

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 41A-124

W.P. No. _____

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W. O. No. _____

STR. SITE No. 2-380

HWY. No. _____

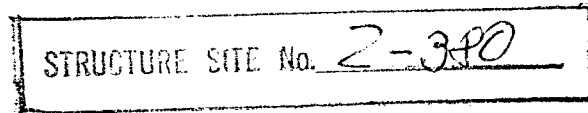
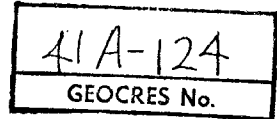
LOCATION BR.* 136, Lot 38,
CON. A, GREENOCK & BRANT
TWP'S.

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS: _____

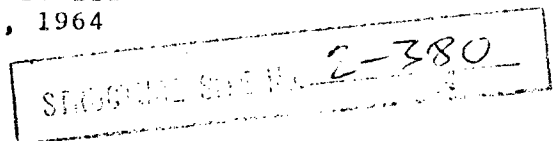
MR. B. M. ROSS
CONSULTING ENGINEER
GODERICH ONTARIO



Report on
SOIL INVESTIGATION
for
BRIDGE NO. BR 136
LOT 38, CONCESSION A
TOWNSHIPS OF GREENOCK AND BRANT



by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO
Reference No. 4-10-L12
December 14th, 1964



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41A-124
GEOCRES No.

SUMMARY

The strata consist of 6 feet 6 inches to 9 feet of sandy clay fill and 4 feet of clayey sand and gravel overlying a deposit consisting of interbedded layers of very stiff clay and dense silts and sands.

It is recommended that the structure should be supported on spread footings bearings at El. 85.0 and using a maximum net soil pressure of 6,000 pounds per square foot. The estimated total settlement is less than 1 inch and differential settlement between abutments $3/4$ inches.

To prevent bottom heave in excavations below the water table, it is suggested that the excavations are carried out inside a sheet pile enclosure.

I INTRODUCTION

It is proposed to replace an existing bridge No. 136 in the County of Bruce with a new structure. The bridge is situated in Lot 38 of Concession A and the road marks the border between the Township of Greenock and the Township of Brant. The bridge crosses a Branch of the Teeswater River.

Verbal authorization was received from Mr. B. M. Ross's office, the consulting engineers, to carry out a soil investigation at the site of the new structure. The new bridge will be of steel beam design with a span of about 40 feet. The purpose of this investigation was to reveal the subsurface conditions at the site and to determine the relevant soil properties for the design and construction of the new foundation.

II FIELD WORK

Two boreholes were put down to a maximum depth of 26 feet 6 inches during the period 6th to 9th of November, 1964. The holes were advanced by washboring and lined with Bx casing.

Standard penetration tests were performed at frequent intervals of depth to determine the relative density or consistency of the soil and to recover representative samples. The results are plotted as 'N' values on the geotechnical data sheet for each borehole at the depths to which they refer.

Dynamic cone penetration tests were performed adjacent to each borehole.

The locations of the boreholes are shown on the site plan, enclosure 2, and elevations have been referred to a site Bench Mark (nail in Elm west side station 1 + 56, El. 98.35).

III SUBSURFACE CONDITIONS

Detailed descriptions of the strata encountered at each borehole are given on enclosure 3, and a general picture of the soil stratigraphy, in the form of a section, on enclosure 2.

Both boreholes penetrated a fill deposit which is associated with the construction of the approaches to the existing bridge. This material is 9 feet thick in borehole 1 and 6 feet 6 inches thick in borehole 2 and consists of generally firm to stiff brown sandy, very silty clay. This clay fill is underlain by about 4 feet of clayey gravel and sand which may also be fill material.

Natural soil was encountered at an average level of El. 89 feet and was penetrated a maximum depth of 15 feet 6 inches. This stratum consists of interbedded layers of very stiff clay and dense silts and fine sands.

IV GROUNDWATER CONDITIONS

From an observation of the water level taken in borehole 2 it would appear that the ground water table is about the same elevation as the water level in the stream. (El. 93.3 at the time of the field work).

V DISCUSSION

The soil profile at each abutment is generally similar and consists of about 6 feet 6 inches to 9 feet of fill and 4 feet 6 inches of clayey gravel and sand overlying the stiff clays and dense silts.

