D_f	DEPTH OF FOOTING
B,L	FOOTING DIMENSIONS

INDEX PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G_s	SPECIFIC GRAVITY OF SOLIDS
e	VOIDS RATIO
e_o	INITIAL VOIDS RATIO
e_{max}	e IN LOOSEST STATE
e_{min}	e IN DENSEST STATE
D_r	RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
n	POROSITY
w	WATER CONTENT
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
w_s	SHRINKAGE LIMIT
I_p	PLASTICITY INDEX = $w_L - w_p$
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
A_c	ACTIVITY = $\frac{I_p \text{ of soil}}{\%< 2\mu m \text{ Soil Fraction}}$
Om	ORGANIC MATTER CONTENT
S_r	DEGREE OF SATURATION
S	SENSITIVITY = $\frac{S_u \text{ (undisturbed)}}{S_u \text{ (remoulded)}}$

STRENGTH PARAMETERS

ϕ	ANGLE OF SHEARING RESISTANCE
τ_f	PEAK SHEAR STRENGTH
τ_R	RESIDUAL SHEAR STRENGTH
c	COHESION INTERCEPT
$\sigma_1, \sigma_2, \sigma_3$	NORMAL PRINCIPAL STRESSES
u	PORE WATER PRESSURE
u_e	EXCESS u
r_u	PORE PRESSURE RATIO
q_u	UNCONFINED COMPRESSIVE STRENGTH
s_u	UNDRAINED SHEAR STRENGTH
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO
E	MODULUS OF ELASTICITY
G	MODULUS OF SHEAR DEFORMATION
k_s	MODULUS OF SUBGRADE REACTION
m,n	STABILITY COEFFICIENTS
A,B	PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
σ' = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

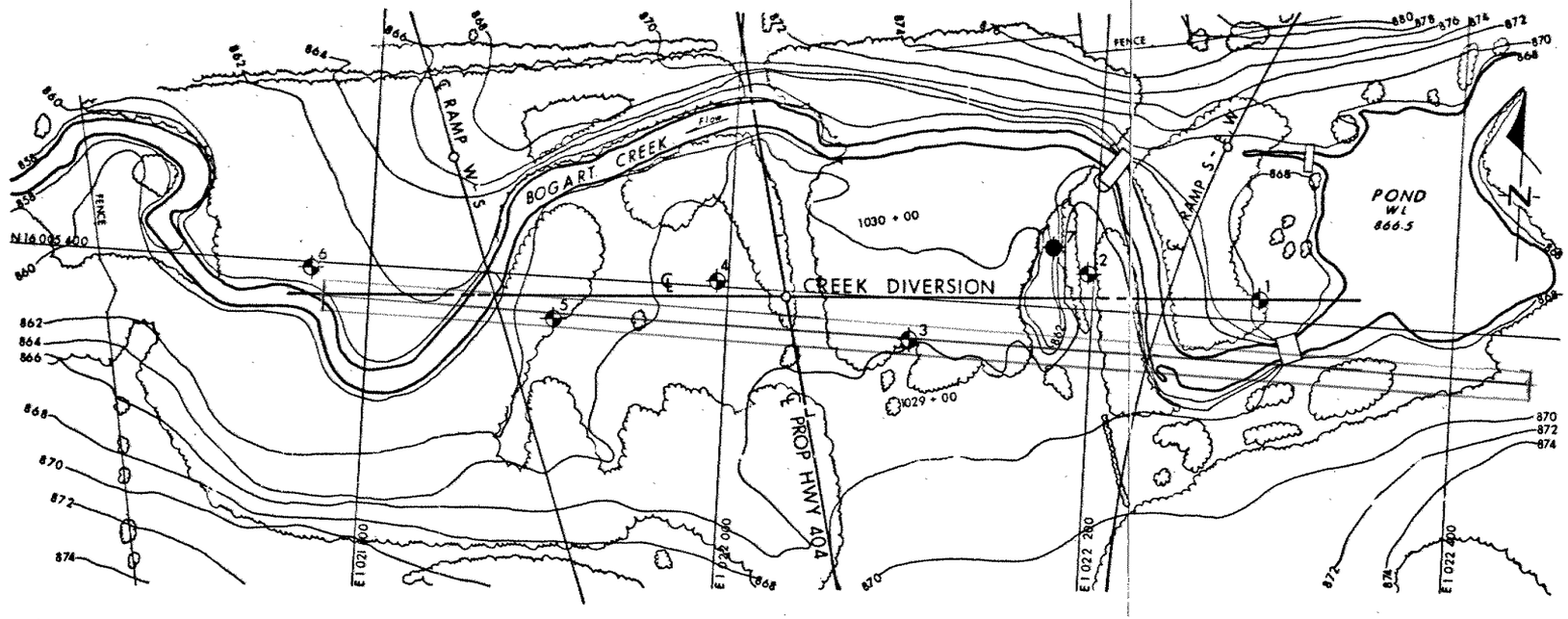
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
j	SEEPAGE FORCE PER UNIT VOLUME
η	COEFFICIENT OF VISCOSITY
k	COEFFICIENT OF HYDRAULIC CONDUCTIVITY
k_h	k IN HORIZONTAL DIRECTION
k_v	k IN VERTICAL DIRECTION
m_v	COEFFICIENT OF VOLUME CHANGE
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX
C_r	RECOMPRESSION INDEX
d	DRAINAGE PATH DISTANCE
T_v	TIME FACTOR
U	DEGREE OF CONSOLIDATION
OCR	OVERCONSOLIDATION RATIO (OCR)

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO 08-MT-309 10-75

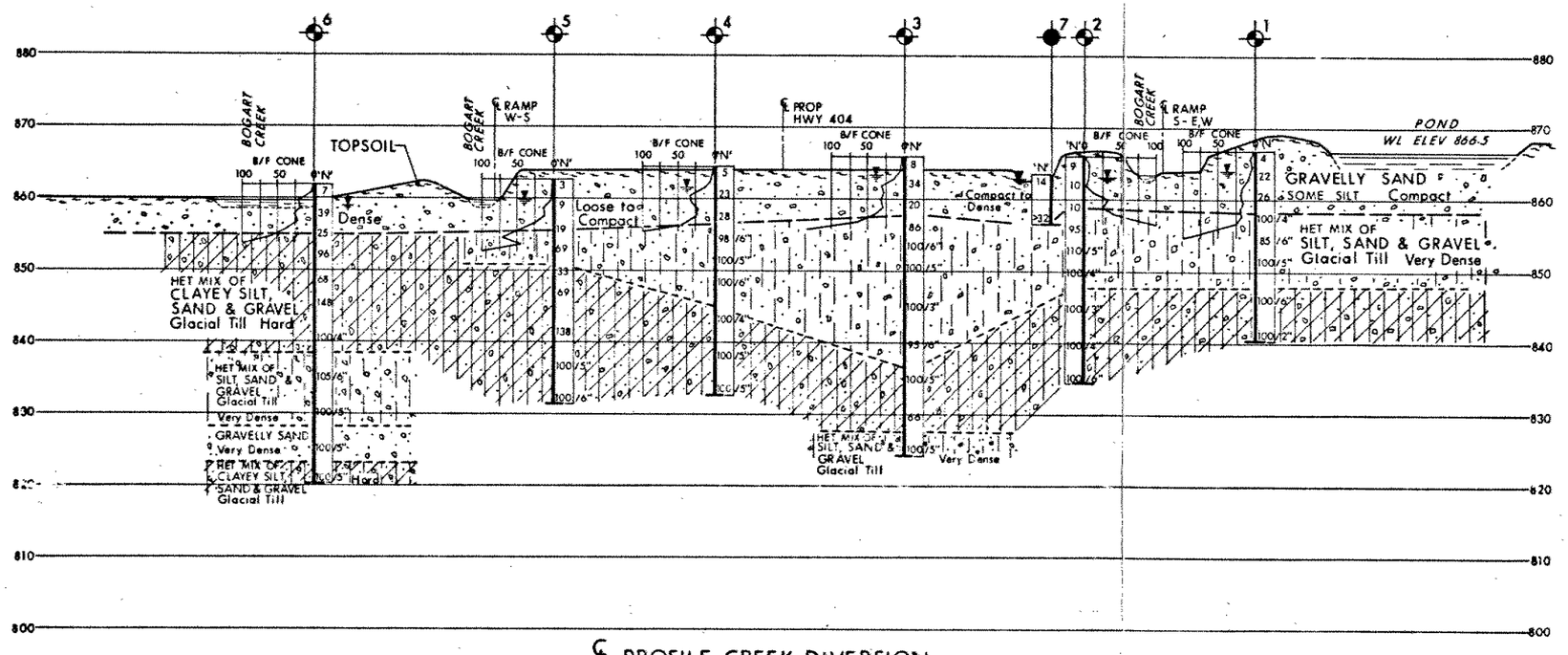
CONT No
WP No 160-74-38

BOGART CREEK BRIDGE
(2.4 Miles North of Reg Rd 15)
BORE HOLE LOCATIONS & SOIL STRATA

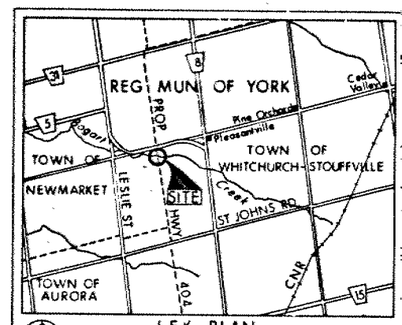
SHEET



PLAN
SCALE
40 20 0 40 80 FT



℄ PROFILE CREEK DIVERSION
SCALE
40 20 0 40 FT HOR
10 5 0 10 FT VERT



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation June 1978

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	866.6	16 005 411	1 022 293
2	865.9	16 005 419	1 022 196
3	865.9	16 005 378	1 022 102
4	864.3	16 005 403	1 021 994
5	862.7	16 005 377	1 021 904
6	861.7	16 005 397	1 021 768
7	863.2	16 005 433	1 022 177

