Mr. E. R. Saint,
Regional Soils Engineer,
North Bay, Ontario.

February 3, 1961.

Materials & Research Section.

Re: Hwy. #17 - W.P. 224-59,
Meilleurs Bay - Proposed New
Causeway Fill Material.
District #13.

In reply to your telephone message regarding the above project, we have the following comments to make:-

If it is desired to use the granular material which you mentioned as being available, as fill for the new causeway, the construction should be carried out in the same way as outlined in our Foundation Report 60-F-6, with the following additions:-

(1) Provision must be made for the excavation of mud waves should they form in front of the advancing fill. Mud waves at the sides should be reduced if they rise above water level.

(2) The front 30 ft. of the advancing fill should be kept about 6 ft. above the profile grade in order to provide a surcharge to accelerate displacement. This can, of course, be reduced to profile grade as the work proceeds.

L. G. Soderman,
PRINCIPAL FOUNDATION ENGR.
Per:

KGS/MdeF

(K. C. Selby,
PROJECT FOUNDATION ENGR.)

cc: Foundations Office
Gen. Files.

Inquiring from the Bridge Office (Jim McAlister)
What is the bearing capacity i.e the allowable
pressures that can be used in the design of
the culvert?
It was answered that 2.5 T/sq ft can be used.
Oct., 7/1960 Asterman

Mr. A. Rutka,
A/Materials & Research Engr.

Mr. A. Stermac, Fdns. Office Engr.

August 26, 1960.

Hwy. No. 17; W.P. 224-59, Meilleurs Bay, D.H.O., Foundation Investigation Report.

In reply to your memo dated August 25th, 1960, regarding the above mentioned report, we would like to comment on the three questions that you put forward.

1. Why is rock fill better than gravel? The clay which forms the subsoil in the area is a normally consolidated sensitive clay of relatively low shear strength. When disturbed, the shear strength of the clay is greatly reduced and the material becomes nearly a fluid. To take advantage of this fact, it was our intention to apply a procedure by which this material would be mostly disturbed. When bedrock is dumped, heavy stones puncture the clay layer, disturb it and make it much softer, thus creating a much more favourable condition for the following smaller material to displace the rest.

   It is not disputed that the voids in the rock fill may get filled with clay, but this fill would not influence the properties of the rock fill because the contact of rock to rock is the factor which would govern the main properties, and this contact would not be prevented or interfered with.

   It has been our experience (Naiscoot River) that the only danger in the proposed procedure would be the incomplete displacement of the soft clay - i.e., if the soft clay is somewhere trapped. This is much more likely to occur if a finer material is dumped.

   The sand or gravel blanket ± 3' that you mention in your memo, would only prevent the displacement of the material and, therefore, in this particular case, could not be applied. Such a sand or gravel blanket is only applied in cases where a certain "filter" action is desired - i.e., where the sinking of the fill material into the subsoil has to be prevented and a "floating" foundation achieved.

cont'd. /2 ...

2. Why should the gravel be not less than 1" ?

Because of the reasons mentioned under (1), we would not agree that this does not occur in nature; but we would agree that such gravel deposits are not commonly encountered. Our proposal has been made in order to open this possibility if such material is available. Having in mind the goal that we wanted to achieve, only such gravel could have been suggested. Maybe it would have been more correct if we would have specified pebbles rather than gravel.

3. Should we not recommend that the fill be started at the South side and constructed to the North, then along the centre line, to ensure displacement of the soft material to the North?

By looking at Drawing No. 60-F-60A of the report, it can be seen that up to about the middle of the bay, from West to East, the hard sand-gravel bottom is level; therefore, the displacement in both directions will be equally easy. Farther to the East, the hard bottom slopes in the northern direction. The material will always displace in the direction of lesser resistance, and it is our opinion that in this location, it will displace towards the South, because it will meet, here, less resistance in spite of the sloping hard bottom.

The hard bottom underlying the eastern part of the causeway does slope toward the North. The quantities of the clay to be displaced South of centre line are comparatively small, and it is our opinion that advancing the fill at an angle to force displacement to the North of centre line would give rise to an undesirable large berm of remoulded material on the North side of the embankment. The development of this berm would serve only to make displacement more difficult, and could result in material being trapped, or not completely displaced under the North section of the roadway. The principle to be followed in displacement of soft foundation material by loading, is to cause the disturbed material to move the least distance possible. The procedure of advancing the fill with a centre V-type front is based upon this principle.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.
Per: A. Stermac
(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

AS/MdeF

cc: Foundations Office (2)
Gen. Files.

cc: Foundations Office

93-62-364

Mr. A. M. Toye

Bridge Engineer.

Materials & Research Section.

August 9, 1960.

D.H.O. FOUNDATION INVESTIGATION
W.P. 98-60 & W.P. 224-59
W.J. 60-F-60.

Attention: Mr. S. McCombie.

Re: Proposed New Causeway on Highway #17,
at Mellieurs Bay, Deep River, Ontario,
District No. 13.

Accompanying this memo, is our detailed report on the subsoil conditions existing at the above site.

The conclusions and recommendations to be followed in your future design work, are summarized in the report, and are self-explanatory.

Should any questions arise in connection with this project that you would like to discuss, please do not hesitate to contact our Office.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.

Attorneau

(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

AS/MdeF
Attach.
cc: Messrs. A. M. Toye (2)
H. A. Tregashes
D. G. Ramsay
G. K. Hunter
D. Foster
E. R. Saint
A. Watt
Foundations Office
Gen. Files.

TABLE OF CONTENTS

FOUNDATION INVESTIGATION

For

The Proposed New Causeway on Hwy. #17,
at Meilleurs Bay, Deep River, Ontario.
W.P. 98-60 & W.P. 224-59, W.J. 60-F-60.
District No. 13.

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1. INTRODUCTION:

At a location some five miles west of Port Alexander, Hwy. #17 crosses, by means of a causeway, a strip of water approximately 600' wide, known as Meilleurs Bay. The average depth of water in this bay is six to eight feet. A concrete culvert of twenty foot span is located about two hundred feet from the east side of the bay.

It is proposed to construct a new causeway to the North of the existing one, for the proposed realignment, Line 'C'. This also involves the construction of a new culvert.

A previous Field Investigation carried out in February 1960 (60-F-15), showed that very soft material some seven to fifteen feet in depth, exists to the west of Sta. 296+00, and that this material overlies a dense deposit of boulders, sand and gravel.

Different construction procedures were considered, and in order to arrive at the best solution, it was decided that more data about the properties of the su soil were required. Also, more information was required for the final positioning of the culvert. An additional investigation was carried out, and the findings of this investigation as well as the discussion and recommendations, are presented in the following paragraphs.

cont'd. /2 ...

1. INTRODUCTION: (cont'd.) ...

The following investigation was carried out during the period July 7th - July 13th, 1960. Equipment used was owned, and operated by Johnston Drilling Co. of Ottawa, under the direction o. the Department of Highways. A total of six boreholes, eleven penetration tests, and four soundings, was carried out the purpose of which was:-

(1) To determine the properties of the soft stratum referred to above.

(2) To determine the most suitable location for the proposed new culvert.

2. DESCRIPTION OF THE SITE:

The site is located in undulating ground adjacent to the south bank of the Ottawa River about ten miles west of Deep River on Hwy. #17. The site itself, consists of a small bay or inlet some six to eight feet deep, and five to six hundred feet in width. The surrounding area is covered with thick bush. The existing Hwy. #17 crosses the bay on a causeway about six to seven feet above the normal summer water level, which is about Elev. 368.0'. The highest water level recorded to date is Elev. 372.0'. Line 'C' which is the centre line of the proposed realignment of Hwy. #17, is 160' north of existing Hwy. #17 at the west side of the bay, and 35' north at the east side. A 20' span concrete culvert is located about 130' from the east side of the bay on Hwy. #17. A small creek empties into the south end of the bay causing a flow of water north to the main channel of the Ottawa River.

3. FIELD INVESTIGATION PROCEDURE:

A total of six borings were carried out using conventional diamond drill equipment adapted for soil sa. ling purposes.

cont'd. /3 ...

3. FIELD INVESTIGATION PROCEDURE: (cont'd) ...

The holes were cased with 4" diameter steel casing which was driven by means of a 350 lb. hammer to the various sampling intervals.

Samples were recovered in the disturbed state using a 2-inch O.D. split spoon which was driven into the soil by a 140 lb. hammer with an energy of 350 ft. lbs. per blow. Undisturbed samples were recovered using 2-inch I.D. Shelby tubes. These were pushed into the soil by hand.

A total of eleven dynamic cone penetration tests was carried out. Driving energy to advance the cone was 350 ft. lbs. per blow.

Four soundings were carried out in order to determine more completely the extent of the soft stratum in the vicinity of Line 'C'.

In the soft clay deposit Vane Tests were carried out to determine the in-situ shear strength of the material at elevations 12" below the bottom of the various sample depths.

Boring was carried out with the drill mounted on a 14' x 12' raft specially constructed for the purpose.

Locations of all boreholes were established prior to drilling by the Field Engineer. They are shown on Drawing 60-F-60A which forms part of this report.

All elevations were established using a T.B.M., Elev. 372.9', located at Sta. 296+47, 62.0' Rt. - top of outlet of concrete culvert.

4. LABORATORY INVESTIGATIONS:

Laboratory tests were carried out on a selection of undisturbed samples to determine the following properties of the soft clay material:

1. Liquid Limit
2. Plastic Limit

cont'd. /4 ...

4. LABORATORY INVESTIGATIONS: (cont'd.) ...

3. Moisture Content

4. Shear Strength (By Vane Test)

5. Density

From this information it was possible to produce curves showing variation of the above properties with depth. These together with detailed test results, are shown in Appendix I of this report.

5. DESCRIPTION OF SOIL TYPES AND SOIL CONDITIONS:

5.1 General:

Detailed descriptions of the various soil types are given below, and are also shown in Appendix I of this report. The estimated stratigraphical profiles shown in Drawing 60-F-60A are based upon this information. From ground level downward the soil types are as follows:

5.2 Very Soft Organic Clay of High Plasticity:

This material covers most of the lake bottom on the site of Line 'C'. It varies in thickness from one to three feet to the east of Sta. 296/50, and from three to fifteen feet to the west. It is highly organic in composition, and derives some of its shear strength from a very thin organic fibrous material uniformly dispersed throughout. The moisture content of this clay is very high, and varies with depth from about 380% at the surface to 100% at 15.0'. Bulk density of the material is very low, being 74 p.c.f. at the surface, and 84 p.c.f. at 15.0'. The shear strength varies with depth, being zero at the surface and 140 p.s.f. at 15.0'. Physical properties of this material, determined as a result of laboratory tests, are tabulated in Appendix I, of this report.

cont'd. /5 ...

5. DESCRIPTION OF SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

5.3 Loose Grey Silty Fine Sand:

This material was observed in Borehole #1, and #6 being at the east, and west edges of the bay respectively. The material extends from ground level, and is about 12.0' in depth in each location. The upper two or three feet of this material is highly contaminated with decayed vegetation. In its present state this material has a very low shear strength. However, it is anticipated that consolidation will take place under the proposed loading of fill material, resulting in an adequate shear strength.

5.4 Sand, Gravel and Boulders:

The entire area of the site is underlain by this material. Depths from ground level to the surface of this deposit vary from 3.0' at Sta. 296/70 to 18.0' at Sta. 293/00. Dynamic cone tests indicated the abundant presence of boulders. Penetration refusal was achieved at widely differing elevations in different locations.

6. DISCUSSION AND RECOMMENDATIONS:

6.1 General:

Proposals for the realignment of Hwy. #17 in this area include the construction of a causeway across Meilleurs Bay together with a culvert at some location on the causeway. Particular problems dealt with by this report are discussed under the appropriate headings.

6.2 The Causeway:

The investigation has shown that the deposit of soft organic clay has insufficient strength to provide a stable foundation for the proposed new

cont'd. /6 ...

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.2 The Causeway: (cont'd.) ...

causeway; therefore, the main problem becomes whether or not the very soft organic clay layer can be completely displaced, by end dumping. Field and laboratory tests carried out on this material show that it possesses a very low shear strength, being zero at the surface, and increasing with depth to about 140 p.s.f. at 15.0'. It is anticipated that complete displacement will be achieved if a dense fill material such as rock, is used. If rock fill is not available, it is suggested that very coarse gravel of minimum fine aggregate size not less than 1", be used. This fill material must be placed to an elevation not less than two feet above high water level which is given on Profile #4060 as 372.0'.

It is recommended that the above fill material be placed continuously from Sta. 292+40, to Sta. 298+40 to ensure complete consolidation of the loose silty fine sand at each side of the bay, as well as complete displacement of the very soft material in the middle of the bay.

6.3 Concrete Culvert:

It is proposed to construct a concrete culvert at some location between Sta. 296+00, and Sta. 296+70. Borings and Penetration Tests carried out in this area show that the safe bearing capacity of the sand, and gravel deposit is adequate for Spread Footings. The sand and gravel deposit is overlain by a deposit of very soft organic clay which varies in depth from 7.0' at Sta. 296+09 to 1.0' at Sta. 296+70, 20' Rt. It is suggested that the culvert be located east of Sta. 296+40 in which case excavation in the soft clay deposit for construction purposes would be reduced to a minimum.

cont'd. /7 ...

7. **SUMMARY** (cont'd) ...

The investigation findings, and resulting recommendations are summarized in the following paragraphs:

Up to fifteen feet of very soft organic clay overlies a dense layer of sand, gravel and boulders. This layer has such low shear strength values that it cannot provide a stable support for the new proposed causeway.

It is believed that this material will be displaced if end dumping procedure of rock fill is used. The rock fill should be built up to an elevation 2.0' above the high water level, i.e., to elevation 372.0'. If rock fill is not available coarse gravel (above 1") should be used. The fill should be end dumped from Sta. 292+40 to Sta. 298+40.

It is proposed to construct the culvert east of Sta. 296+40 in order to minimize the excavation or displacement of the soft material overlying the layer of sand, and gravel. This latter has adequate bearing capacity to provide a stable foundation for the culvert on spread footings.

8. MISCELLANEOUS:

The field investigation was carried out during the period of July 7th to July 13th, 1960, under the supervision of Mr. Ken Selby of this section. Equipment used was owned, and operated by Johnston Drilling Company of Ottawa.

August 1960

REPORT PREPARED BY: Ken Selby,
Project Foundation Engr.

REPORT APPROVED BY: A. Stermac,
Foundations Office Engr.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-60
W.P. 244-59

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	5'-6.5'	Sand with excess of fine silty particles - v. loose - grey in colour - cont. pieces of decayed vegetation.	2	-	-	-	-	-	
	S2	8'-9.5'	" "	2	-	-	-	-	-	
	S3	12'-13.5'	Silt with fine sand, loose, grey.	5	-	-	-	-	-	
	S4	15'-16.5'	Sand fine med. - loose - grey.	3	-	-	-	-	-	
	S5	20'-21.5'	Gravel and sand well graded - dense.	46	-	-	-	-	-	
	S6	25'-26.5'	" " "	50	-	-	-	-	-	
2	S1	11.3'-12.8'	Gravel and sand - well graded - dense - boulders present	51	-	-	-	-	-	
	S2	16.3'-17.8'	" " "	>72	-	-	-	-	-	
3	T1	6.7'-8.2'	Organic clay of high plasticity - very soft.	P	230	129.5 92.9	325.0 110.8	V-22	75	
	VANE	11.2'		-	-	-	-	60	-	Sens: 2.0
	T2	11.7'-12.7'	" " "	P	88	27.2 26.4	72.9 43.3	U-82 V-55 V-66	91	
	S3	12.7'-14.2'	Gravel and sand - well graded - dense.	25	-	-	-	-	-	
4	T1	7'-8.5'	Organic clay of high plasticity - very soft - dark in colour.	P	393.0	-	-	U-28	68.3	

Cont'd P. 2

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-60
W.P. 244-59

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
4	VANE	10.5'		-	-	-	-	30	-	Sens: 2.0
	T2	12'-13.5'	Organic clay of high plasticity very soft - dark in colour.	P	123.7 153.5	43.3 52.0	153.2 62.4	V-82.5 V-71.5	78.6	
	VANE	15'		-	-	-	-	110	-	Sens: 1.8
	T3	18'-19.5'	" " " "	P	122.2 120.3 103.5 94.6	26.5 30.7	85.2 48.2	U-75 V-93.5 V-109.5 V-93.5	83.3	
	VANE	21'		-	-	-	-	190	-	Sens: 2.7
	T4	22'-23.5'	" " " "	P	53.1 57.5 60.0	25.1 22.4	43.8 27.9	U-150 V-165.0 V-187.0	101.0	
	S5	23.8'-25.3'	Gravel and sand - well graded - dense.	>61	-	-	-	-	-	
5	T1	6.7'-8.2'	Organic clay of high plasticity very soft - dark in colour.	P	-	-	-	-	-	
	VANE	9.7'		-	-	-	-	35	-	Sens: 3.5
	T2	11.7'-13.2'	" " " "	P	-	-	-	-	-	
	VANE	14.7'		-	-	-	-	115	-	Sens: 11.5
	T3	15.7'-17.2'	" " " "	P	-	-	-	-	-	
	VANE	18.7'		-	-	-	-	140	-	Sens: 7.0
	S4	19.2'-20.7'	Sand and gravel - well graded - dense.	44	-	-	-	-	-	

Cont'd. P. 3

FORM OB—ML—222
FEB 59
1M-58-5569

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-60

W.P. 244-59

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
56	S1	5.5'-7'	Silt with fine sand - loose - brown	2	-	-	-	-	-	
	S2	9.5'-11'	Sand with excess of fine silty particles - very loose.	1-18"	-	-	-	-	-	
	S3	12.5'-14'	" " " "	6	-	-	-	-	-	
	T4	17.5'-19'	Organic silt of intermediate plasticity - soft - dark in colour.	P	47.5 45.6 49.3	27.8 26.7	51.8 29.7	U-300 V-394 V-374 V-411	106.5	
	ANE	22'		-	-	-	-	360	-	Sens: 4.5
	S5	22.8'-24.3'	Gravel and sand - well graded - dense.	26	-	-	-	-	-	
	7-14		Cone penetration only							
	15-18		Soundings							

S denotes split spoon sample

T denotes shelby tube sample

FORM OB-ML-126 (REV. 1959) 59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 1

JOB 60-F-60 STATION Line 'C' 298+00 20' Lt.

DATUM G.S.C. COMPILED BY H. S.

BORING DATE July 8/60. CHECKED BY K. S.

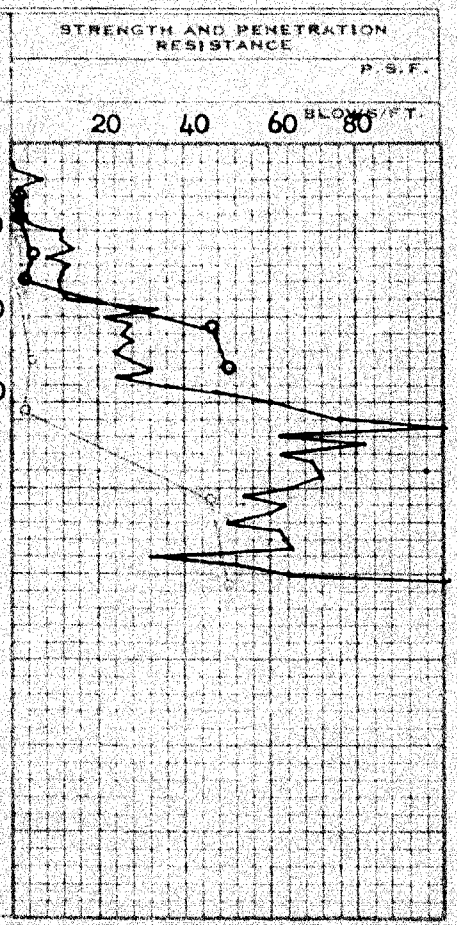
2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

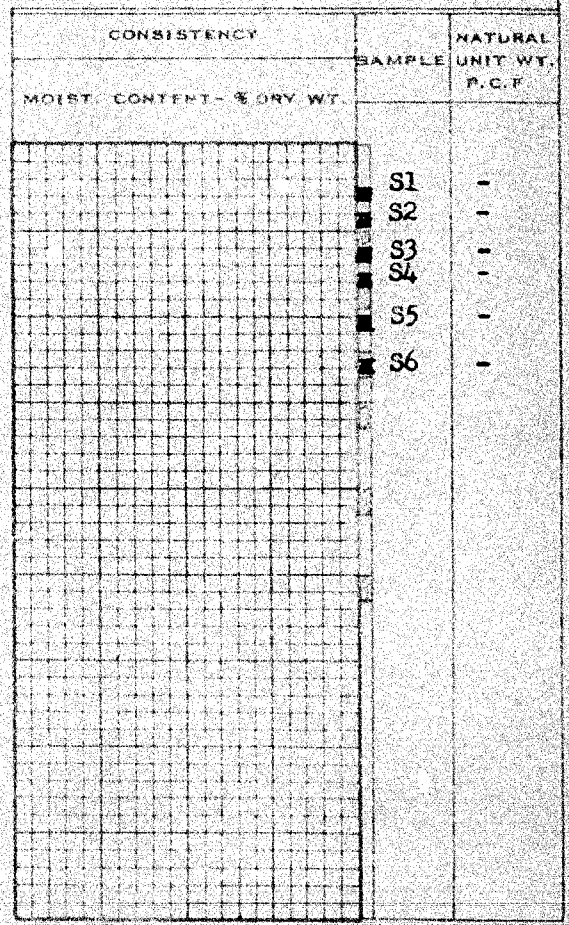
LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX W
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Waterlevel	369.5	
	Water	367.5	
	Sand with excess of fine silty particles-V. loose - grey in colour - cont. pieces of decayed vegetation.	359.5	10
	Silt with fine sand, loose - grey.	355.5	
	Sand fine-med. - loose - grey.	349.0	20
	Gr. & sand - well graded - dense.	343.0	30
	End of Borehole		

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.





FORM OB-ML-126 (REV 1959.) - 59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 2

JOB 60-F-60 STATION Line 'C' 297+03 20' Lt.

DATUM G.S.C. COMPILED BY H.S.

BORING DATE July 9/60. CHECKED BY K.S.

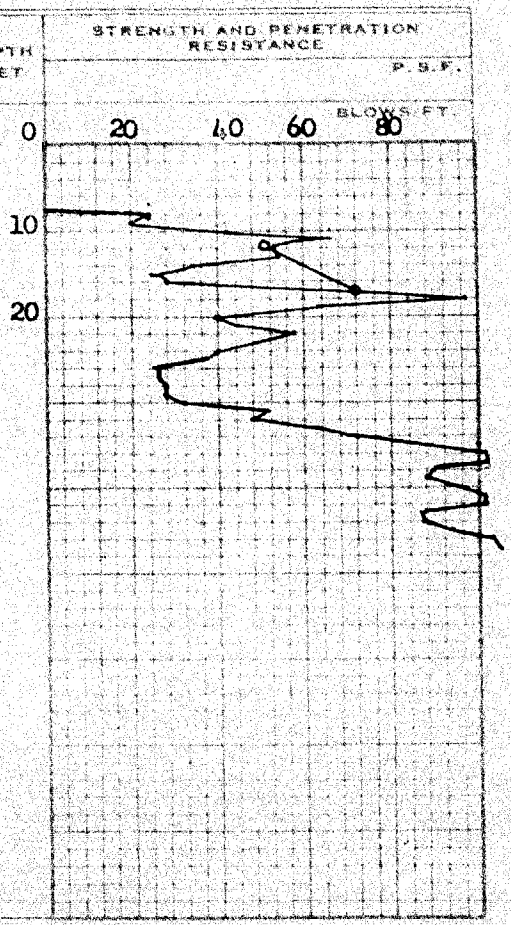
2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

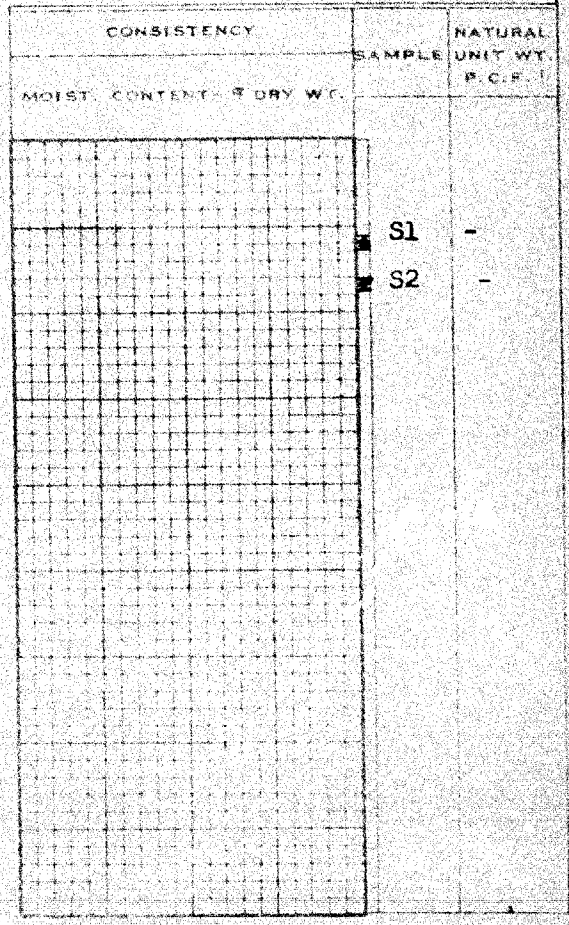
LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) :*
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT —o
PLASTIC LIMIT |—

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Water level	368.7	
	Water	362.4	
	Org. cl. of high plasticity-v. soft.	361.1	
	Gravel & sand - well graded- dense Boulders present.	350.9	
	End of Borehole.		

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to 350 ft./lbs. per blow.





FORM OB-ML-126 (REV. 1959.)—59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 3

JOB 60-F-60 STATION Line 'C' 296+02 20' Rt.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE July 11/60. CHECKED BY K.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

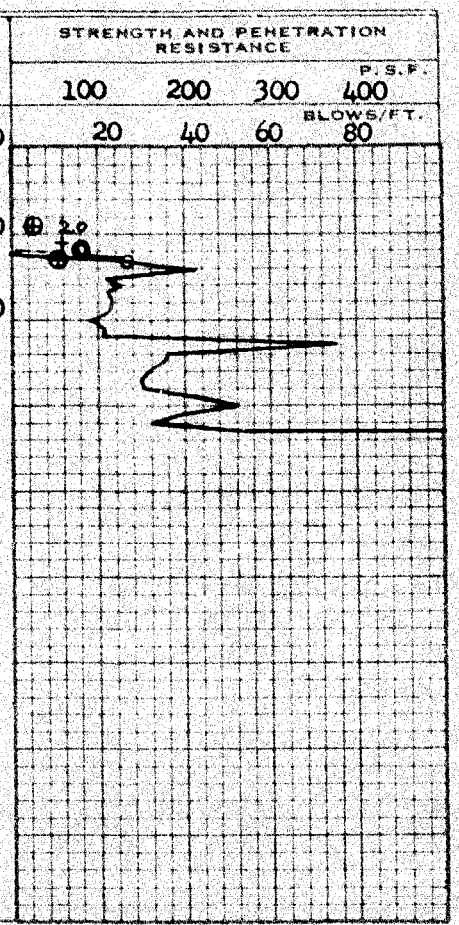
LEGEND

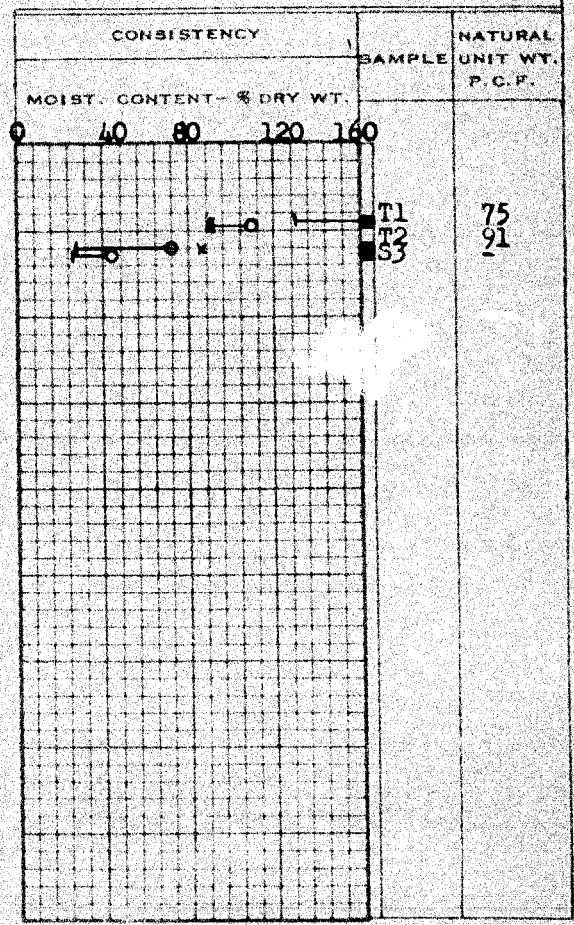
1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX (LI)
LIQUID LIMIT
PLASTIC LIMIT
Lab. Vane

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.7	0
	Water		
	Org. clay of high plasticity-v. soft.	362.0	10
	Gr. & Sand- well graded - dense.	356.0	
		354.5	20

End of Borehole.

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to 350 ft./lbs. per blow.





FORM OB-ML-126 (REV. 1959.) - 59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 4

JOB 60-F-60 STATION Line 'C' 295+00

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 11/60. CHECKED BY K. S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST(C) AND SENSITIVITY(S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT
Lab. Vane

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level.	368.7	0
	Water	361.7	
	Organic clay of high plasticity - v. soft - dark in colour.	344.9	10
	Gr. & Sand- well graded - dense.	343.4	20
	End of Borehole.		30

STRENGTH AND PENETRATION RESISTANCE
P.S.F.
100 200 300 400
BLOWS/FT.

CONSISTENCY
MOIST. CONTENT - % DRY WT.
40 80 120 160

SAMPLE	NATURAL UNIT WT. P.C.F.
T1	68.3
T2	78.6
T3	83.3
T4	101.0
S5	-

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 5

JOB 60-F-60 STATION Line 'C' 294+00

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 11/60. CHECKED BY K. S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.7	
	Water	362.0	
	Organic clay of high plasticity - v soft - dark in colour.	349.5	
	Sand & gr. - well graded - dense.	348.0	
	End of Borehole.		

STRENGTH AND PENETRATION RESISTANCE

P.S.F. 100 200 300 400

BLOWS/FT. 0 20 40 60 80

10 20 30

3.5 +4.5 7.0

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

T1 T2 T3 S4

NATURAL UNIT WT. P.C.F.

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OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 24-59 BORE HOLE NO. 6

JOB 60-F-60 STATION Line 'C' 293+00

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 12/60. CHECKED BY K. S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT
Lab. Vane

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Water level	368.5	
	Water	364.0	
	Silt with fine sand loose brown.	362.0	
	Sand - fine - very loose - brown.	361.5	
	Sand with excess of fine silty particles - very loose.	352.0	
	Organic silt of intermediate plasticity - soft - dark in colour.	345.7	
	Gravel & sand - well graded - Dense.	344.2	
	End of Borehole		

STRENGTH AND PENETRATION RESISTANCE

P.S.F. 100 200 300 400

BLOWS/FT. 0 20 40 60 80

10 20 30

CONSISTENCY

MOIST. CONTENT - % DRY WT. 0 40 80 120

SAMPLE

NATURAL UNIT WT. P.C.F.

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
T4	106.5
S5	-

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DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 7

JOB 60-F-60 STATION Line 'C' 293+00 50' Lt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 12/60. CHECKED BY K. S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.5	
	Water	364.3	
	Sand with excess of fine silty particles - very loose.	351.0	
	Organic silt of intermediate plasticity-soft - dark in colour.	344.3	
	Sand & gravel- well graded - dense.	338.8	
	End of penetration Dynamic cone test only.		

Penetration Resistance Profile shown, obtained by driving a 2" dia cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 0 20 40 60 80

0 10 20 30 40

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

OFFICE REPORT ON SOIL EXPLORATION

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MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 8

JOB 60-F-60 STATION Line 'C' 294+00 50' Lt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 12/60. CHECKED BY K. S.

2" DIA SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Water level	368.5	0
	Water		
	Organic clay of high plasticity - very soft.	362.0	10
	Sand, gravel - well graded - dense.	349.0	20
	End of Penetration Dynamic cone test only	338.0	30
			40

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 0 20 40 60 80

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

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DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 9

JOB 60-F-60 STATION Line 'C' 295/00 50' Lt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 12/60. CHECKED BY K. S.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.5	0
	Water	362.5	
	Organic clay of high plasticity - very soft.		10
			20
	Sand & gravel - well graded - dense.	342.5	30
		333.5	40

End of Penetration
Dynamic cone test only

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 20 40 60 80

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

FORM OB-MR-126 (REV. 1959.) - 59-5008

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DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 10

JOB 60-F660 STATION Line 'C' 296+00 50' Lt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 12/60. CHECKED BY K. S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +%
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.5	0
	Water	361.3	
	Organic clay of high plasticity - v. soft.		10
		345.3	20
	Sand & gravel - well graded - dense.		30
		336.0	
	End of Penetration Dynamic cone test only		40

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.
BLOWS/FT. 20 40 60 80

CONSISTENCY
MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

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MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 11

JOB 60-F-60 STATION Line 'C' 297+00 50' Lt.

DATUM G.S.C. COMPILED BY R. K.

BORING DATE July 12/60. CHECKED BY K. S.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.5	
	Water	363.2	
	Organic clay of high plasticity - v. soft.		
	Sand & gravel-well graded - dense.	356.2	
		353.0	

End of Penetration
Dynamic cone test only

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 0 20 40 60 80

0
10
20

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

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MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 12

JOB 60-F-60 STATION 297+80 Line 'C' 36' Lt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 12/60. CHECKED BY K. S.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX (
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.5	0
	Water	365.8	
	Organic clay of high plasticity-v. soft.	358.8	10
	Gravel & sand - well graded - dense.		20
		336.5	30
	End of Penetration Dynamic cone test only		40

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 20 40 60 80

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

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MATERIALS AND RESEARCH SECTION

W.P. 98-60 BORE HOLE NO. 13

JOB 60-F-60 STATION Line 'C' 296+70 20' Rt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 13/60. CHECKED BY K. S.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Water level	368.5	0
	Water		
	~~Org. clay of high plasticity-v. soft~~	363.0	
	Gravel & sand-well graded-dense.	362.0	10
		355.0	20

End of Penetration
Dynamic cone test only

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE
P.S.F.
BLOWS/FT.
20 40 60 80

CONSISTENCY
MOIST. CONTENT - % DRY WT.
SAMPLE
NATURAL UNIT WT. P.C.F.

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 98-60 BORE HOLE NO. 14

JOB 60-F-60 STATION Line 'C' 296/70 20' Lt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 13/60. CHECKED BY K. S.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.5	
	Water		
	Org. clay of high plasticity-v. soft.	363.0	
	Gravel & sand-well graded - Dense.	360.0	
	End of Penetration Dynamic cone test only	340.0	

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 0 20 40 60 80

10 20 30

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with an energy equal to 350 ft./lbs. per blow.

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MATERIALS AND RESEARCH SECTION

W P 224-59

JOB 60-F-60

DATUM G.S.C.

BORING DATE July 13/60.

BORE HOLE NO. 15 (Sounding)

STATION Line 'C' 296+00 40' Rt.

COMPILED BY B. K.

CHECKED BY K. S.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

2" DIA. CONE

2" SHELBY

CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O

VANE TEST (C) AND SENSITIVITY (S) +%

NATURAL MOISTURE AND LIQUIDITY INDEX LI

LIQUID LIMIT X

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.0	
	Water	363.3	
	Org. clay of high plasticity-v. soft		
	End of Sounding - Refusal - Probably sand, gravel & boulders		

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 0 10

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

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MATERIALS AND RESEARCH SECTION

W.P. 224-59

JOB 60-F-60

DATUM G.S.C.

BORING DATE July 13/60.

BORE HOLE NO. 16 (Sounding)

STATION Line 'C' 295/00 45' Rt.

COMPILED BY B. K.

CHECKED BY K. S.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

2" DIA. CONE

2" SHELBY

CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O

VANE TEST (C) AND SENSITIVITY (S) +

NATURAL MOISTURE AND LIQUIDITY INDEX W

LIQUID LIMIT

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Water level	368.0	0
	Water	362.4	
	Org. clay of high plasticity-v. soft.	357.5	10
	End of Sounding- Refusal - Probably sand gravel and boulders.		20

STRENGTH AND PENETRATION RESISTANCE

P.S.F.

BLOWS/FT.

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

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MATERIALS AND RESEARCH SECTION

W.P. 224-59

JOB 60-F-60

DATUM G.S.C.

BORING DATE July 13/60.

BORE HOLE NO. 17 (Sounding)

STATION Line 'C' 294+00 50' Rt.

COMPILED BY B. K.

CHECKED BY K. S.

2" DIA SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

2" DIA CONE

2" SHELBY

CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)

VANE TEST (C) AND SENSITIVITY (S)

NATURAL MOISTURE AND LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.0	0
	Water	363.3	
	Org. clay of high plasticity - very soft.		10
		349.0	20
	Refusal - End of Sounding Probably sand, gravel and boulders.		

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT

CONSISTENCY

MOIST. CONTENT & DRY WT.

NATURAL SAMPLE UNIT WT. P.C.F.

FORM OR-ML-126 (REV. 1959) - 59/5008

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DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 224-59 BORE HOLE NO. 18 (Sounding)

JOB 60-F-60 STATION Line 'C' 293/50 50' Rt.

DATUM G.S.C. COMPILED BY B. K.

BORING DATE July 13/60 CHECKED BY K. S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Water level	368.0	0
	Water	363.0	
	Organic clay of high plasticity - v. soft.		10
		347.0	20
	Refusal - End of Sounding Probably sand, gravel and boulders.		30

STRENGTH AND PENETRATION RESISTANCE P.S.F. BLOWS/FT.

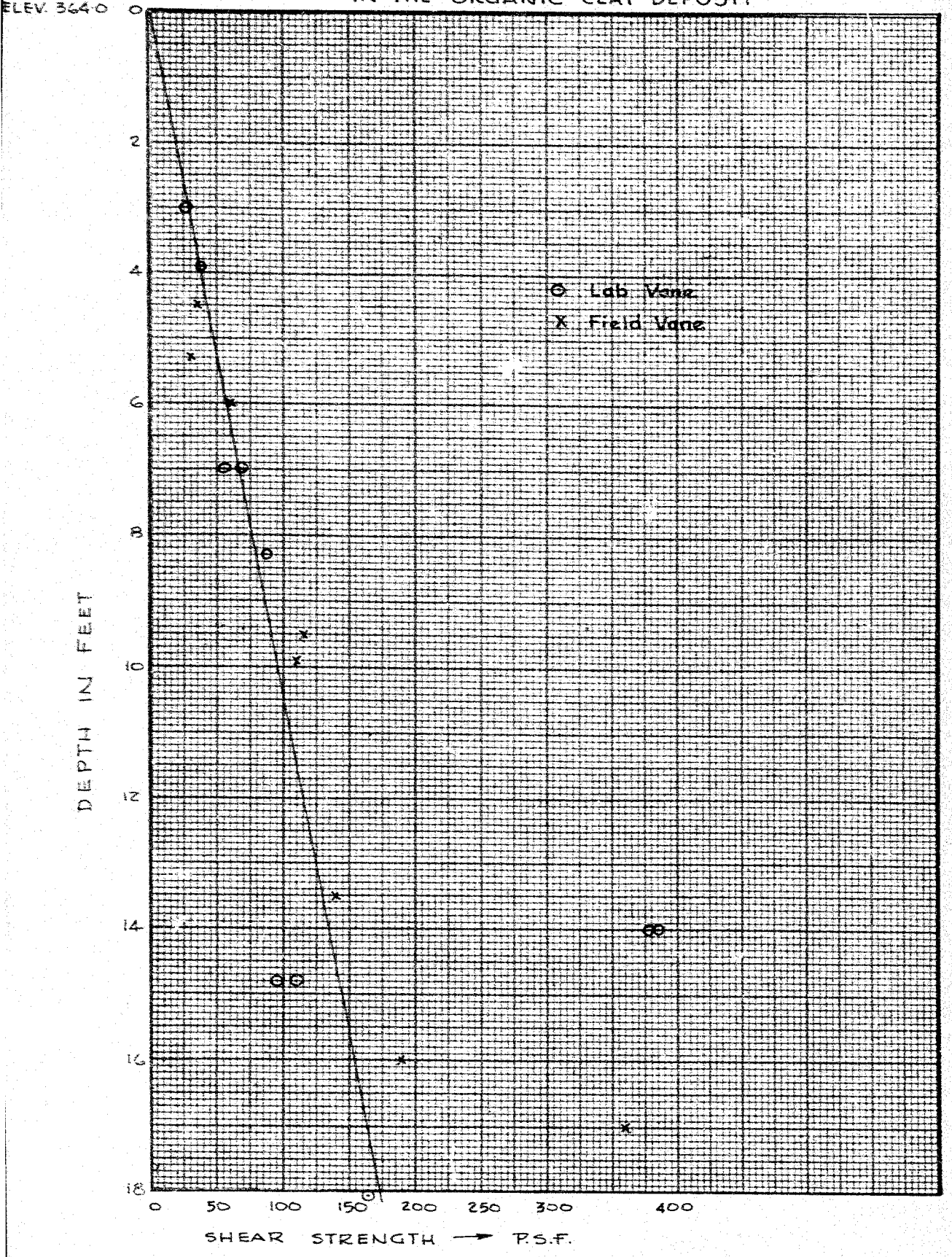
CONSISTENCY MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

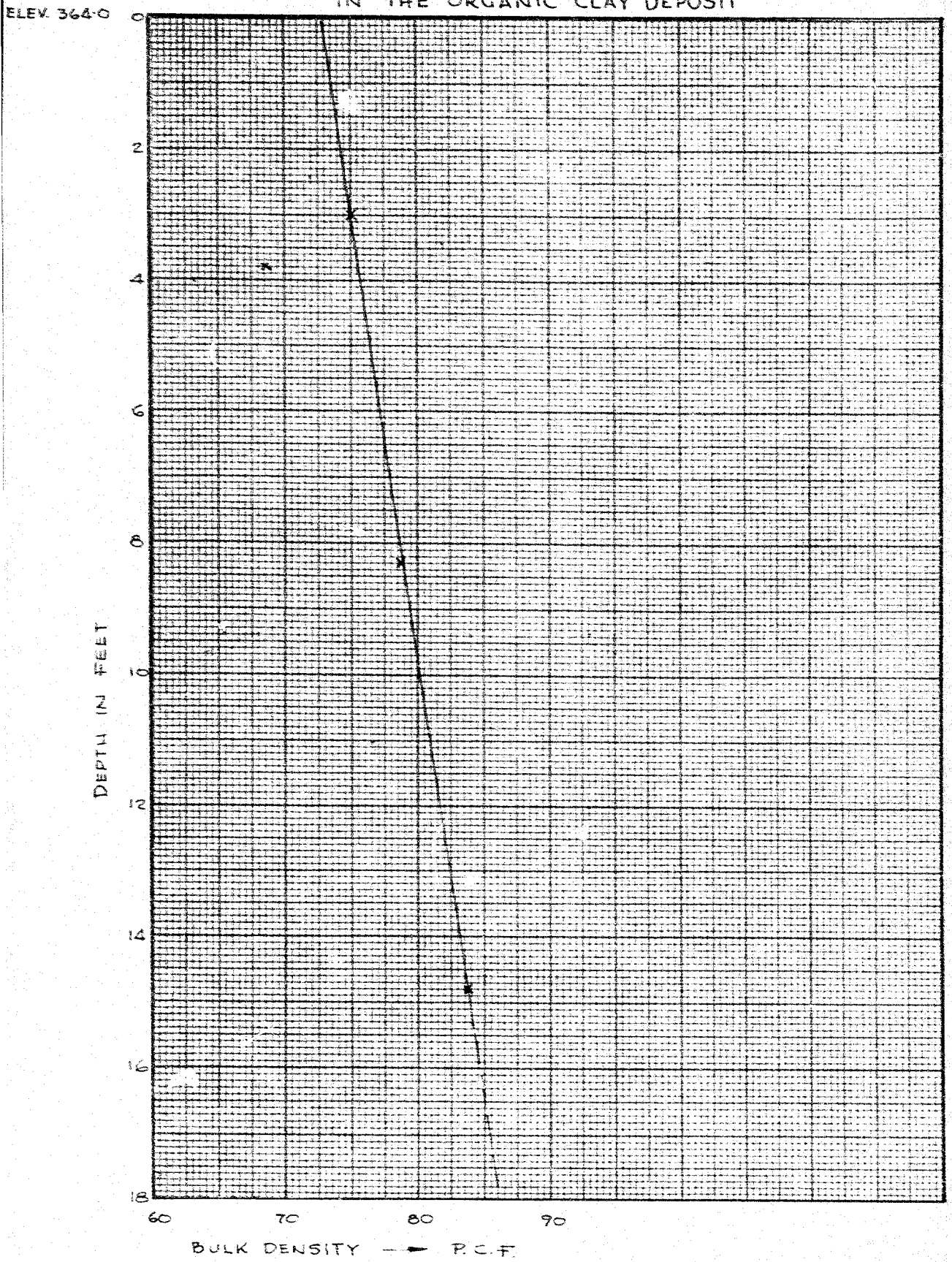
W.P. 224-59 JOB 60-F-60

VARIATION of SHEAR STRENGTH WITH DEPTH IN THE ORGANIC CLAY DEPOSIT



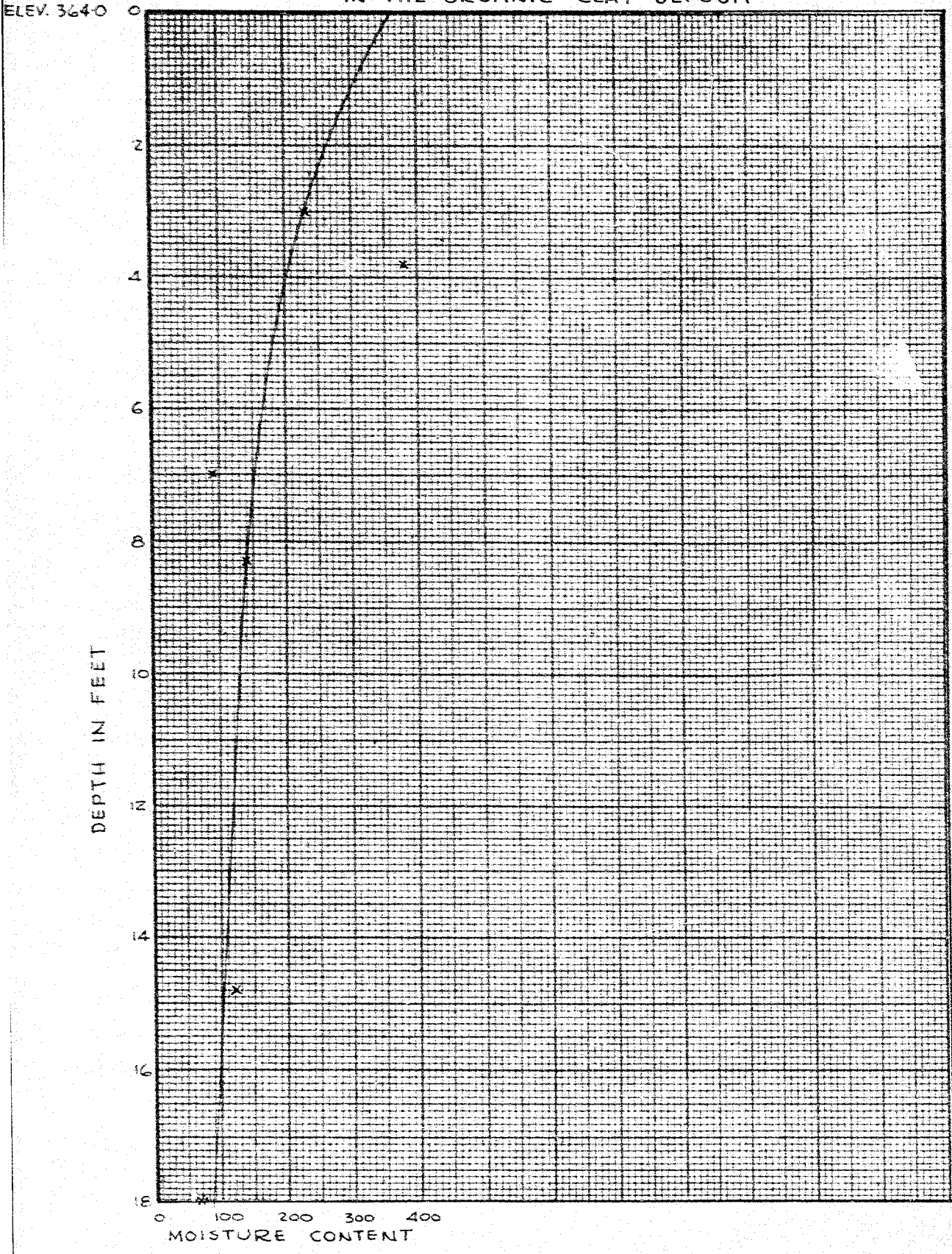
W.P. 224-59 JOB 60-F-60

VARIATION of BULK DENSITY WITH DEPTH IN THE ORGANIC CLAY DEPOSIT



W. P. 224-59 JOB 60-F-60

VARIATION of MOISTURE CONTENT WITH DEPTH IN THE ORGANIC CLAY DEPOSIT



#60-F-60

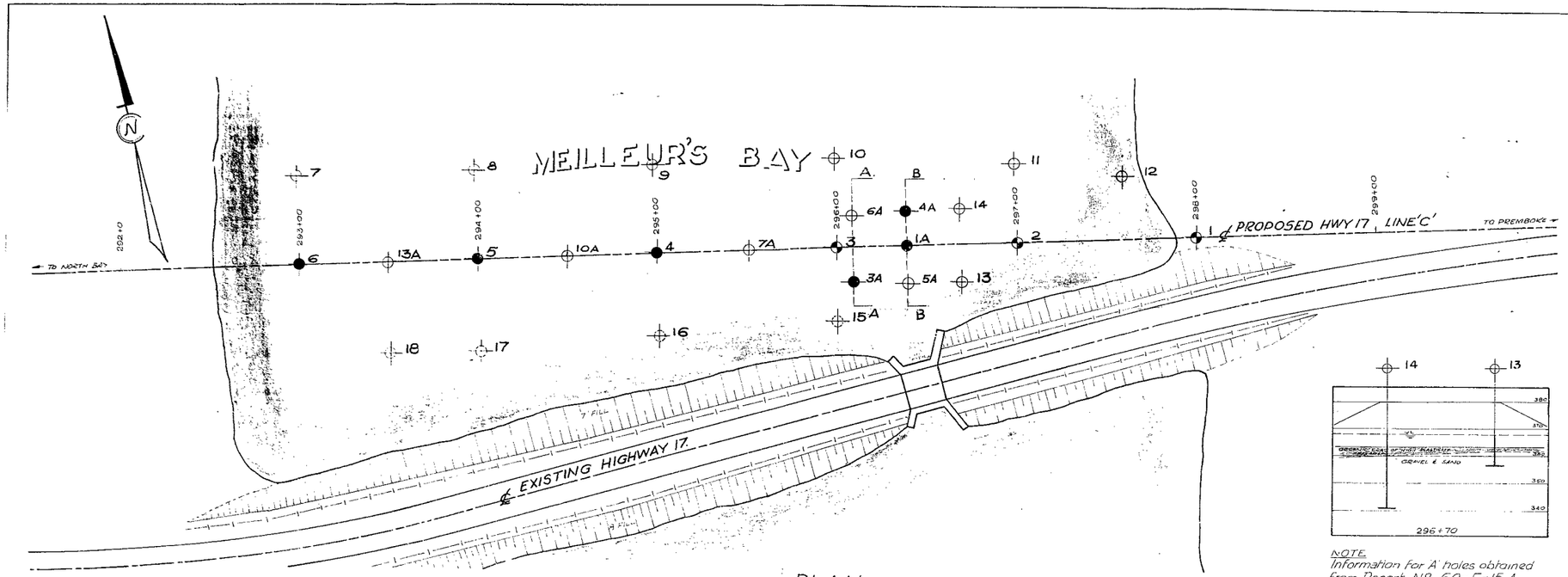
W.P. #224-59

Hwy. #17

NEW CAUSEWAY

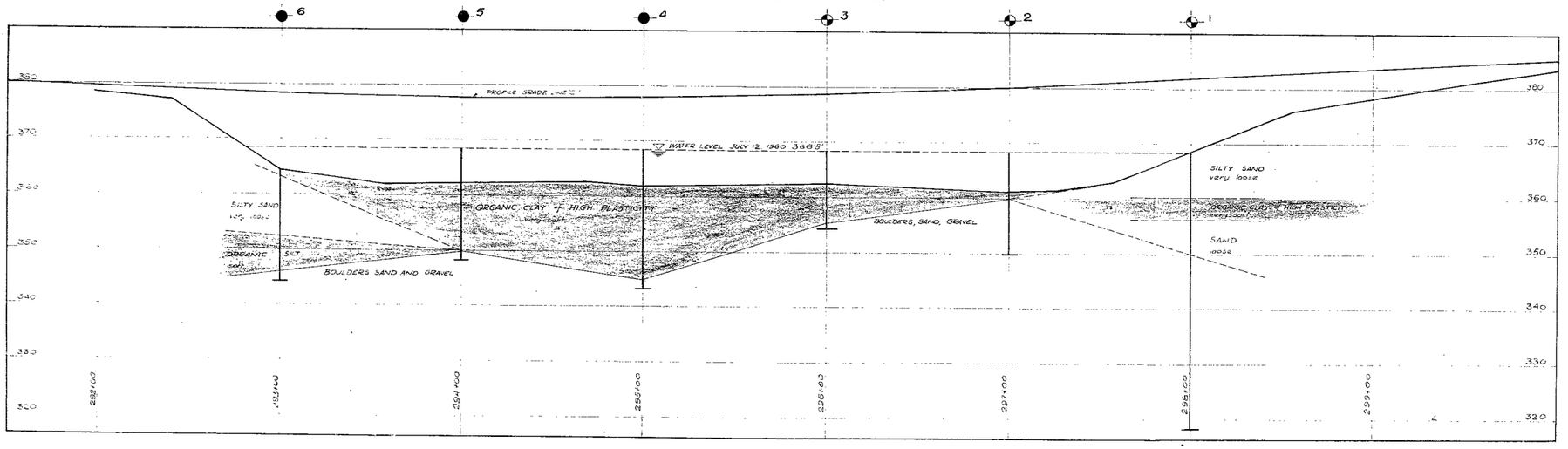
(PROP.) AT

MEILLEURS BAY



PLAN

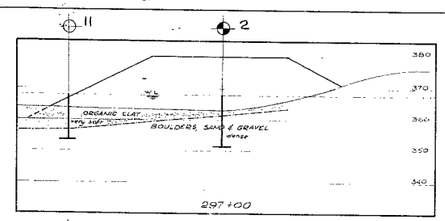
Scale: 1 inch = 30 feet

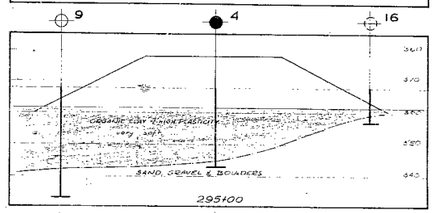


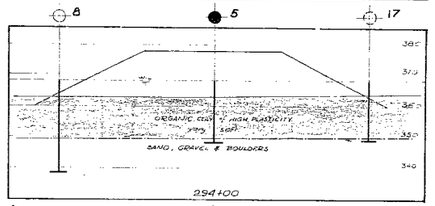
PROFILE

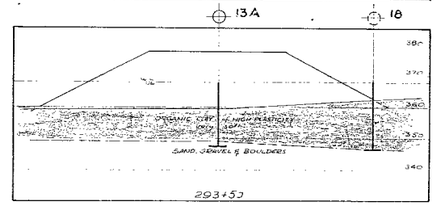
Scale = Hor 1"=30 Vert 1"=10'

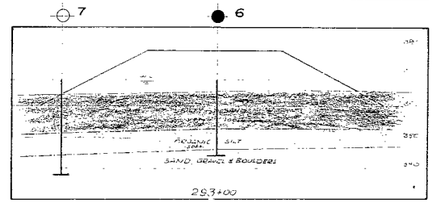
NOTE.
Information for A holes obtained from Report No. 60-F-15 A.



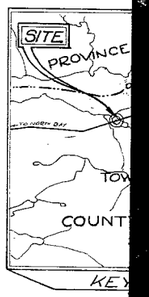


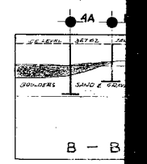






SECTIONS Scale: 1 inch = 20 Feet



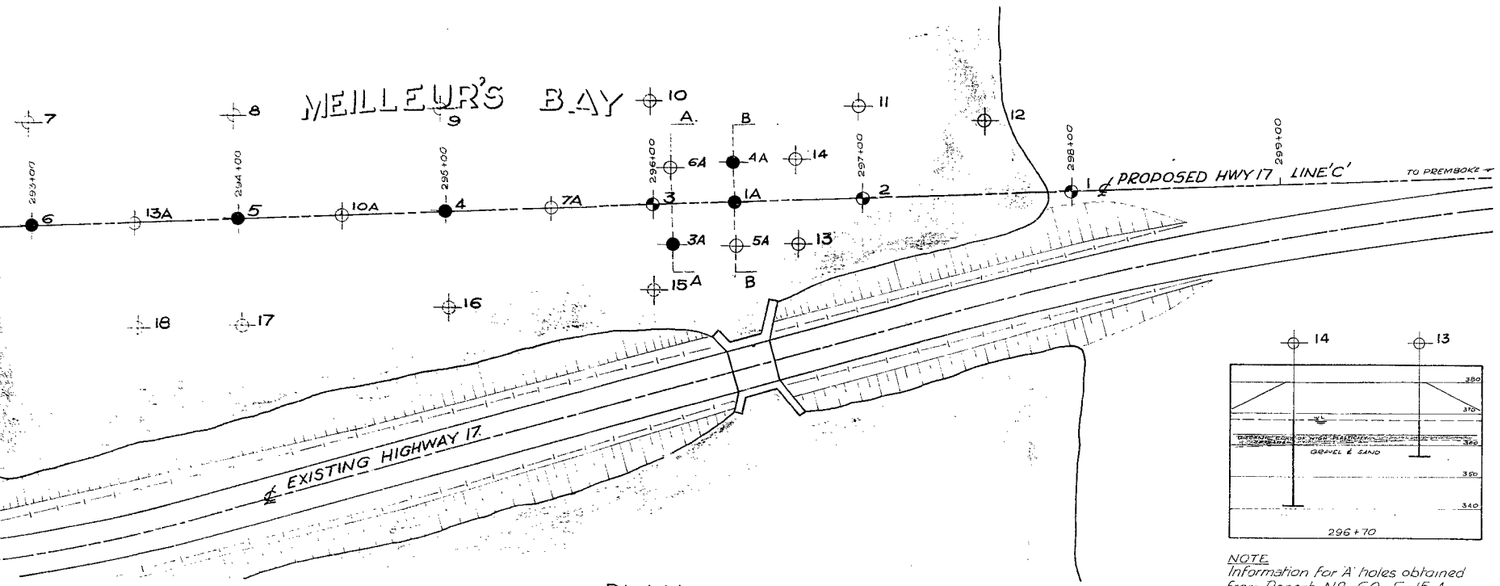


BORE HOLE	
A HOLES BORED FR	
HOLE No	STATION
1	298+00
2	297+03
3	296+02
4	295+00
5	294+00
6	293+00
7	293+00
8	294+00
9	295+00
10	296+00
11	297+00
12	297+60

DEPA

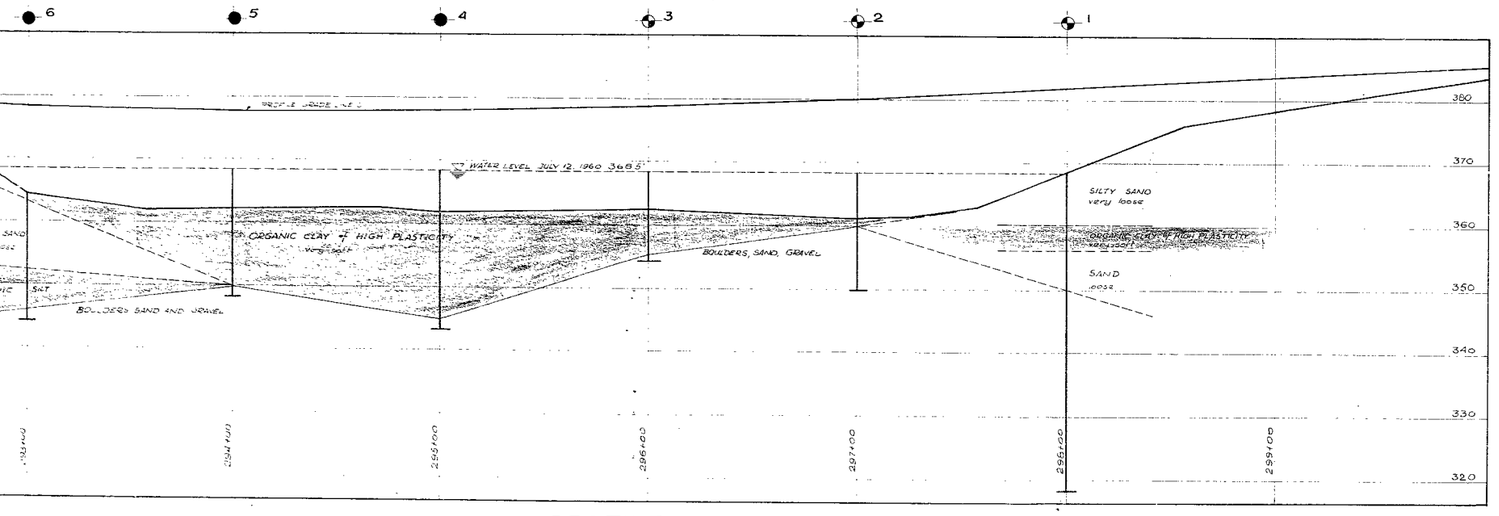
MEILLEU

HWY 17
TOWNSHIP RO...
LOCATION ...
DRAWN ...
DATE ... AUG ...
SCALE ... SHOWN



PLAN

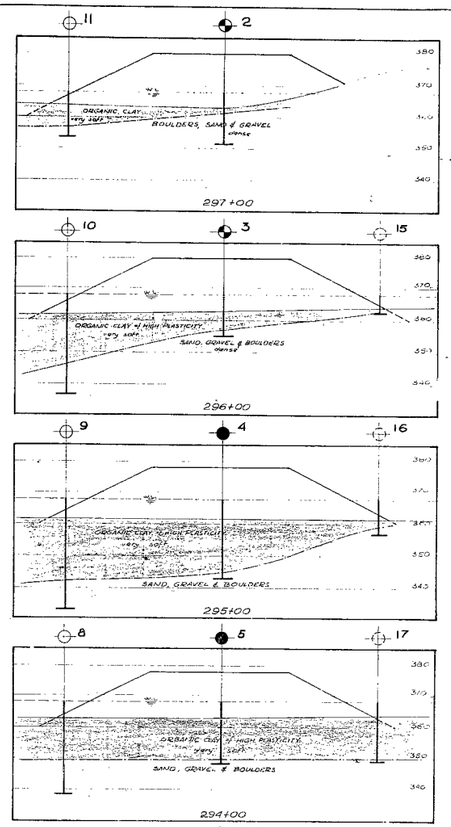
Scale: 1 inch = 30 feet



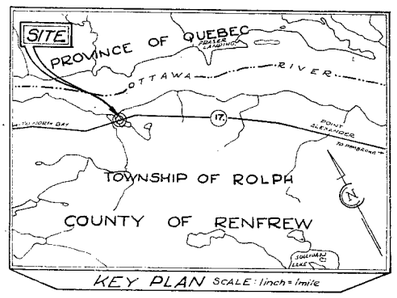
PROFILE

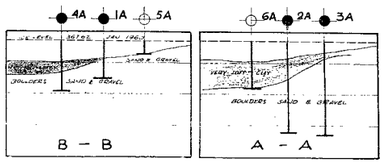
Scale = Hor 1"=30 Vert 1"=10'

NOTE
Information for 'A' holes obtained from Report Nº 60-F-15 A.



SECTIONS Scale - Inch = 20 Feet





Scale Hor 1" = 30' Vert 1" = 20'

LEGEND

BORE HOLE ● PENETRATION HOLE ⊕ SOUNDING ⊕

'A' HOLES BORED FEB 1960 ELEVATIONS 368.0 (WATER LEVEL)

HOLE Nº	STATION	DISTANCE FROM ℄	HOLE Nº	STATION	DISTANCE FROM ℄
1	298+00	℄	13	296+70	20' RT
2	297+03	℄	14	296+70	20' LT
3	296+02	℄	15	296+00	40' RT
4	295+00	℄	16	295+00	45' RT
5	294+00	℄	17	294+00	50' RT
6	293+00	℄	1 A	296+39	℄
7	293+00	50' LT	3 A	296+03	18' RT
8	294+00	50' LT	4 A	296+39	20' LT
9	295+00	50' LT	5 A	296+39	20' RT
10	296+00	50' LT	7 A	295+50	℄
11	297+00	50' LT	10 A	294+50	℄
12	297+80	35' LT	13 A	293+50	℄

NOTE

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT 'A' HOLE LOCATIONS. BETWEEN HOLES THE BOUNDARIES ARE ADJUSTED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH SECTION

MEILLEUR'S BAY PROPOSED CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY 17 DISTRICT 13 COUNTY RENFREW

TOWNSHIP ROLPH LOT 36 CON. RANGE A-B

LOCATION 4 MILES N.W. OF POINT ALEXANDER

DRAWN BY T. COUTTS CHECKED BY J.C.L. W.I. 324-59

DATE 4 AUG 1960 APPROVED BY DRAWING No. 60-F-60 A

SCALE AS SHOWN