The bed of the stream extends to El. 89.5 and allowing for scour it is recommended that the footings should bear at El. 85.0. This level lies within the stratum of stiff clay and dense silt and on the basis of the field observations, a maximum net soil pressure of 6,000 pounds per square foot would be appropriate for the design of footings. This will involve excavating below the water table, with the consequent danger of causing heave in the bottom of the excavation due to excessive hydrostatic pressure in the granular strata. To avoid this, the excavation should be carried out inside sheet piling, which should be driven at least an equivalent distance below the footing elevation as the water level is above it. The total settlement of the foundation would not exceed 1 inch and differential settlement between abutments 3/4 inch.

The coefficient of friction between the footings and the underlying soil should be taken as 0.35 and the factor of safety against horizontal sliding of the abutments should be at least 1.5.

The permeability of the strata is generally low with a possible exception of occasional seams of sand and silt. These may cause some seepage into the excavation but this will be easily controllable by pumping from a sump.

Yours very truly

DOMINION SOIL INVESTIGATION LIMITED

C. J. W. Atkinson

C. J. W. Atkinson, M. Sc.,
Project Engineer.

CA/sg

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.

BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANICS	BEDROCK	GROUND WATER LEVEL	DEPTH OF CAVE-IN
		COARSE	FINE	COARSE	MEDIUM	FINE						
Ø	> 8"	3"	3/4"	4.76mm	2.0	0.42	0.074	0.002	>	NO SIZE LIMIT		
U.S. Standard Sieve Size:		No.4	No.10	No.40	No.200							

SAMPLE TYPES.

AS	Auger sample	RC	Rock core	TP	Piston, thin walled tube sample
CS	Sample from casing	%	Recovery	TW	Open, thin walled tube sample
ChS	Chunk sample	SS	Split spoon sample	WS	Wash sample

SAMPLER ADVANCED BY static weight : w
 " pressure : p
 " tapping : t

OBSERVATIONS MADE WHILE CORING

	Steady pressure		Washwater returns
	No pressure		Washwater lost
	Intermittent pressure		

PENETRATION RESISTANCES.

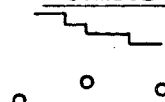
DYNAMIC PENETRATION RESISTANCE : to drive a 2" ϕ , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

STANDARD PENETRATION RESISTANCE, -N- : to drive a 2" outside dia, split spoon sampler 1 foot into the ground, expressed in blows per foot.

EXTRAPOLATED -N- VALUE

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

SYMBOL :



322

SOIL PROPERTIES.

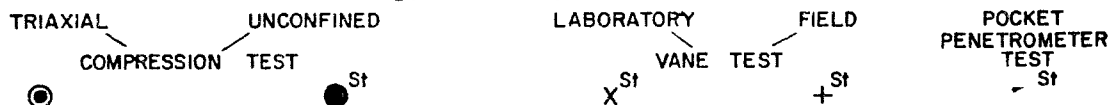
W %	Water content	γ	Natural bulk density (unit weight)	k	Coeff. of permeability
LL %	Liquid limit	e	Void ratio	C	Shear strength
PL %	Plastic limit	RD	Relative density	ϕ	Angle of int. friction
PI %	Plasticity index	C _v	Coeff. of consolidation	C'	Cohesion
LI	Liquidity index	m _v	Coeff. of volume compressibility	ϕ'	Angle of int. friction

in terms of total stress

in terms of effective stress

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —



Strain at failure is represented by direction of stem

20%
15% + 5%
10%

$$St : \text{sensitivity} = \frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$$

