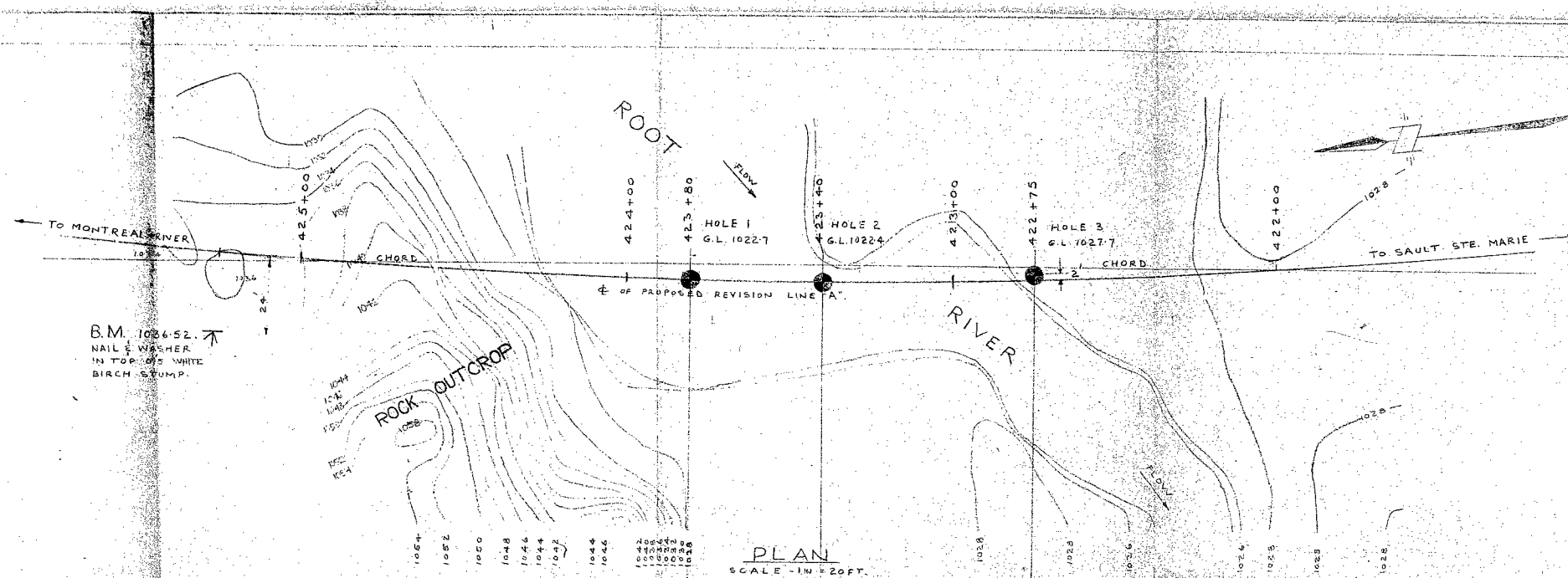
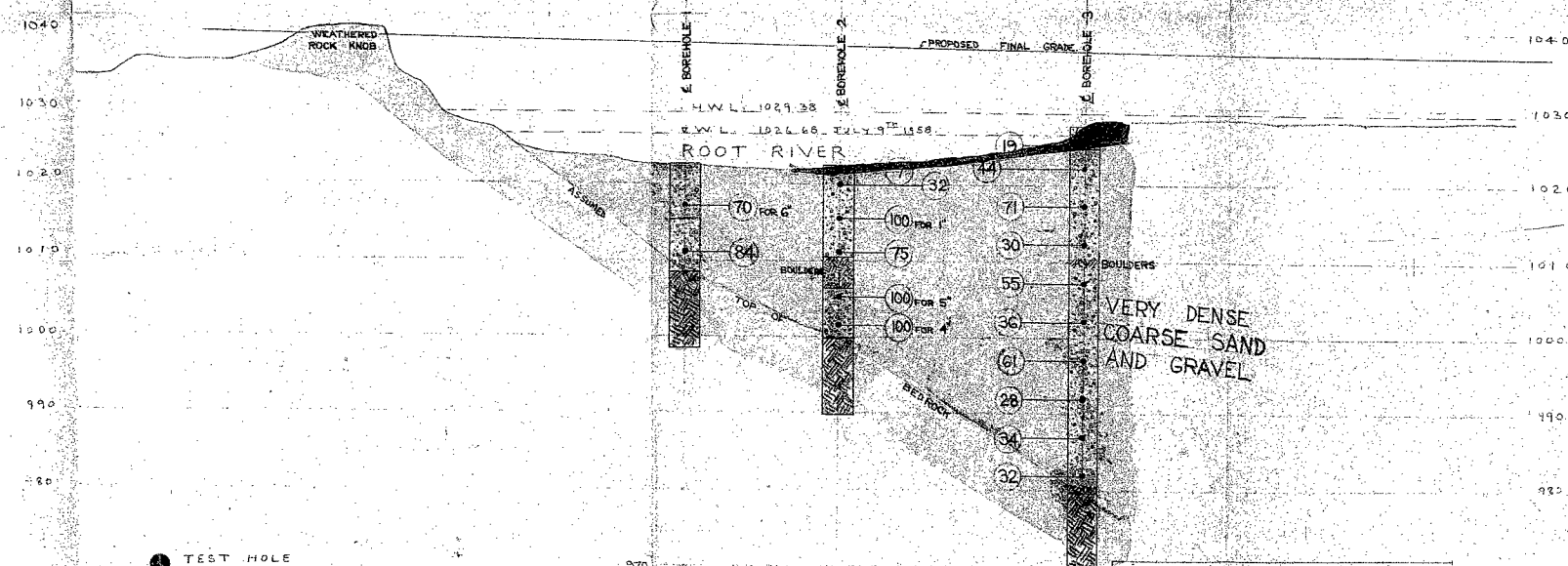


