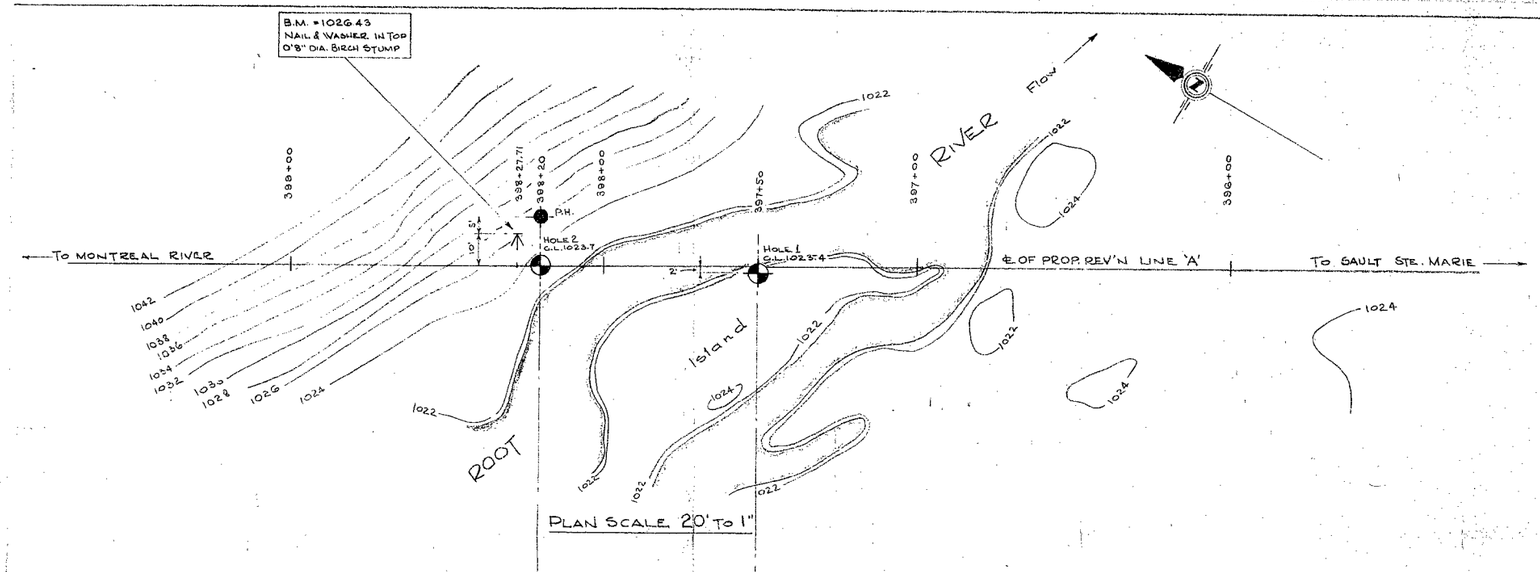
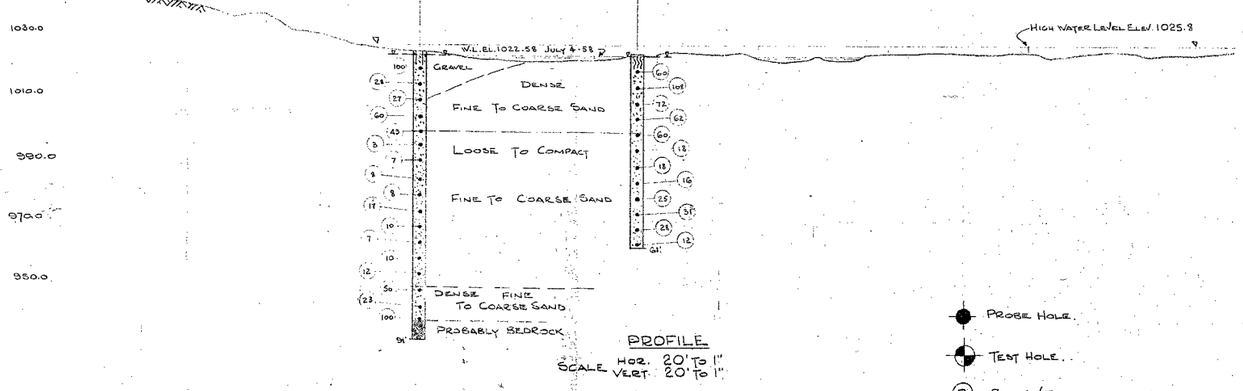
58-F-284C
W.P. 909-57
Hwy. #17
Root River
#3 Crossing



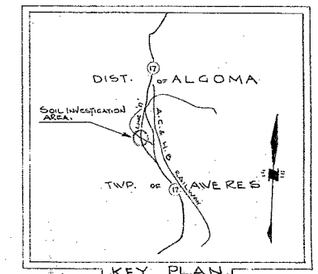
PLAN SCALE 20' TO 1"



PROFILE
SCALE HOR. 20' TO 1"
VERT. 20' TO 1"

PROBE HOLE.
TEST HOLE.
(9) BLOWS/FOOT.

NOTE: PLEASE SEE BOREHOLE LOGS FOR COMPLETE SOIL DETAILS.



KEY PLAN
SCALE 1 MI. TO 1 IN.

NOTE: THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. A LINEAR VARIATION IN SOIL STRATIGRAPHY HAS BEEN ASSUMED BETWEEN BOREHOLES, AND THIS MAY ACTUALLY DIFFER FROM THAT SHOWN.

REGISTERED PROFESSIONAL ENGINEER
E. M. PETO
PROVINCE OF ONTARIO

e.m. peto & associates ltd.

SOIL SITE INVESTIGATION
AT
HWY.17 – ROOT RIVER CROSSING No.3
FOR
DEPARTMENT OF HIGHWAY OF ONTARIO

OUR JOB No. 5870 DATE JULY 14-58
CLIENTS PLAN No. E3368-1 PER. C.T.

BA 765

AN INDEPENDENT ORGANIZATION PROVIDING A COMPLETE SOIL ENGINEERING & INVESTIGATION SERVICE

e. m. peto associates ltd.

YOUR REFERENCE:- W.P. 909 - 57

OUR REFERENCE:- 5870

850 roselawn avenue,
TORONTO, ONTARIO.
RUssell 1 - 4955.

16th July, 1958.

58-284C

Mr. A.M. Toye,
Chief Bridge Engineer,
Department of Highways of Ontario,
280, Davenport Road,
TORONTO.
Ontario.

For the attention of Mr. J.C. McAllister, P. Eng.

Dear Sir,

Soil Site Investigation
Highway 17 and Root River # 3 Crossing

In reference to your letter dated 27th May, 1958, we are forwarding herewith four (4) copies of our report covering this investigation for your attention.

We have considered the site conditions in detail in the attached soils report. Here for your convenience is a summary of our findings and recommendations.

1. Soil Condition.

Throughout the profile, the soil is granular with varying texture and density.

(a) From the ground surface to 25 feet depth, the soil is a dense fine to coarse sand.

(b) Between 25 and 75 feet depth the sand is loose to compact; the texture is fine, mixed with some coarse gravel.

(c) Below 75 feet and to refusal coarse sand dominates and the soil is very dense.

2. The ground water level is 1 foot below the ground surface at elevation 1022.5. The water level in the river on July 4th, 1958, was at elevation 1022.58; the recorded high water level at the Root River at this site is at elevation 1025.80.

3. Using spread footings the recommended depth of foundation is 5 feet below the river bottom. The allowable bearing capacities with a factor of safety of 3 and with 1 inch maximum settlement are:-

(a) 5 feet minimum width of footing, 5500 p.s.f.

(b) 10 feet minimum width of footing, 9500 p.s.f.

It will be necessary to dewater the excavation during construction.

4. The bearing capacity of the soil is adequate for a bridge foundation. Vibration transmitted by the foundation structure may affect the underlying loose granular material and can cause differential settlement. We therefore recommend the use of a simply supported span for this site.

5. Using multiple span box or pipe culverts the applied foundation pressure will be low and the embankment mass will absorb the traffic-created vibration.

The minimum cover required on the culvert is 4 feet.

6. If no record of scour is available, scour protection should extend 10 feet below the existing river bottom.

7. For the construction of the fill on the low-lying flood plain, gravel is the best suited material. The fill should be constructed in 12 inches well compacted layers.

Side slopes 1-1/2 horizontal on 1 vertical can be used.

We hope that we have covered all the technical matters arising from this investigation. Should you require any additional advice or amplification of our recommendations, we shall be pleased to be of further service.

Yours very truly,

E. M. PETO ASSOCIATES LTD.

GYS:pf

E.M. Peto, P. Eng.

DEPARTMENT OF HIGHWAYS OF ONTARIO

Highway 17 and Root River # 3 Crossing

W. P. 909 - 57

SOILS REPORT

by

E. M. Peto Associates Ltd.

Toronto. Ontario.

July, 1958.

e. m. peto associates ltd., 850 roselawn avenue, Toronto 10, Ontario

Job No. 5870 Client's Ref. No. W.P. 909 - 57 Date 16th July, 1958.

Report on

SOIL SITE INVESTIGATION

at

HIGHWAY 17 AND ROOT RIVER # 3 CROSSING W.P. 909 - 57, ALGOMA. ONTARIO.

for

DEPARTMENT OF HIGHWAYS OF ONTARIO.

INTRODUCTION

In accordance with written instructions from Mr. J. C. McAllister, dated May 27th, 1958, a soil investigation was carried out at the site of the proposed crossing of Highway 17 (T. C. H.) and Root River # 3.

The object of the investigation was:-

(a) to determine the soil profile at the site

(b) to make recommendations for the type of foundation best suited to the soil condition.

(c) to determine the allowable bearing capacity of the soil at the elevation of the proposed foundation structure.

PROGRAMME OF WORK

June 23th, 1958:	Equipment moved to the site from Root River # 2.
June 30th - July 8th, 1958:	Driving borehole # 2.
July 9th, 1958:	Driving Dutch cone probe beside test hole # 2.
July 9th - 11th, 1958:	Driving borehole # 1.
July 12th - 13th, 1958:	Equipment loaded and returned, to Toronto.

GENERAL INFORMATION

1. Our standard soil sampling procedures were followed. These are described in Appendix II.

2. Two boreholes were driven, borehole # 1 to the depth of 61 feet and borehole # 2 to 91 feet depth.

3. A site plan showing the soil test hole locations together with a soil profile through the two test holes and detailed individual borehole logs are included.

The ground surface elevations are referred to D. H. O. benchmark N. & W. in top 0.8 feet birch stump 10 feet right Sta. 398 + 27.71, elevation 1026.43.

SITE AND GEOLOGY

The site is located on the flood plain of the Root River at approximately elevation 1023.5 (Geod. datum).

To the North the terrain rises sharply some 20 feet and then levels off; to the South the rise is gradual.

SITE AND GEOLOGY (contd.)

In borehole # 2 refusal, probably bedrock, was reached at the depth of 85 feet. Six feet of light green and pink quartz porphyry rock core was recovered from 85 to 91 feet. Core recovery was 85%.

SOIL CONDITIONS

Throughout the profile, the soil is granular, with varying texture and density.

From the ground surface to a depth of about 25 feet, a dense fine to coarse sand layer is found. Below this dense upper layer, there exists a thick stratum of loose to compact fine to coarse sand. The sand becomes denser and coarser at about 75 feet depth, refusal probably bedrock was reached in this material at 85 feet depth in borehole # 2. The rock was cored by diamond drilling an additional 6 feet to the 91 feet depth.

(a) Upper Dense Fine to Coarse Sand Layer

Below the ground surface and to the depth of about 25 feet is a layer of dark grey to olive grey fine to coarse sand. In borehole # 2 only, from the ground surface to the 15 feet depth, a gravel pocket was encountered.

(b) Loose to Compact Fine to Coarse Sand

Below the dense layer for a considerable depth is a grey-brown loose to compact layer of fine to coarse sand. This layer extends to approximately 75 feet depth. Hole # 1 was terminated in this material at a depth of 61 feet.

(c) Lower Dense Fine to Coarse Sand Layer

In borehole # 2 between 75 to 85 feet depth, a layer of compact to very dense light grey-brown fine to coarse sand is found. Refusal, probably bedrock, was reached at 85 feet depth. Six feet of light green and pink quartz porphyry rock core was recovered from 85 to 91 feet.

TEST RESULTS

Standard Penetration Test

The variation of the standard penetration with depth in a graphical form is given in Appendix I.

The upper fine to coarse sand layer is compact to very dense with an average standard penetration of 62.

Between 25 and 75 feet below ground surface in the loose to compact fine to coarse sand, there is a marked drop in the penetration values obtained, and consequently, in the density of the underlying material. In this layer, the average standard penetration is 14.4 blows per 12 inches. In this layer there is a difference in the penetration values obtained between the two boreholes. The average penetration value for borehole # 1 is 21 blows per foot and, for borehole # 2, 9 blows per foot.

In hole # 2 between the 75 feet depth and refusal (in the lower dense fine to coarse sand layer), the standard penetration values were between 23 to 100 blows per 12 inches.

A dutch cone probe test was carried out (using the 140 lbs hammer) approximately 15 feet East of hole # 2 in order to provide additional information for pile driving operations, should a pile foundation be considered necessary.

WATER CONDITIONS

The general surface and subdrainage is toward the Root River.

At the time of the soil sampling work, the ground water level was about 1 foot below the ground surface at elevation 1022.5. The water level in the river on July 4th, 1958, was at elevation 1022.58. The maximum depth of water in the river at the centerline was about 1' 6". The water level fell about 4 inches between July 1st and 4th, 1958. The high water level of the Root River recorded at this site is at elevation 1025.80.

ENGINEERING CONSIDERATIONS

1. To carry the foundation load by piles on refusal at the depth of 85 feet is a possible but uneconomical proposition.

2. The 25 feet thick dense fine to coarse sand layer is well suited for support of a spread foundation structure. However, as it is underlain by the loose to compact fine to coarse sand, it will be necessary to place the foundation as high as the frost condition and the river bottom elevation allow. To place the footings 5 feet below the river bottom will give a reasonable foundation depth, with scour protection extending to sufficient distance below the footing.

The allowable bearing capacities based on an average standard penetration of 62 blows per 12 inches with a surcharge of 5 feet, using a safety factor of 3 and limiting settlement to 1 inch, are as follows:-

(a) For 5 feet minimum width of footing, 5500 p.s.f.

(b) For 10 feet minimum width of footing, 9500 p.s.f.

3. Bridge, reinforced concrete box culvert or a battery of pipe culverts can be installed for this Root River crossing.

(a) A bridge foundation structure will concentrate the loading and the vibration. The bearing capacity of the upper dense fine to coarse sand layer is sufficient to carry the superimposed load; however, the vibration may affect the underlying loose granular material and can cause differential settlement. A simple span structure is therefore preferable.

As the ground water level is high, it will be necessary to dewater the excavation during construction of the foundation structure.

(b) Culverts have the advantage of applying low pressure on the soil and the mass of the embankment will absorb a considerable part of the vibration created by the traffic.

ENGINEERING CONSIDERATIONS (contd.)

(b) (contd.) The more common culvert types suitable for use on this site are:-

(i) Multiple span, reinforced concrete box culverts

(ii) Multiple pipe culverts made of reinforced concrete, plain concrete or corrugated metal.

The size and the number of openings for the culvert are dictated by hydraulic considerations. To minimize the possibility of losing support underneath the pipe culverts, a reinforced concrete base slab, with up and downstream cut off walls, for scour protection, is recommended.

The minimum height of fill from top of pipe to the road surface is 4 feet.

4. It is general practice to assume a depth of scour of 3 or 4 times the maximum flood rise of the river. On this basis, scour protection should extend approximately 10 feet below the existing river bottom. However, should the Department have extensive records for the Root River indicating that scour is somewhat less than average along this section of the river, this requirement can be adjusted accordingly.

5. For the low lying area on the flood plain of the river, the best suited material for fill construction is the fairly well graded gravel found in the upper 25 feet of the profile, and probably on the river bank.

The fill should be constructed in 12 inches well compacted layers.

Side slopes 1-1/2 horizontal on 1 vertical can be used.

E. M. PETO ASSOCIATES LTD.

E. M. Peto, P. Eng.

GYS:pf

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Highway N.S.17 - Rest Runs #3 Sampling Job No. 5870 Borehole No. 1

Client Dept. of Highways of Ontario Casing B.X. (2½" diam.) Boring Date July 9th, 11th 1958

Datum Geodetic Compiled By G.V.S. Checked By M.M.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S.S. 2" STANDARD SPLIT TUBE SAMPLE
- S.L. SPLIT BARREL WITH LINERS
- S.T. THIN-WALLED SHELBY TUBE SAMPLE
- W.S. WASH SAMPLE
- R.C. ROCK CORE

ABBREVIATIONS

- V.T. IN SITU VANE SHEAR TEST
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
Ground Surface			0' 0"					
			1023.4					G.W.L. = 1'0" July 11th, 1958
Organic matter, partly decomposed mixed with medium sand	Dark brown light brown	-			1 Sample from casing			Wet
			5' 0"					
Fine to medium sand with rock fragments	Dark brown	Very dense			2	S.S.	60	Wet
			10' 0"					
Fine to coarse sand with gritts, pebbles & rock fragments	Dark grey	Very dense			3	S.S.	108	Very moist
			15' 0"					
Medium to coarse sand with fine gravel	Mixed colour	Very dense			4	S.S.	72	Sample lost, wash sample
			20' 0"					
Medium sand, some fines	Dark grey	Very dense			5	S.S.	62	Sample lost, wash sample
			25' 0"					
Fine to medium sand, Some coarse sand	Dark grey brown	Very dense			6	S.S.	60	Sample lost, wash sample
			30' 0"					
Fine to medium sand	Grey brown	Compact			7	S.S.	18	Sample lost, wash sample
			35' 0"					
As above	-"-	-"-			8	S.S.	18	Sample lost, wash sample Note: Cased hole to 35 feet, left overnight, sand backed up in casing 7 feet.
			40' 0"					
Coarse sand, Some fines, grit & pebbles	Mixed colour	Compact			9	S.S.	16	Sample lost, wash sample
			45' 0"					
Fine sand	Grey brown	Compact			10	S.S.	25	Sample lost, wash sample
			50' 0"					
As above	-"-	Compact to Dense			11	S.S.	31	Sample lost, wash sample
			55' 0"					
As above	-"-	Compact			12	S.S.	28	Sample lost, wash sample
Fine to coarse sand, gritts & pebbles	Dark grey brown		61' 0" 952.4 Hole		13	S.S.	12	Sample lost, wash sample retained. Note: Unable to bail hole below 15' because of incoming water.

terminated.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE — TORONTO, ONTARIO

BOREHOLE LOG

Job Name [illegible] Job No [illegible] Elevation Top [illegible]

Client [illegible] Casing [illegible] Bottom Hole [illegible]

Datum Geodetic Compiled By [illegible] Checked By M.M.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

S.S. 2" STANDARD SPLIT TUBE SAMPLE
S.L. SPLIT BARREL WITH LINERS
S.T. THIN-WALLED SHELBY TUBE SAMPLE
W.S. WASH SAMPLE
R.C. ROCK CORE

ABBREVIATIONS

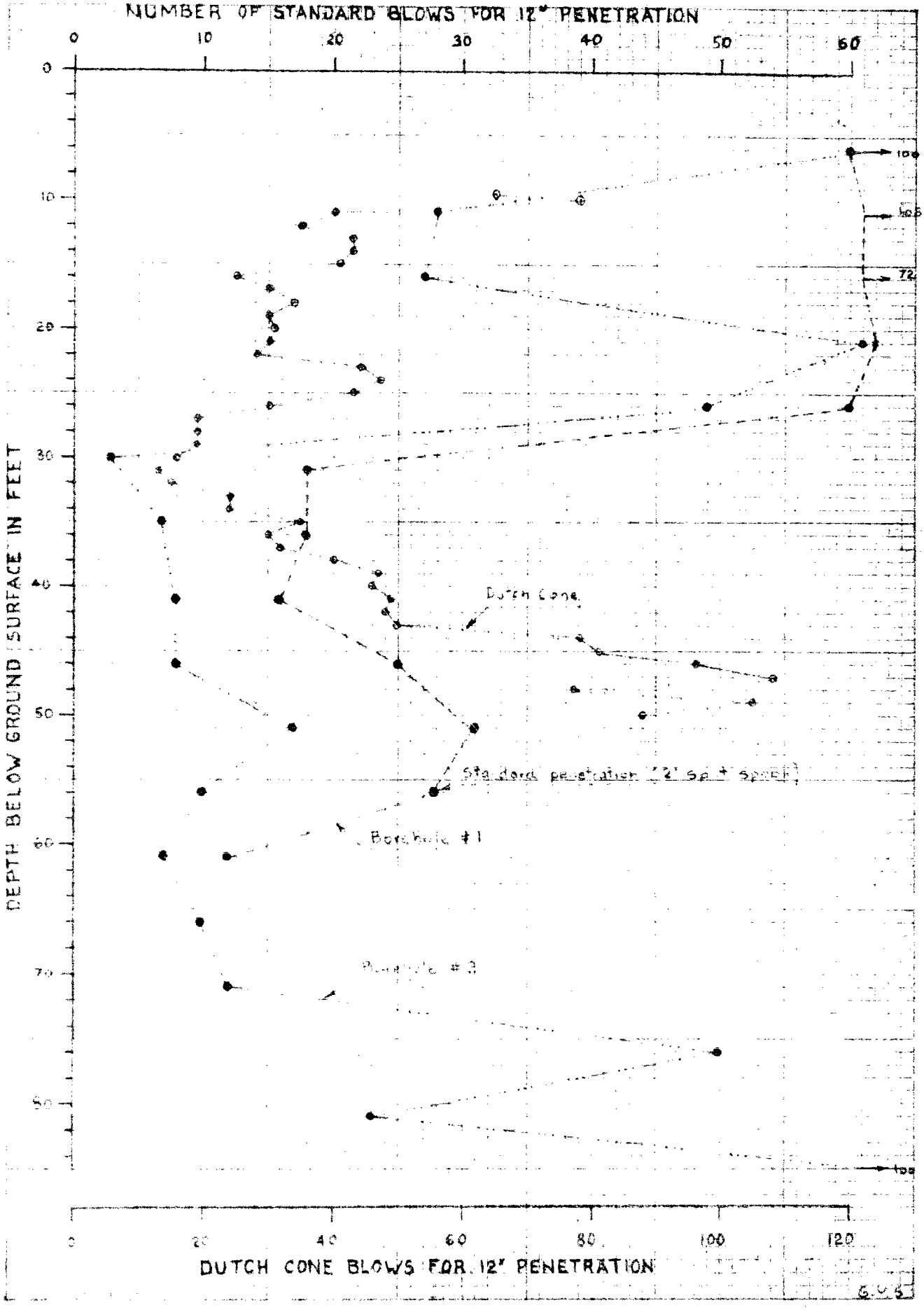
W.L. WATER LEVEL
W.P. WATER PRESSURE

SOIL DESCRIPTION	COLOUR	CONSISTENCY	DEPTH (Feet)	ELEV.	SAMPLE No.	TYPE	BLOWS PER FOOT	REMARKS
Ground surface								
			0' 0"					6 W.L. - 1' 2" July 8, 58
Fill with silt & fine to med. sand	Brown	-			1	[illegible]	-	moist
Gravel with medium sand & some silt. Boulders noted 6'-10'	Dark grey	Very dense	10' 0"		2	S.S.	-	very wet
Gravel well graded with coarse sand	Grey-brown	Compact			3	S.S.	28	very moist
Coarse, some medium sand	Grey	Compact	20' 0"		4	W.S.	27	sample lost, wash sample
Gravel well graded with coarse sand, some fines	Light olive-brown	Very dense	25' 0"		5	S.S.	80	very moist
Coarse sand & some gravel	Olive-grey	Dense			6	S.S.	49	wet
Fine sand	Dark grey-brown	Very loose	30' 0"		7	S.S.	3	Sample lost, wash sample returned
As above fine	-"-	Loose			8	S.S.	7	Sample lost wash sample returned
Fine sand	Light brown	Loose	40' 0"		9	S.S.	6	Sample lost wash sample retained.
As above	-"-	Loose	45' 0"		10	S.S.	8	Sample lost, wash sample retained. Note sand continually backing up in casing below 45 foot depth.
As above	-"-	Compact	55' 0"		11	S.S.	17	Sample lost, wash sample retained.
Fine to medium sand	Light brownish grey	Loose to compact	60' 0"		12	S.S.	10	Sample lost, wash sample retained
As above	Light grey-brown	Loose	65' 0"			S.S.	7	-"-
Fine sand some coarse sand	Mixed colours, grey with medium	Loose to compact	70' 0"			S.S.	10	-"-
Fine to coarse sand	Mixed colours, Lt. brown predom.	Compact	75' 0"			S.S.	12	-"-
Fine sand	LT. Grey-brown	Dense to very dense	80' 0"		16	S.S.	50	Wet
Fine to medium sand	-"-	Compact			17	S.S.	23	Wet N.C. = 8.2%
Fine to coarse sand possibly some gravel	-"-	Very dense	85' 0"	938.7	18	S.S.	100	Sample lost, wash sample retained
Quartz porphyry. Probably bedrock	Light green & pink				19	AXT R.C.	-	Recovery = 85% Harder than glass
			90' 0"					
			91' 0	883.27			Note	W.L. 1' 2" July 8, 58. Unable to put hole beyond 5' because of incoming water. Water believed to be coming from bottom of casing (91') and rising at a rate of about 5' per 8 minutes.
			Hole terminated.					

APPENDIX I

TEST RESULTS

Job 58-0


NUMBER OF STANDARD BLOWS FOR 12" PENETRATION
0
10
20
30
40
50
60
DEPTH BELOW GROUND SURFACE IN FEET
0
10
20
30
40
50
60
70
80
100
108
72
Dutch Cone
Standard penetration (2" SS + Spoon)
Borehole #1
Borehole #3
0
20
40
60
80
100
120
DUTCH CONE BLOWS FOR 12" PENETRATION
G.W.S.

APPENDIX II

METHOD OF OPERATION

The field investigation work is carried out by means of a skid-mounted diamond drill rig.

Standard sampling procedures are followed. Casing is driven and cleaned, either by tubes or by wash water.

Samples are recovered ahead of the casing at frequent intervals, with either a 2 inch or 3 inch O.D. split barrel sampling tube, Shelby tube, or split barrel sampling tube fitted with brass liners and special sharp cutting nose.

The standard penetration test results are recorded when sampling with the regular 2 inch O.D. split barrel sampler, these being the number of blows of a 140 pound hammer falling 30 inches, required to drive the sampling tube a distance of one foot into undisturbed soil.

The Dutch cone probe test is made by driving the drill rods into the ground with a 2-1/4" - 90° cone tip. The number of 4200 inch pound blows per foot of penetration are recorded, as in the standard penetration test.

Where required, "in situ" shear strength tests are made ahead of the casing, using modified Acker vane test equipment.

Disturbed samples are visually classified in the field, sealed in sample jars, and are re-examined, and tested as necessary, in the soils laboratory. Undisturbed samples are returned to the laboratory for later examination and testing, as required.

The test holes are bailed at the end of the day and on completion. Subsequent water level readings are taken for the duration of the field work. Water pressure readings are recorded when Artesian water conditions are encountered. Moisture content samples are recovered at frequent intervals to assist in the soil classification and the interpretation of water table results.