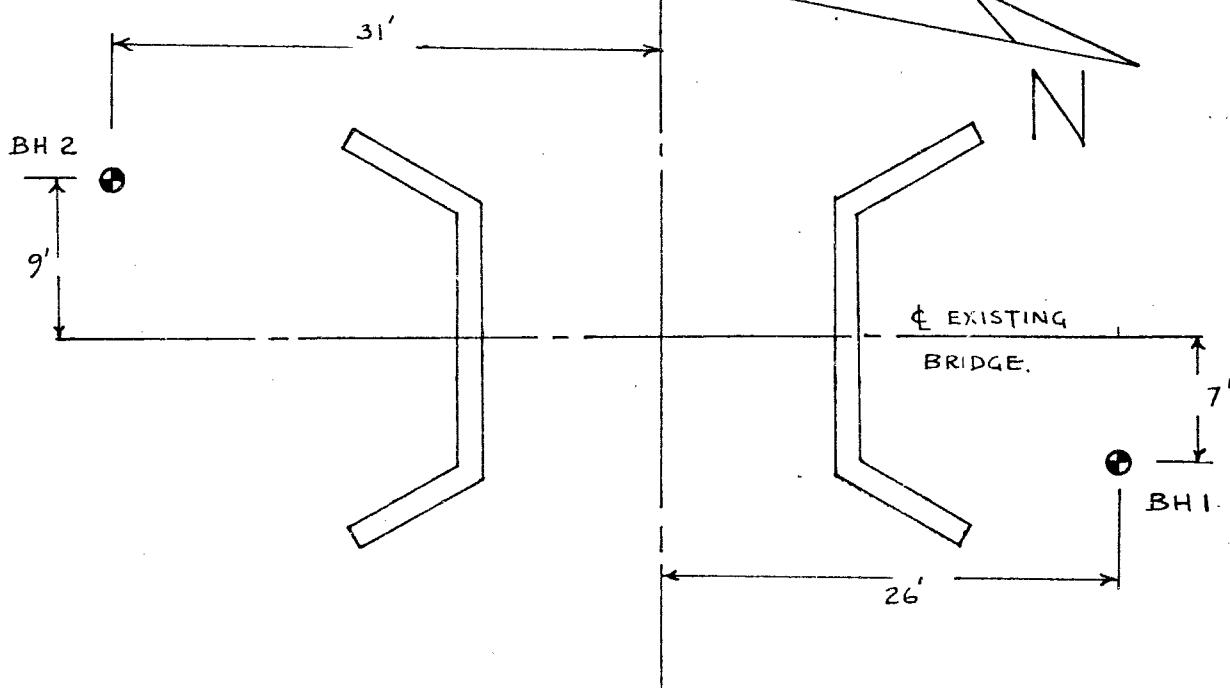
SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :	COHESIVE SOILS :	C lbs/sq.ft.
Very loose	0 - 15 %	Very soft	less than 250
Loose	15 - 35 %	Soft	250 - 500
Compact	35 - 65 %	Firm	500 - 1000
Dense	65 - 85 %	Stiff	1000 - 2000
Very dense	85 - 100 %	Very stiff	2000 - 4000
		Hard	over 4000

Our Ref. No. 4-10-L12.