58-F-285C
W.P. 909-57
Hwy. #17
ROOT RIVER
4 CROSSING



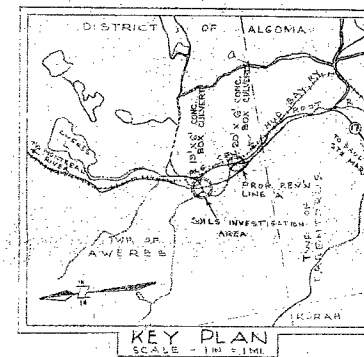
PLAN
SCALE - 1" = 20 FT.



PROFILE

SCALE - HOR. - 1" = 20 FT.
VER. - 1" = 10 FT.

NOTE: PLEASE SEE BOREHOLE LOGS
FOR COMPLETE SOIL DETAILS



KEY PLAN
SCALE - 1" = 1 MI.

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



e.m. peto & associates Ltd.

SOIL SITE INVESTIGATION
AT

HWY. 17-ROOT RIVER CROSSING No. 4

FOR

DEPARTMENT OF HIGHWAYS OF ONTARIO

OUR JOB No. 8871

DATE: JULY 15, 1958

CLIENTS PLAN No. E-3371-1

PER: K.R. 12/58

e. m. peto associates ltd.

YOUR REFERENCE: **W. P. 909 - 57**
OUR REFERENCE: **5871**

**850 roselawn avenue,
TORONTO, ONTARIO.
RUscell 1 - 4955.**

19th July, 1958.

**Department of Highways of Ontario,
Bridge Office,
280, Davenport Road,
TORONTO.
Ontario.**

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

Dear Sirs,

**Soil Site Investigation
Proposed Highway 17 - Root River # 4 Crossing**

In accordance with your letter dated 27th May, 1958, enclosed please find four (4) copies of our report on the soil conditions at the site.