M. D. MacLEAN

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

REVISIONS			
DATE	BY	DESCRIPTION	

GEOCRES No 31D-261

HWY No PROP 404 SUBMD DC CHECKED DATE 78 07 31 SHEET 6 of
DRAWN E.J. CHECKED APPROVED DWG 160-74-38-A

memorandum

Ontario

To: Mr. G. Burkhardt
Head, Structural Planning
Central Region

Date: 82 08 30

From: Pavement & Foundation Design Section
Room 315, Central Bldg.
Downsview

Re: Bogart Creek Culvert
W.P. 160-74-38
Hwy. 404, District 6

We have reviewed the final design drawings for the above-mentioned culvert site and provide the following comment:

A special provision should be drawn up to cover temporary unwatering of the site to prevent "boiling" of the founding soils during excavations below the prevailing groundwater level.

Tom Kazmierowski, P. Eng.
Foundations Engineer

TK:cr

memorandum

Ontario

To: Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region

Date: 1980 08 19

From: Pavement & Foundation Design Section
Engineering Materials Office
Room 313, Central Building

Attention: Mr. K. Pilgrim

Re: Bogart Creek Culvert
Hwy. 404, Dist. 6, Toronto
W.P. 160-74-38, N.R. Site N/A

In response to your request of 80 07 28 we have reviewed the preliminary structural drawings for the above project and have the following comments to make.

According to the drawings, the base of the required excavation for the culvert varies from elevation 854 to 855. Our foundation investigation fieldwork revealed that the groundwater level varied from elevation 864 to 858 and that subsurface conditions at and immediately below the proposed invert level consist of a granular type of glacial till except for the extreme western section of the culvert excavation which consists of a cohesive type of glacial till. In order to facilitate construction it will be necessary to incorporate a temporary dewatering scheme to prevent boiling of the base of the excavation in areas where the granular type of glacial till is present. This dewatering scheme could be accomplished by means of an oversize excavation with perimeter drains.

Backfill to the culvert and retaining walls should consist of a free draining granular type of material compacted in accordance with current Ministry Standards. No heavy compaction equipment should be allowed within 6 feet of the culvert and retaining wall.

Settlements of the culvert will be negligible.

M. MacLean
Project Foundations Engineer

for:

M. Devata
Senior Foundations Engineer

MM/mkq

File 57
K. Kilgore
77-11-16

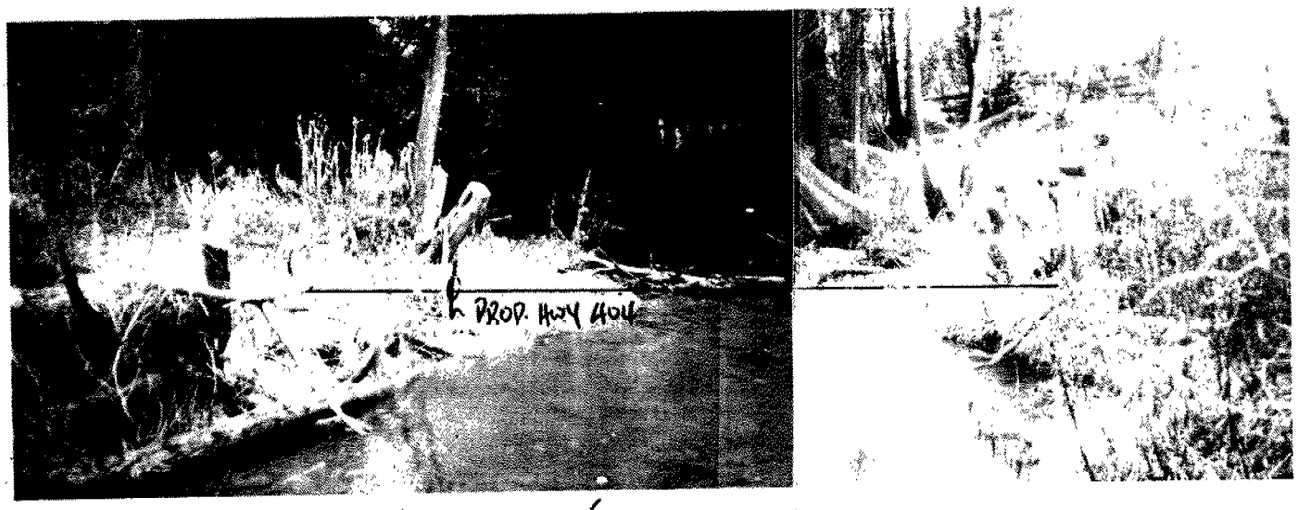
BOGART CREEK STRUCTURE
W.P. 160-74-38

NORTH ALONG ℄ HWY 404

SOUTH ALONG ℄ HWY 404

Film 57
K. Pilgrim
77-11-16

BOGART CREEK STRUCTURE
W.P. 160-74-38



WEST ALONG ℄ CREEK

EAST ALONG ℄ CREEK.