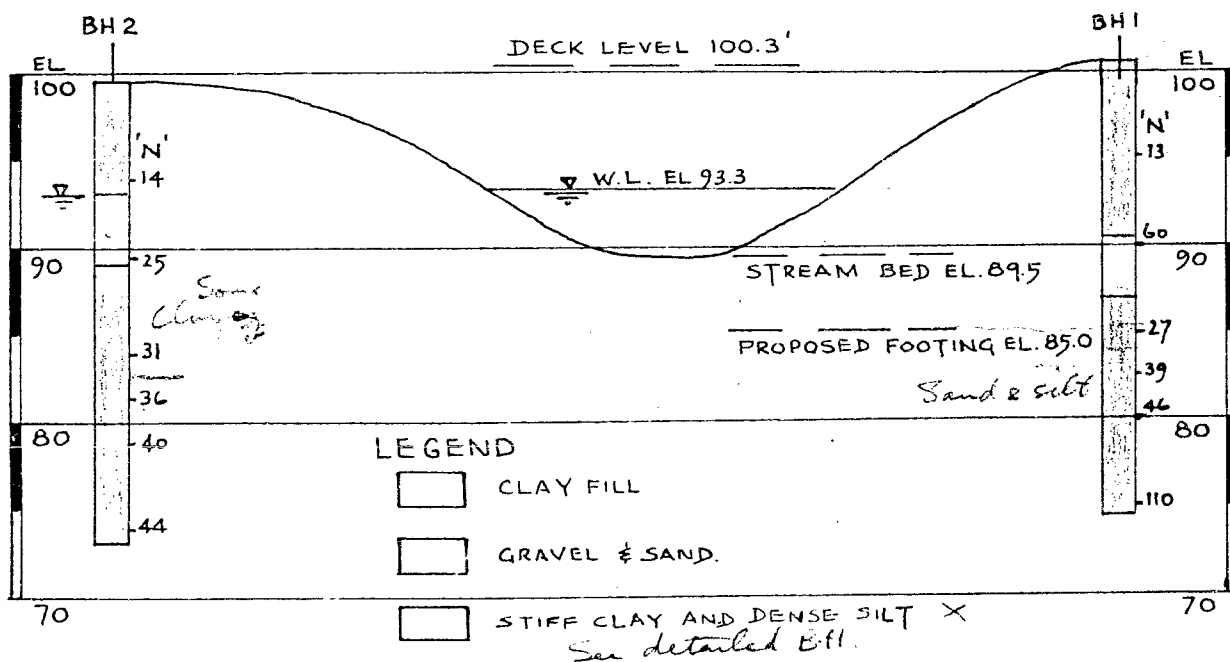
Enclosure No. 2

Prep. By



LOCATION OF BOREHOLES

SCALE: 1 INCH TO 10 FEET.



SUBSURFACE PROFILE.

SCALE: 1 INCH TO 10 FEET.

DOMINION SOIL INVESTIGATION LIMITED

OUR REFERENCE NO. 4-10-L12

GEOTECHNICAL DATA SHEET FOR BOREHOLE ...1...

CLIENT: B. M. Ross

PROJECT: Bridge No. BR-136

LOCATION: Townships Greenock and Brant

DATUM ELEVATION: 98.35 feet

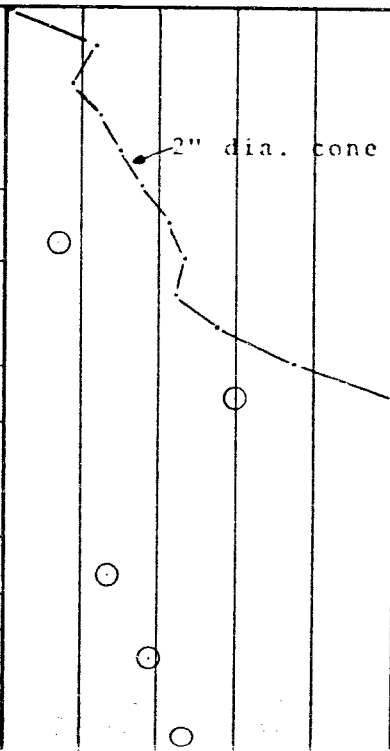
METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: Bx (3-inch)

DATE: November 6th, 1964

ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE				CONSISTENCY		REMARKS
				NUMBER	TYPE	N- or Advancement of Sampler	blows per foot	20	40	60	80	100	
							SHEAR STRENGTH				water content %		
							lbs/sq ft				PL	W	LI
100.4	0.0	Ground Surface											
100.0	0.0	6" Road Fill											
95.0	4.4	Stiff brown sandy, very silty clay (Fill)		1	SS	13							
90.0	9.0	Gravel in clayey matrix		2	SS	60							
87.5	13.5	Very stiff sandy very silty clay with fine gravel		3	SS	27							
82.5	17.5	Interbedded stiff clay, dense silts and fine sands		4	SS	39							
80.0				5	SS	46							



75
80
75

Interbedded stiff
clay, dense silts
and fine sands



4	SS	39
5	SS	46
6	WS	
7	SS	110

26.0

End of Borehole



VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE:

CH'D:

OUR REFERENCE NO. 4-10-L12

GEOTECHNICAL DATA SHEET FOR BOREHOLE ...2...