Detailed description of the site, the soil profile and the soils engineering aspects of the proposed crossing are given in the report. Here for your convenience is a short summary of our findings and recommendations.

- 1. Fairly uniform soil conditions exist at the site.**

The top 1 to 3 feet is a loose organic silty sand river bottom material.

Below the thin layer of river bottom material and to the bedrock the soil is a very dense, mixed coloured coarse sand and gravel with occasional boulders. Bedrock was reached at elevation 1008.5, elevation 999.8 and elevation 979.7 in boreholes # 1, # 2 and # 3 respectively. (Root River W. L. 1026.7).

The bedrock is very hard and of igneous origin.

2. The ground water level is approximately at the level of the Root River; on July 4th, 1958, it was at elevation 1026.7. The recorded high water level at the Root River at this site is at elevation 1029.38.

A very minor Artesian flow of water was noted at borehole # 2; however this would not affect any construction procedure or foundation type.

3. For spread footings the recommended depth of foundation is 5 feet below the river bottom, with scour protection extending to 8 feet depth. The allowable bearing capacities with a safety factor of three and with 1 inch limiting settlement are

(a) No surcharge

For 5 feet minimum width of footing, 3,000 p.s.f.

For 10 feet minimum width of footing, 5,000 p.s.f.

(b) 5 feet surcharge

For 5 feet minimum width of footing, 4,000 p.s.f.

For 10 feet minimum width of footing, 7,000 p.s.f.

It will be necessary to dewater the excavation during construction, or to carry out underwater concreting procedures.

4. If a bridge structure is used for the crossing it would be advisable to carry the foundation load down to the bedrock by steel H piles. This, besides other advantages, will save the driving of sheetpiling for scour protection.

5. Using multiple span box or pipe culverts for the river crossing is a good alternative, from both the engineering and economical standpoint. Construction of a reinforced concrete base slab with up and downstream cut off walls is recommended. This will ensure uniform support and will prevent scour.

6. Possibly realignment of the river channel will be necessary. It will be advisable to keep the water velocity during flood period below 1 foot per second, failing which it will be necessary to provide some erosion protection.

7. If no record of scour is available, scour protection should extend 8 feet below the existing river bottom.

8. For fill construction fairly well graded granular material is recommended, constructed in 6 to 9 inch layers and compacted to 95% of maximum density.

For fine granular material or for that part of the embankment which will be inundated, a side slope of 2 horizontal to 1 vertical is recommended. For coarse granular material under ordinary conditions side slope of 1-1/2 horizontal to 1 vertical is adequate.

We believe that all the technical information has been discussed in the Soils Report concerning our investigation. If any additional information or assistance is required, we shall be pleased to be of further service.

Yours very truly,

E. M. PETO ASSOCIATES LTD.



E. M. Peto, P. Eng.

GYS:pf

DEPARTMENT OF HIGHWAYS OF ONTARIO

HIGHWAY 17 - ROOT RIVER #4 CROSSING

W.P. 906 57

SOILS REPORT

by

E. M. PETO ASSOCIATES LTD.

TORONTO, ONTARIO.

July, 1958.

**SUPER IMPOSED DOCUMENT MAY
APPEAR AS MULTI-FEED ON FILE.**

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

Job No. 5871

Client's Ref. No. W.P. 909 - 57

Date 19th July, 1958.

Report on
SOIL SITE INVESTIGATION
at
PROPOSED HIGHWAY 17 - ROOT RIVER # 4 CROSSING
W.P. 909 - 57 TOWNSHIP OF AWERES

for
DEPARTMENT OF HIGHWAYS OF ONTARIO.

INTRODUCTION

On May 27th, 1958, we received a letter from Mr. J. C. McAllister, acting for the Chief Bridge Engineer, requesting us to proceed with a soil investigation at the above site. At the same time we were issued with D. H. O. plan and profile E - 3371 - 1, on which were shown two suggested borehole locations. If insufficient data was obtained from the first two holes, or if some variation in the soil stratification was indicated, additional test holes could be driven as deemed necessary.

PROGRAMME OF WORK

June 30th, July 1st, 1958:	Locating materials for raft and building raft.
July 2nd, 1958:	Field work commenced.
July 4th, 1958:	Field levels taken by Engineer. Decision made to drive test hole # 2 deeper, and to drive a third test hole.
July 11th, 1958:	Field work completed.
July 12th, 1958:	Equipment loaded, crew and equipment moved back to Toronto.

SUPER IMPOSED DOCUMENT MAY
APPEAR AS MULTI-FEED ON FILM.

GENERAL INFORMATION

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

2. Three boreholes were driven to bedrock and all three test holes were terminated only after 16 feet of continuous rock coring, with good core recovery, had been performed.

Borehole # 3 was necessary for the determination of the bedrock profile at the site.

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

4. The ground surface elevations are referred to D. H. O. benchmark N. & W. found in top of 0.5 feet birch stump 24 feet left of Sta. 425 + 40, assumed elevation 1036.52 (Geodetic datum).

The benchmark given on your plan, 1B 327 and 2B 327, N. & W. in top of 0.5 feet birch stump 24 feet left of Sta. 424 + 94, could not be located in the field.

SITE AND GEOLOGY

The site is located on the flood plain of the Root River at approximately elevation 1028 (Geodetic datum).

South from the site the terrain is gently sloping toward the river. The area is covered with birch trees and shrubs.

The river at the site and during the time of the drilling operation was slow flowing. It formed a pond some 60 feet in width for a length of about 130 feet.

On the Northern bank there is a steep rock outcrop, about 25 feet high, sloping to the South. In all probability the refusal encountered in the three boreholes is the continuation of the rock surface as shown on our soil profile. The bedrock is of igneous origin, coarse to fine crystalline texture, of intermediate colour, harder than glass.

SOIL CONDITIONS

For a varying depth of 1 to feet the river bottom is a loose, dark brown organic silty sand with partly decomposed wood.

Below the thin layer of river bottom material and to the bedrock the soil is a mixed colour very dense coarse sand and gravel with occasional boulders.

Bedrock was reached in borehole # 1 at elevation 1008.5; in borehole # 2 at elevation 999.8; and in borehole # 3 at elevation 979.7.

The igneous rock is very hard; the average core recovery was 93%.

Disregarding the standard penetration values higher than 100 blows per 12 inches, which very probably were obtained on boulders or large gravel pockets, the average standard penetration was 48 blows per foot.

The whole profile was saturated.

WATER CONDITIONS

The general surface and subdrainage is toward the Root River.

At the time of the sampling work the ground water was at the level of the Root River at elevation 1026.7. The high water level recorded at this site is at elevation 1029.38.

The maximum depth of the river on the centerline "A" at the time of our investigation was 6.4 feet. A very minor Artesian flow of water was noted at borehole # 2, emanating from a depth just above bedrock.

ENGINEERING CONSIDERATIONS

1. The soil condition at the site indicates adequate bearing capacity for spread footings. The allowable bearing capacities based on an average standard penetration of 48 blows per 12 inches, using a safety factor of three and limiting settlement to 1 inch, are as follows:-

(a) No surcharge

For 5 feet minimum width of footing, 3,000 p.s.f.

For 10 feet minimum width of footing, 5,000 p.s.f.

(b) 5 feet surcharge

For 5 feet minimum width of footing, 4,000 p.s.f.

For 10 feet minimum width of footing, 7,000 p.s.f.

2. Bridge, multiple span box culvert or multiple pipe culverts can be installed for this Root River crossing.

(a) Bridge foundation structure should be placed at least 5 feet below the river bottom with scour protection extending to sufficient distance below the footing.

The North abutment will be founded on rock, since the bedrock rises to the surface on the North bank.

The South abutment can be founded either on spread footing with scour protecting sheet piling, or on steel H-piles driven to bedrock. It would be preferable, of course, to found both abutments on bedrock.

In addition, it may be impossible to drive steel sheet piling successfully, even to 10 feet below river bottom, because of the very dense soil and the presence of large boulders. Considerable difficulty may be encountered also in driving steel H-piles to bedrock refusal.

If spread footings are used it will be necessary to dewater the excavation during construction, or to carry out underwater concreting procedures.

ENGINEERING CONSIDERATIONS (contd.)

- 2 (b) Culverts have the advantage of applying low pressure on the soil, and may be more economical. However, some realignment of the river channel will be necessary for their installation at this site. Construction of a reinforced concrete base slab under the multiple pipe culverts is advisable with up and downstream cut off walls to prevent scour and thus ensure uniform support.

The minimum cover on the culvert should be 4 feet of well compacted fill.

The determination of the size and the number of openings for the culvert will be based on the hydraulic requirements.

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.

Water velocity of one foot per second will carry along fine gravel. It will be advisable to keep the velocity of the water in the realigned channel below this figure in order to prevent scouring and erosion.

If the water velocity during flood period exceeds one foot per second, it will be necessary to provide some scour and erosion protection.

Both to the North and South of the site, the present Highway 17 route crosses the Root River. In both cases the river crossing is in the form of concrete box culverts, with openings, 19' x 6' and 20' x 6' respectively. The size of these culverts and their present condition may provide some additional indication of the suitability of a culvert design for this site. The amount of fill required for the new road grade will be another factor in the choice of the most economical design.

ENGINEERING CONSIDERATIONS (contd.)

3. 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 8 feet below the existing river bottom. However, should the Department have extensive records for the Root River indicating that scour somewhat less than average along this section of the river, this requirement could be adjusted accordingly.

4. For fill construction the most suitable soil is a fairly well graded granular material compacted to 95% of maximum density with side slopes from 1-1/2 horizontal on 1 vertical to 2 horizontal on 1 vertical depending on the fineness of the material and whether or not the embankment is located on the flood plain and subject to inundation.

E. M. PETO ASSOCIATES LTD.

GYS:pf


E. M. Peto, P. Eng.

BOREHOLE LOG

Borehole No. 2

Boring Date July 3-8, 1958.

Compiled By . . . M. Mindess

Checked By G.Y.S.

SAMPLE CONDITION

SAMPLE TYPE

ABBREVIATIONS

LOST

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

V.T. IN SITU VANE SHEAR TEST
Q_u UNCONFINED COMPRESSIVE STRENGTH
W.L. WATER LEVEL IN PILING
W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0" 1026.8					SURFACE OF RIVER WATER
			4' 5" 1022.4 51.8		RIVER BOTTOM			NOTE: TIP OF CASING 22' BELOW RIVER BED. TOP OF CASING 6" ABOVE RIVER WATER LEVEL. FLOWING OVER VERY SLOWLY JULY 7, 1958.
ORGANIC SILTY SAND, PARTLY DECOMPOSED WOOD.	DARK BROWN	LOOSE	1021.3	1	X	S.S.	7	SATURATED.
FINE TO MEDIUM SAND, SOME GRAVEL.	LIGHT BROWN	COMPACT TO DENSE	10' 0"	2	X	S.S.	32	SATURATED.
FINE TO VERY COARSE SAND, SOME ANGULAR GRAVEL.	BROWNISH-GREY	VERY DENSE		3	X	S.S.	100/1"	SAMPLE LOST, WASH SAMPLE RETAINED.
VERY COARSE SAND, SOME GRAVEL.	MIXED COLOURS, GREY PREDOMINATING	VERY DENSE	15' 0" 16' 4" 1010.5	4	X	S.S.	75	SATURATED.
SERIES OF BOULDERS: GRANITE, BASALT, SANDSTONE, WHITE GRANITIC GNEISS.				5	X	R.C.	-	DRILLED 4' THROUGH BOULDERS. CORE RECOVERY=45.8%
COARSE SAND AND ANGULAR ROCK FRAGMENTS.	GREY-BLACK	EXTREMELY DENSE	26' 4" 1006.5	6	X	S.S.	100/5"	SATURATED.
MEDIUM TO COARSE SAND, SOME ROCK FRAGMENTS.	MIXED COLOURS	EXTREMELY DENSE	25' 0"	7	X	S.S. W.S.	100/4"	SATURATED
QUARTZ PORPHYRY, GRANULAR.	LIGHT AND DARK GREEN	GENERALLY EXCELLENT QUALITY. HARDER THAN GLASS.	27' 0" 999.8	8	X	AXT R.C.		CORE RECOVERY=97.5%. CONTAINS ORTHOCLASE FELDSPAR CRYSTALS.
AS ABOVE			32' 0"	9	X	AXT R.C.		CORE RECOVERY=81.7%
			37' 0" 989.8					HOLE TERMINATED.

BOREHOLE LOG

SOIL DESCRIPTION	COLOR	Density or Consistency	Depth Elevation	Legend	Sample No and Condition	Sample Type	No. of Blows per Ft	WATER LEVELS, SOIL MOISTURE & REMARKS
3' ORGANIC TOPSOIL.	BLACK.		0' 0"					
ORGANIC MATTER, FINE SAND, GRITS AND PEBBLES.	DARK GREY-BROWN TO YELLOWISH-BROWN.	COMPACT	1027.7 3' 0"		1	S.S.	19	MOIST.
COARSE, SOME FINE SAND, GRAVEL AND ROCK FRAGMENTS.	DARK GREY	DENSE	5' 0"		2	S.S.	44	VERY MOIST
AS ABOVE WITH BOULDERS.	DARK		10' 0"					BOULDER AT 7 FT., HOLE MOVED 18 INCHES.
COARSE SAND, GRAVEL AND ROCK FRAGMENTS UP TO 1 1/4" SIZE.	GREY-BROWN	VERY DENSE			3	S.S.	71	WET.
COARSE SAND WITH FINE GRAVEL.	MIXED COLOURS.	COMPACT	15' 0"		4	S.S.	30	SATURATED.
BOULDERS AT 17'6".			20' 0"					
COARSE SAND WITH FINE GRAVEL.	"	DENSE	1007.7 25' 0"		5	S.S.	55	"
AS ABOVE.	"	DENSE			6	S.S. W.S.	36	
COARSE SAND, SOME FINES, MIXED WITH 1/2" GRAVEL.	YELLOWISH-BROWN.	VERY DENSE	30' 0"		7	S.S.	61	SATURATED.
MEDIUM TO COARSE SAND, SOME FINES, GRITS AND GRAVEL.	MIXED COLOURS.	COMPACT	35' 0"		8	S.S.	28	SATURATED.
AS ABOVE.	"	COMPACT TO DENSE	40' 0"		9	S.S. W.S.	34	
AS ABOVE.	"	"	45' 0"		10	S.S.	32	
QUARTZ PORPHYRY, GRANULAR TEXTURE.	LIGHT AND DARK GREEN.	GENERALLY EXCELLENT QUALITY. HARDER THAN STEEL	48' 0" 979.7		11	A.X.T. R.C.		CORE RECOVERY=98.4%
FINE-GRAINED PORPHYRY.	DARK GREEN.	GLASS. SOME MINOR FAULTS.	53' 0"		12	A.X.T. R.C.		CORE RECOVERY=98.4%
QUARTZ PORPHYRY, GRANULAR.	LIGHT AND DARK GREEN.		58' 0" 969.7					NOTE: COULD NOT BAIL HOLE BELOW 4'6" DUE TO INCOMING WATER AFTER 5 MINUTES. DEPTH TO WATER= 5 INCHES.
		HOLE TERMINATED.						

APPENDIX I
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.