CLIENT: B. M. Ross

PROJECT: Bridge No. BR-136

LOCATION: Townships Greenock and Brant

DATUM ELEVATION: 98.35 feet

METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: Bx (3-inch)

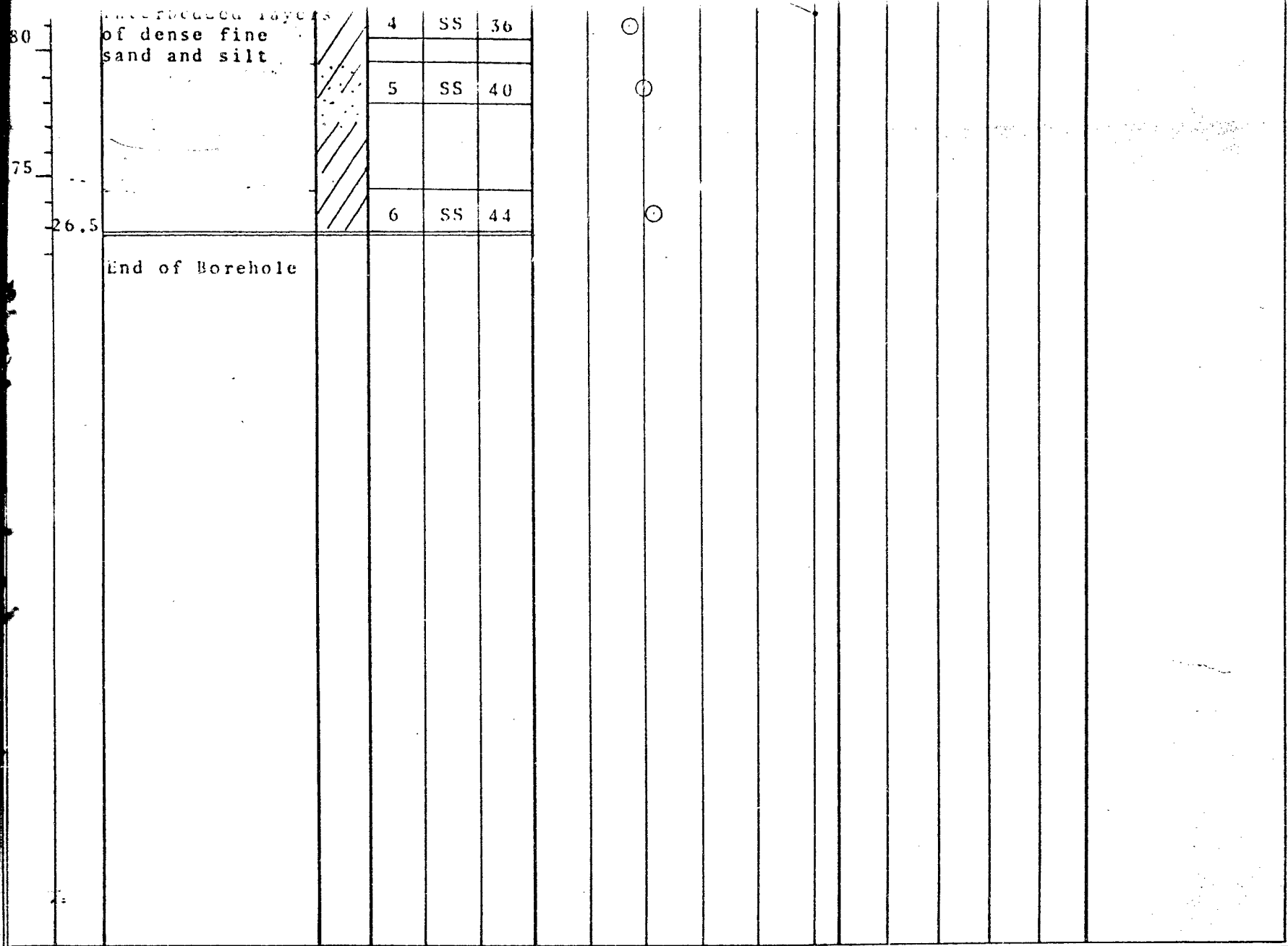
DATE: November 9th, 1964

ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot		CONSISTENCY water content % PL W LI	REMARKS
				NUMBER	TYPE	N- or Advancement of Sampler	20	40 60 80 100		
99.5	0.0	Ground Surface								
		3" Topsoil								
95	6.5	Firm brown very sandy silty clay (Fill)		1	SS	14				
90	11.0	Clayey sand and gravel		2	SS	25				
85				3	SS	31				
80		Interbedded layers of dense fine sand and silt		4	SS	36				
				5	SS	40				

W.L.
El. 92.9
Cave-in
El. 92.0
1730 hours
November 9th

Borehole 2



VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE:

CH'D: