

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Section.

June 17, 1960.

FOUNDATION INVESTIGATION - by
Dominion Soil Investigation, Ltd.

Attention: Mr. S. McCombie.

Re: Proposed Bridge over Tomiko River,
Hwy. No. 11 - Approx. 21 Miles
North of North Bay, Ont., Dist. 13,
W.P. 95-60.

We have reviewed the above mentioned report submitted by Dominion Soil Investigation, Ltd., and we agree with the conclusions and recommendations contained in the report.

The only point that we would like to add is, that no embankment stability problems are expected.

If there are any other additional questions or problems that you would like to discuss, please feel free to call on our Office.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.

Per:



(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

AS/Mdef
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Ramsay
G. K. Hunter
J. D. Foster
E. R. Saint
A. Watt
Foundations Office
Gen. Files.

60-303C

Department of Highways, Ontario
Materials and Research Section
Downsview Ontario

Report on
Foundation Investigation
Proposed Bridge over Tomiko River, approximately
21 miles north of North Bay, on Highway No. 11
District No. 13.
WP 95-60

Submitted by:
Dominion Soil Investigation Ltd.
88 Eglinton Ave. East
Toronto 12 Ontario

May 25, 1960

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DOMINION SOIL INVESTIGATION LTD.

SOIL MECHANICS • FOUNDATION ENGINEERING

TORONTO 12, ONTARIO

Report on

Foundation Investigation

Proposed Bridge over Tomiko River, approximately
2 1/2 miles north of North Bay, on Highway No. 11
District No. 13.

WP 95-60

INTRODUCTION

. . . Authorization was received from Department of Highways, Ontario, Materials and Research Section, to investigate subsoil conditions for a proposed bridge foundation. The proposed bridge will carry the King's Highway No. 11 above the Tomiko River.

I. THE SITE

The proposed bridge is located approximately 21 miles North of North Bay, Ontario, in the District No. 13, between the Township of LYMAN and the Township of NOTMAN, on King's Highway No. 11. Now there is a 90 ft. long timber bridge, resting on four rows of piles, which carries the highway above the Tomiko River. The highway runs in a northwest-southeast direction.

The surrounding land is hilly with elevation differences of the order of a couple of hundred feet. North of the site is Tilden Lake, which drains through a dam into the Tomiko River. There is a 5 ft. difference between the water levels of the lake and the river at the dam at the present time. Several rapids overcome the further difference in elevation between the lake and the bridge site.

The water level in the Tomiko River, on May 8, 1960 was 918.3. According to local people, the water level was about 2 - 2½ feet higher; so that the dam at Tilden Lake had to be partly demolished, thus enabling the outflow of more water. This was the highest water level in 25 years according to them.

Then the river flows through Elbow Lake, southwest of the bridge site.

The topsoil is mainly sand and gravel, mixed with boulders. The bedrock is often at the surface. The trees are mostly evergreen and birch.

The area is part of the Pre-Cambrian Shield. The bedrock as found from drilling and outcrops nearby is a granite biotite gneiss. This rock has been highly folded. It breaks down to form the coarse-loose sand predominant all around the place.

These rocks, dipping about 60 degrees, form parallel ridges or crests running approximately in an east-west direction. The troughs or valleys are filled with the sand mentioned above.

Tomiko River flows through one of these sandy troughs between two bedrock hills on either side.

2. FIELD WORK

The field work was carried out between May 3 and May 8, 1960. The setting out of boreholes and dynamic cone penetration tests was done with the help of WP 95-60. The

center line of Highway No. 11 was used as main axis and the southern end of the bridge as starting point (Sta. 13 + 00).

Elevations were taken using the above mentioned starting point as benchmark: El. 926.9', taken from the Working Plan also. (The benchmark - NAIL IN GUIDE RAIL POST - marked on the profile attached to Working Plan, is missing.)

The drilling was done with conventional wash-boring. The casing was Bx. Samples were taken with 2" ϕ split spoon, and from the bedrock cores were obtained with Ax core barrel. The dynamic cone penetration test was done with 2" diameter, 60 degree standard cone. Hammer Wt: 140 lbs., fall: 30".

The order of work was as follows: BH#1, BH#2, C#1, C#2, C#3, BH#3, BH#4 and BH#5.

NOTE: On WP 95-60, the locations of the boreholes were marked on the original ground level. However, all that area is now under water, so it was impossible to set up the drilling at these places. The holes were made on the top of embankment, as close to the abutments as safety reasons allowed it.

BOREHOLE #1 - (See encl. #3)

The first 10 ft. was of loose material, the casing was driven in the ground readily. Sample 1 was lost, the material was too soft. To get a picture of the subsoil close to the surface, sample #2 was obtained from the withdrawn casing and preserved in a jar.

It was impossible to get sample from the silty stratum around El. 915.0' also; sample #4 was lost. The split spoon was gently tapped into the soft material, so sample No. 5 contained some of it.

From 19'-2" depth, the casing could not be driven into the soil any more. Only diamond drilling reached the bedrock. 5 ft. core was obtained from the granite-biotite-gneiss.

BOREHOLE #2 - (See encl. #4)

At the first attempt, 2'-3" from the surface, the split spoon met refusal - probably on a boulder. So, the hole was relocated 1 ft. to the south. The boring operations were done unhindered at this new location. Sample #3 - very soft material - was lost. Sample #4 was pushed in, and about 8" was the recovery.

Water level was checked at the end of shift (May 4) and next morning, before beginning the work (May 5). It subsided 6" during the night.

At sample #5, gravel jammed into the mouth of the spoon, thus no sample was obtained. Sample #6 came up empty also. The material was too loose and saturated with water.

10.3 ft. diamond drilling was done in the bedrock.

BOREHOLE #3 - (See enclosure #5)

This hole was drilled straight through the bridge deck with the permission of Mr. Homer, Maintenance Engineer, D.H.O., Regional Office, North Bay.

Twice (Sa. #1 & Sa. #2) the split spoon came up empty. The material is in fluid condition, thus no recovery was possible.

The obtaining of the sample with bucket, from the riverbed was impossible because of the fast flow of the river. However, judging by the eye, the bottom of the river consists of coarse, gravelly sand and there are large boulders (1 to 3 ft. diameter) in the riverbed.

The washwater from El. 902⁺ was stored in a jar to check how fast the content settles. Even after 5 hours, the water was not transparent due to the content of fine particles. Thus, it is probable that from Samples #4 and 5, the fine grains were washed out while the spoon was withdrawn.

The number of blows required to drive in Sample #5 are not valid - after 2 inches, the spoon met refusal.

9.6 ft. of core was obtained from the bedrock.

BOREHOLE #4 - (See enclosure #6)

This hole was twice relocated westward (the first two attempts have been made east of the Guardrail) because the casing met refusal 2 - 3 ft. from the surface. The rock fill against the erosion extends to the top.

Sample #2 showed no appreciable difference to the #1, thus it has not been stored. As gravel was squeezed into the mouth of the split spoon, nothing was recovered at Sample #4.

The washwater from El. 907⁺ was stored in a jar again to check the sediment. Eight hours later, the water was still not clear.

Nothing was recovered from Samples #6 and 7. The penetration value of sample #8 is not valid because after 3 inches penetration, the spoon met refusal.

From elevation 900'± diamond drilling was necessary. However, after approximately 2 ft., sand came up. Probably a boulder was encountered or broken bedrock.

8 ft. core was obtained from the solid bedrock.

BOREHOLE #5 - (See enclosure No. 7)

The rain poured the whole day when this hole was drilled. However, the operations proceeded undisturbed.

Sample #3 was empty. Gravel was squeezed into the mouth of the split spoon. The washwater from El. 912'± was clear after an hour. The sediment was coarse sand.

No recovery was obtained from Sample #7. The material slipped out of the split spoon.

Sample #9 was taken from the washwater.

7.9 ft. of core drilling was done in the bedrock.

DYNAMIC CONE PENETRATION TESTS #1, 2 and 3 (See enclosure #8)

These tests were carried out as close to the abutments as possible. C#1 was driven next to BH#2, C#2 near BH#4 and C#3 in the neighbourhood of BH#5. The cones met refusal at about the same elevations where the boreholes proved the top of bedrock.

The shape of the curves (number of blows required per foot to drive in the cone) is very similar to each other, which proves also the uniformity of the subsoil at the site.

3. THE SUBSOIL

The subsoil can be grouped into three categories.

1. Fill Material

The top 6 to 7 ft. down to El. 920'± is fill for the road embankment. It is loose, brown sand, mixed with graded gravel, in wet condition. Its color is brown, and can be easily identified with that in the gravel pit on the northern shore of Tomiko River.

2. Gravelly Sand

This is already natural subsoil. It is finer than the fill material above and contains gravels of various sizes (up to 1" dia.). It extends down to the bedrock.

The amount of fine silt and even clay particles is high, of grey color, which was determined with field dispersion test. (Washwater preserved in jar; even after 1 hour, the water is not transparent.) Some silt, with traces of organic content has been encountered in this layer, also.

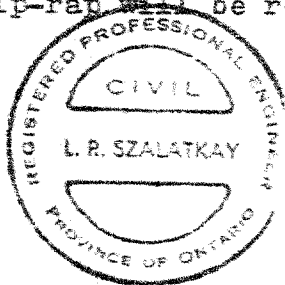
3. Bedrock

The bedrock is granite-biotite-gneiss. The top is somewhat weathered, but this does not extend more than 1/2 ft.; from there on, it is in good, solid condition.

4. RECOMMENDATIONS

span As a most likely arrangement, the bridge will be a one-~~span~~ structure, simple beam on two supports. The footing is recommended to be built on short end bearing piles (25 to 30 ft. long), which transfer the load to the bedrock. It is expected that the piles will meet refusal only after reaching the granite surface. The piles can be of steel, or of reinforced concrete.

Particular attention is called to the possibility of erosion. Now the embankments are protected by rock fill. After the new structure is built, the same protection or rip-rap will be required.

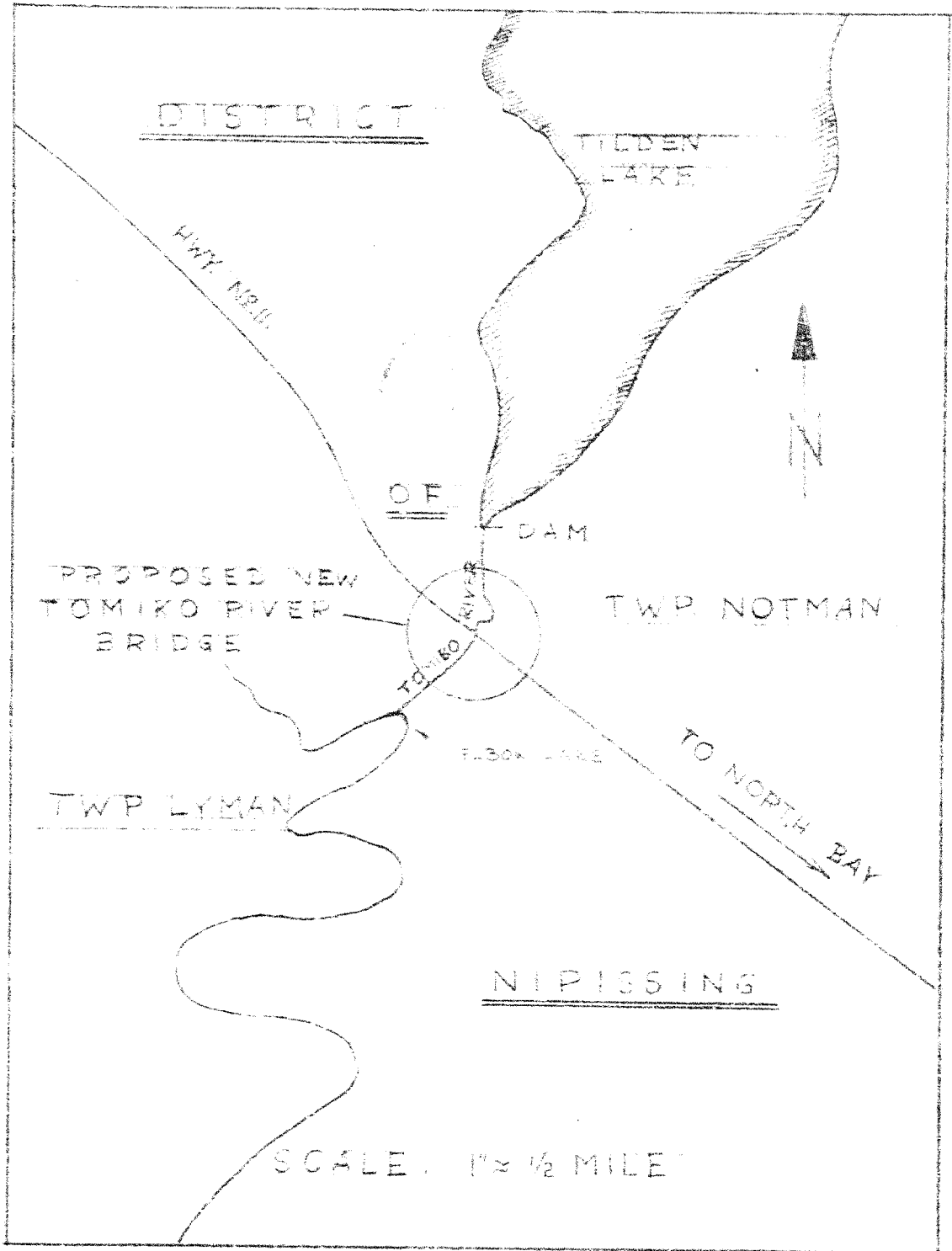


Toronto, Ontario,
May 25, 1960.

DOMINION SOIL INVESTIGATION LTD.

L. R. Szalatkay
L. R. Szalatkay, P.Eng.

Prep. By M.S.



KEY PLAN

Dominion Soil Investigation Ltd.

Engineering Data Sheet for Borehole: 1 OF 5

Date: MAY 3 & 4, 1960

Project: TOMKO RIVER BRIDGE
 Location: 7 1/2 MI. NORTH OF NORTH BAY
 Hole Location: STA. 12+82 RIGHT 15'
 Hole Elevation and Datum: 926.6
 Field Supervisor: L. R. S. Prep: L. R. S.
 Driller: J. V. Checked: L. R. S.

LEGEND

Shear Strength: C

Unconfined compression
 Vane test and sensitivity: S

Penetration: Standard (P)

2" Split tube

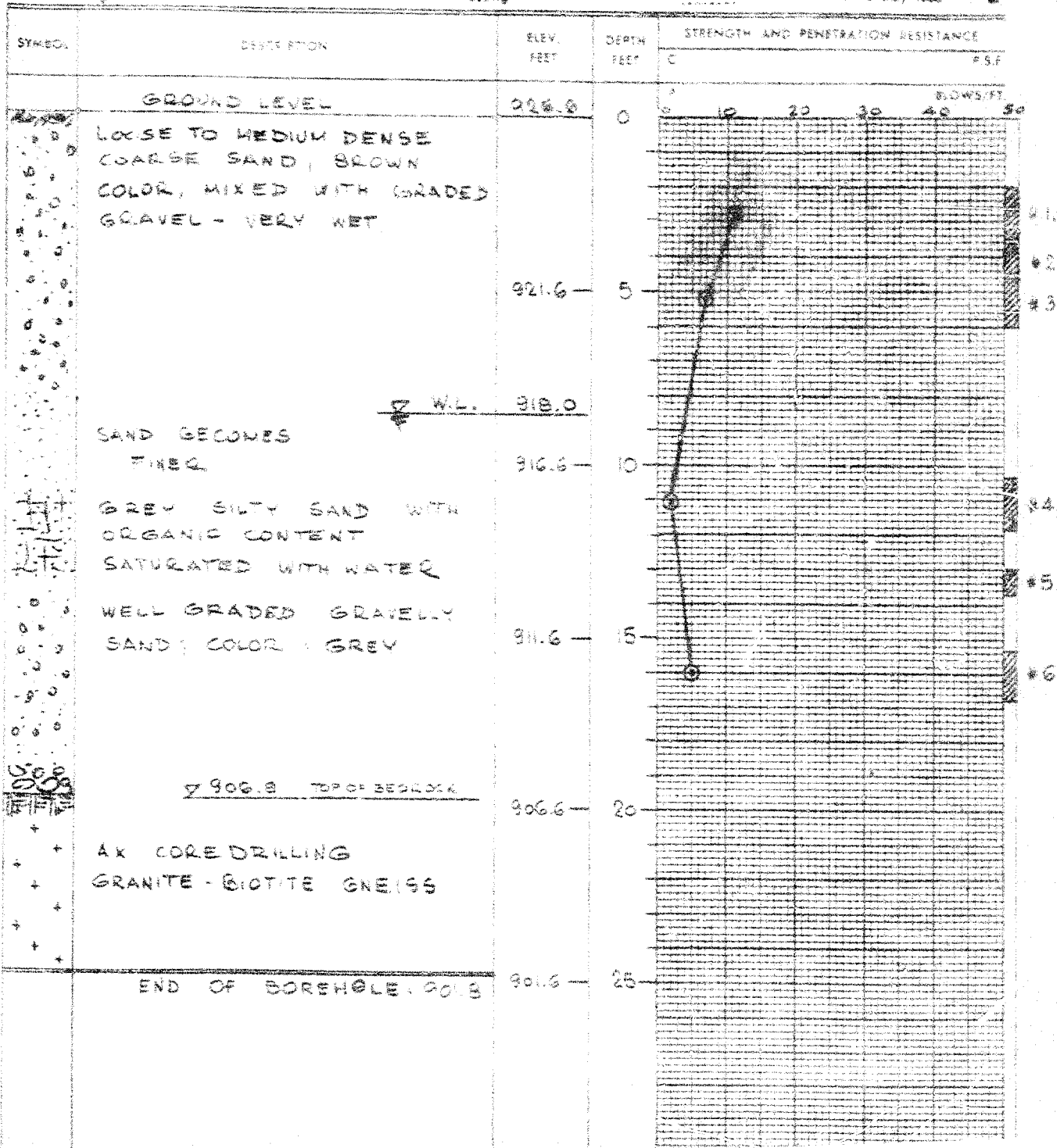
2" Dia. Core

Casing

Sampling Method

2" Dis. split tube

2" Shelby tube



Deminion Soil Investigation Ltd.

Engineering Data Sheet for Borehole: 2 of 5

Date: MAY 4 & 5, 1960

Project: TOMIKO RIVER BRIDGE

Location: 7.0 MI. NORTH OF NORTH BAY

Hole Location: STA. 12+80 LEFT 14'

Hole Elevation and Datum: 926.4

Field Supervisor: L.R.S. Prep: L.R.S.

Driller: J.V. Checked: L.R.S.

LEGEND

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

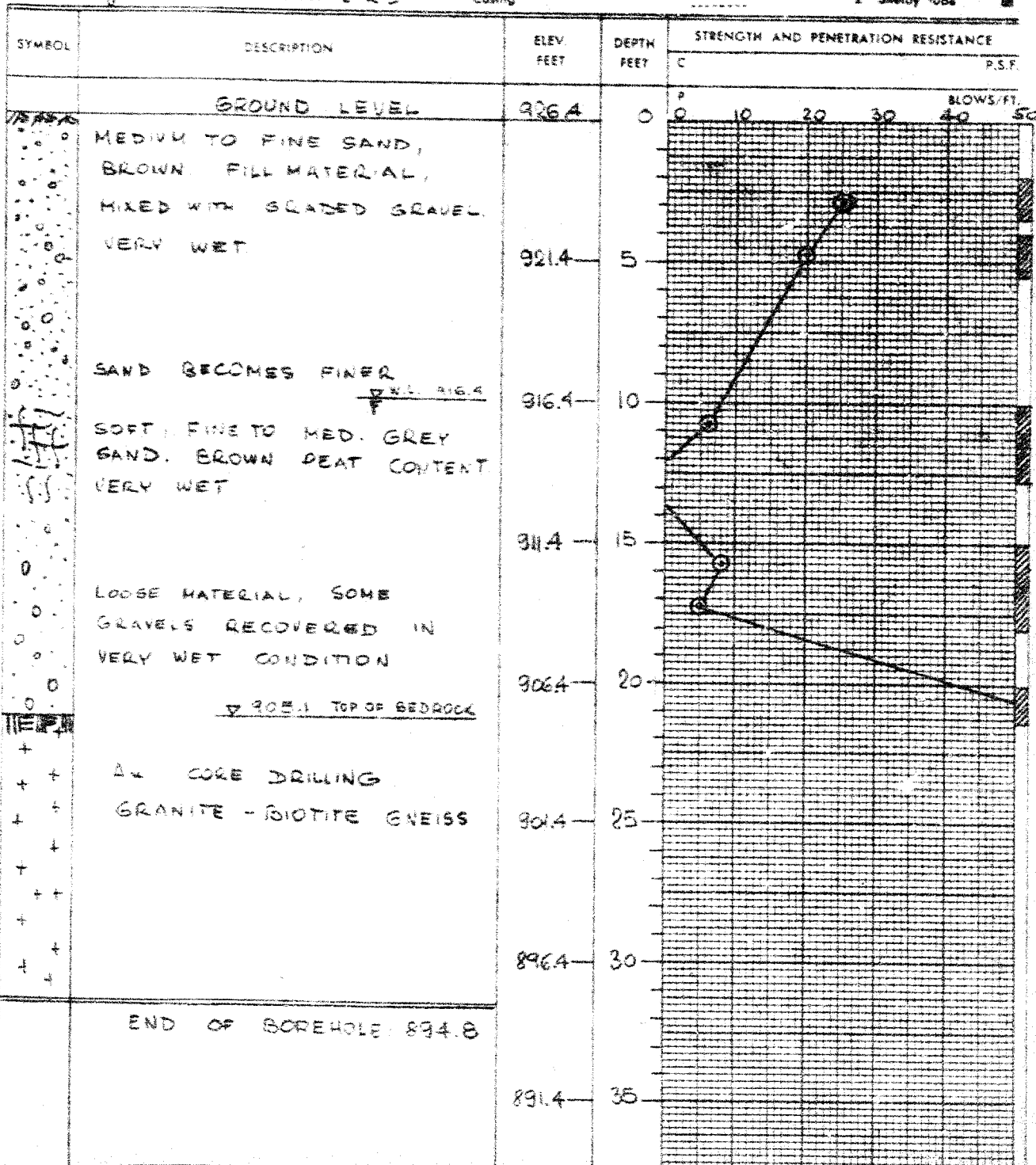
2" Dia. Cone

Casing

Sampling Method

2" Dia. split tube

2" Shelby tube



Dominion Soil Investigation Ltd.Engineering Data Sheet for Borehole: 3 OF 5Date: MAY 5 & 6, '60.Project: TOMIKO RIVER BRIDGELocation: N 1/2 MI. NORTH OF NORTH BAYHole Location: STA 13+57.5 P. 9.5'Hole Elevation and Datum: 927.2 (BRIDGE DECK)Field Supervisor: LRS Prep.: LRSDriller: J.V. Checked: LRS**LEGEND**

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

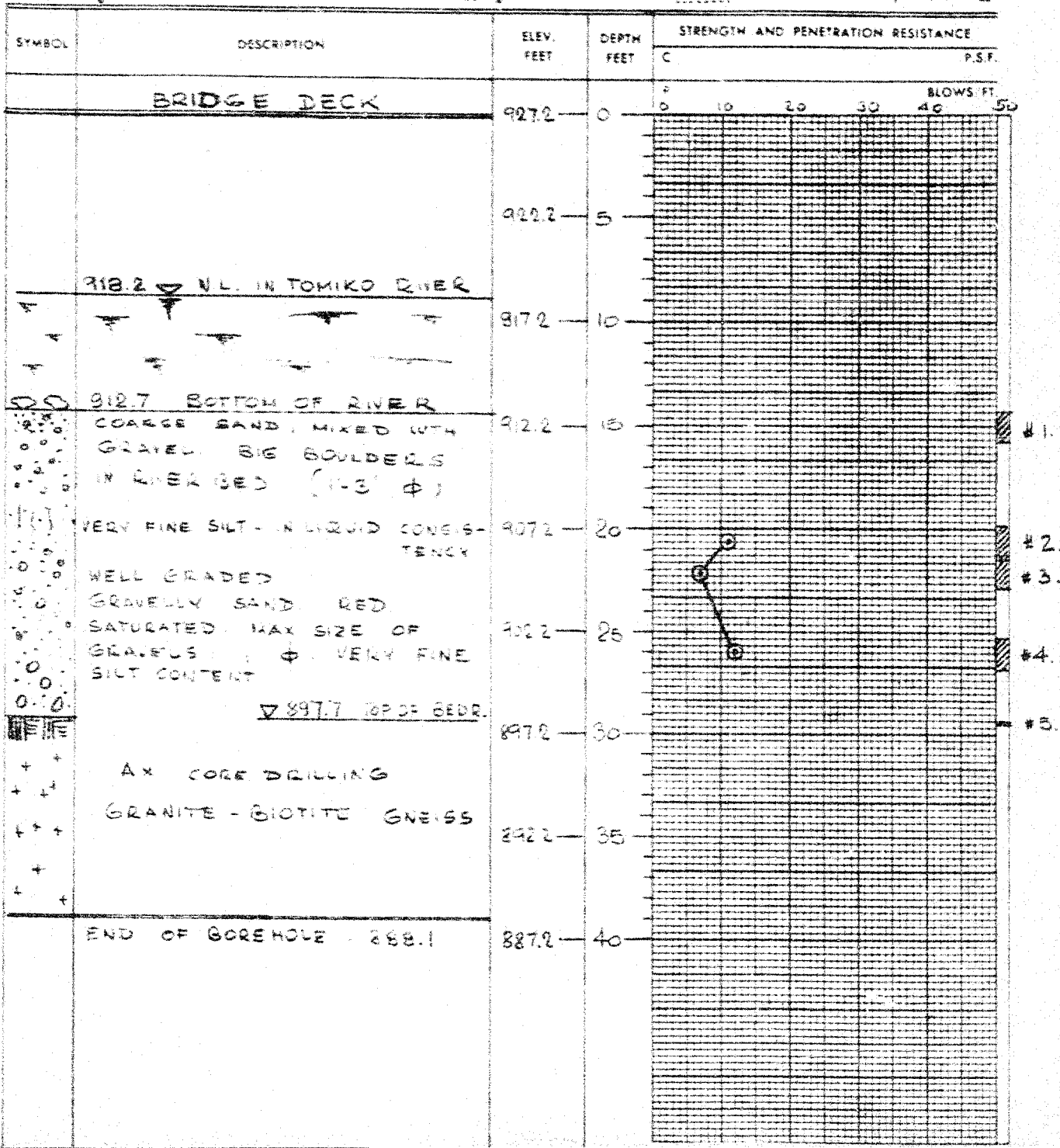
2" Dia. Cone

Casing

Sampling Method

2" Dia. split tube

2" Shelby tube



Dominion Soil Investigation Ltd.

Engineering Data Sheet for Borehole: 4 of 5

Date: MAY 7, 1960

Project: TOHIKO RIVER BRIDGE

Location: 0.1 MILES N. OF NORTH BAY

Hole Location: 14-03 2 ft S

Hole Elevation and Datum: 927.1

Field Supervisor: LRS Prep: LRS

Driller: J. V.

Checked:

LEGEND

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

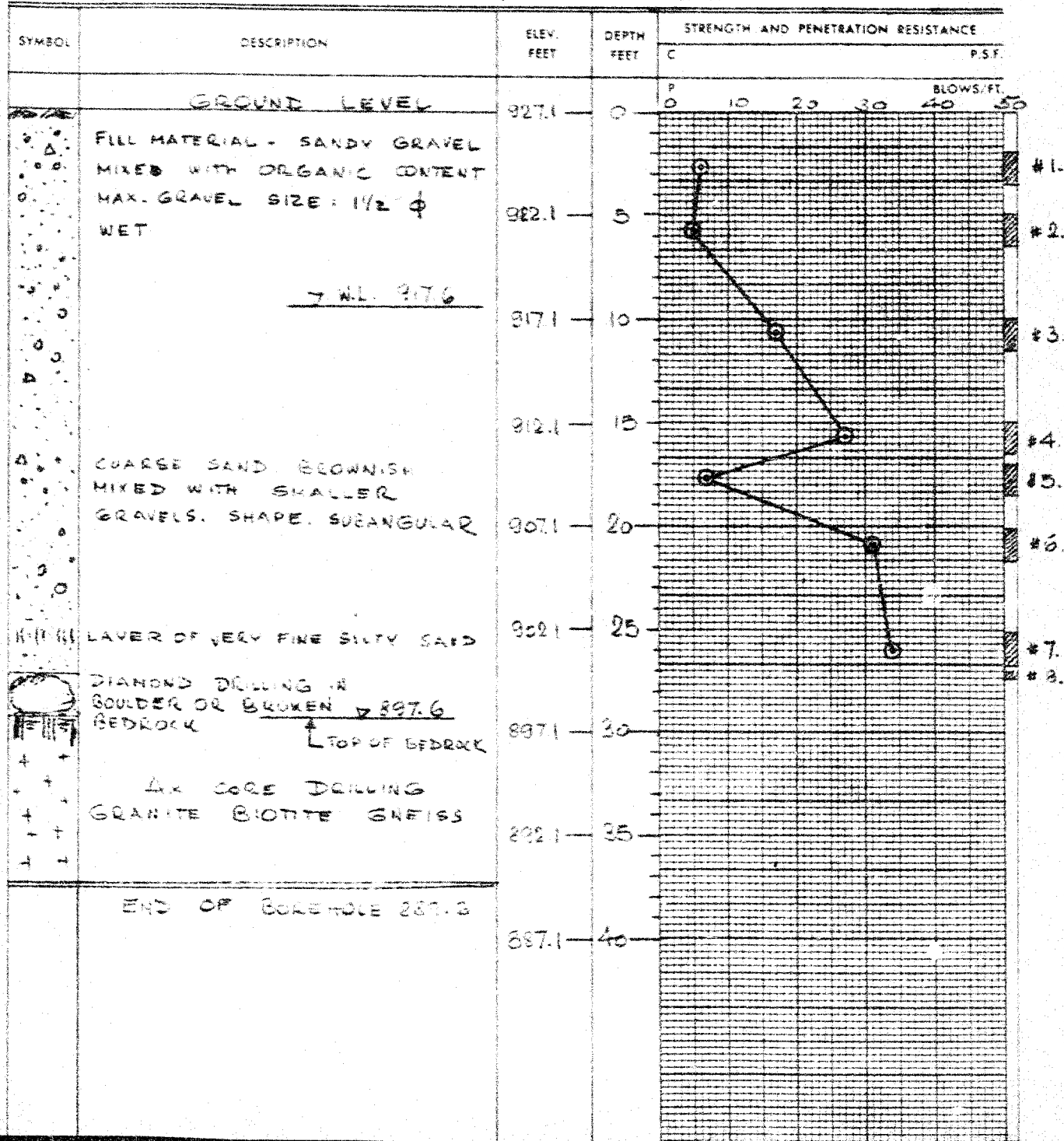
2" Dia. Cone

Casing

Sampling Method

2" Dia. split tube

3" Shelby tube



Dominion Soil Investigation Ltd.

Engineering Data Sheet for Borehole: 5 of 5

Date: MAY 8, 1960

Project: TOMIKO RIVER BRIDGE
 Location: W 3/4 MI. NORTH OF NORTH BAY
 Hole Location: STA 14+09 L 15'
 Hole Elevation and Datum: 927.4
 Field Supervisor: LRS Prep.: LRS
 Driller: J V. Checked:

LEGEND

Shear Strength (S)

Unconfined compression
 Vane test and sensitivity (S)

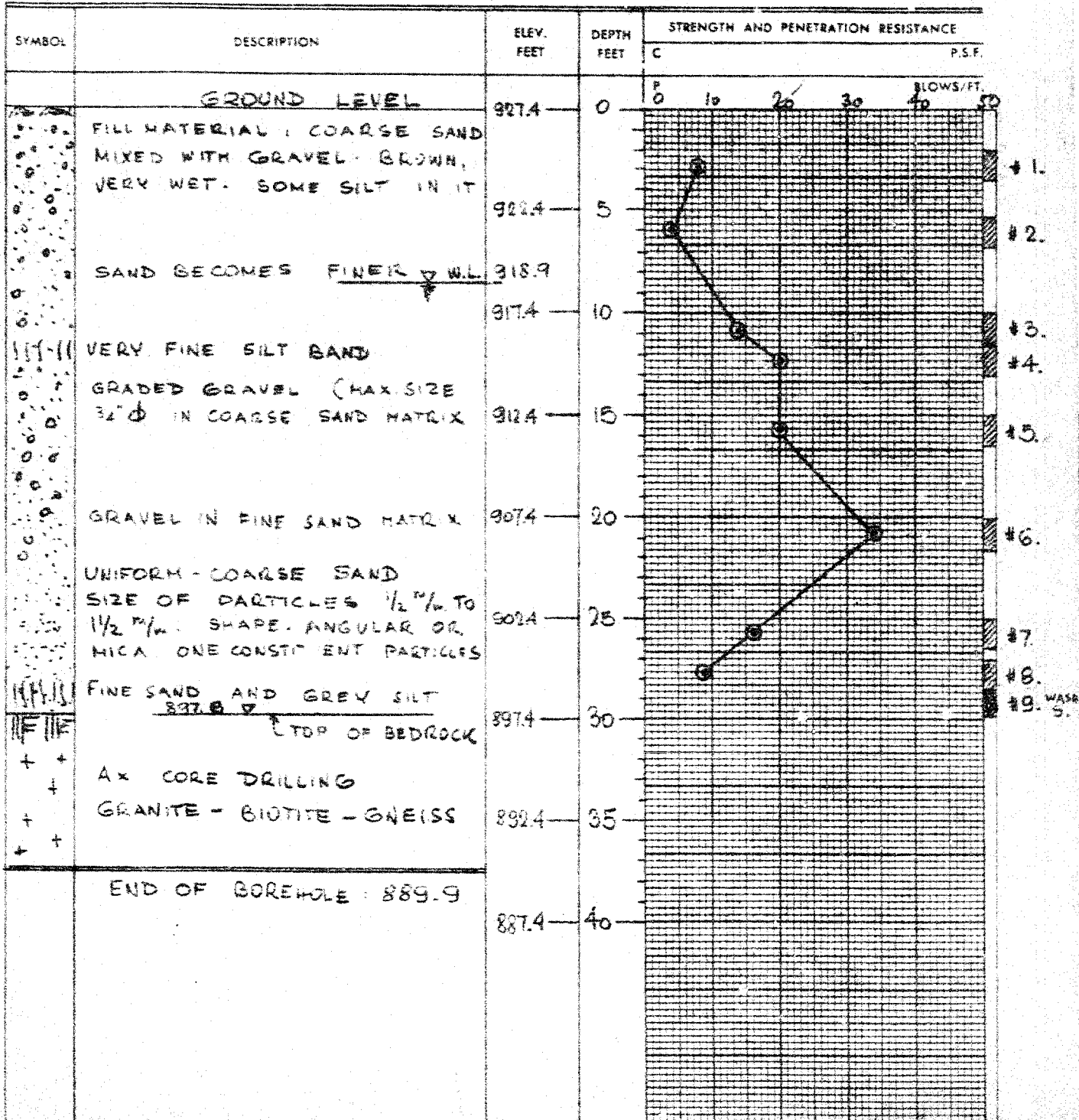
Penetration Resistance (P)

2" Split tube
 2" Dia. Cone
 Casing

Sampling Method

2" Dia. split tube

2" Shelby tube



Dominion Soil Investigation Ltd.

Engineering Data Sheet for

DYNAMIC CONE PENETRATION TESTS Nos 1, 2 & 3.

Date: MAY 5, 1960

Project: TOMIKO RIVER BRIDGE

Location: 2 1/2 MI. N. OF NORTH BAY

Hole Location: (SEE BELOW)

Hole Elevation and Datum: (SEE BELOW)

Field Supervisor: LRS Prep.: LRS

Driller: JV Checked: LRS

LEGEND

Shear Strength (C)

Unconfined compression
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

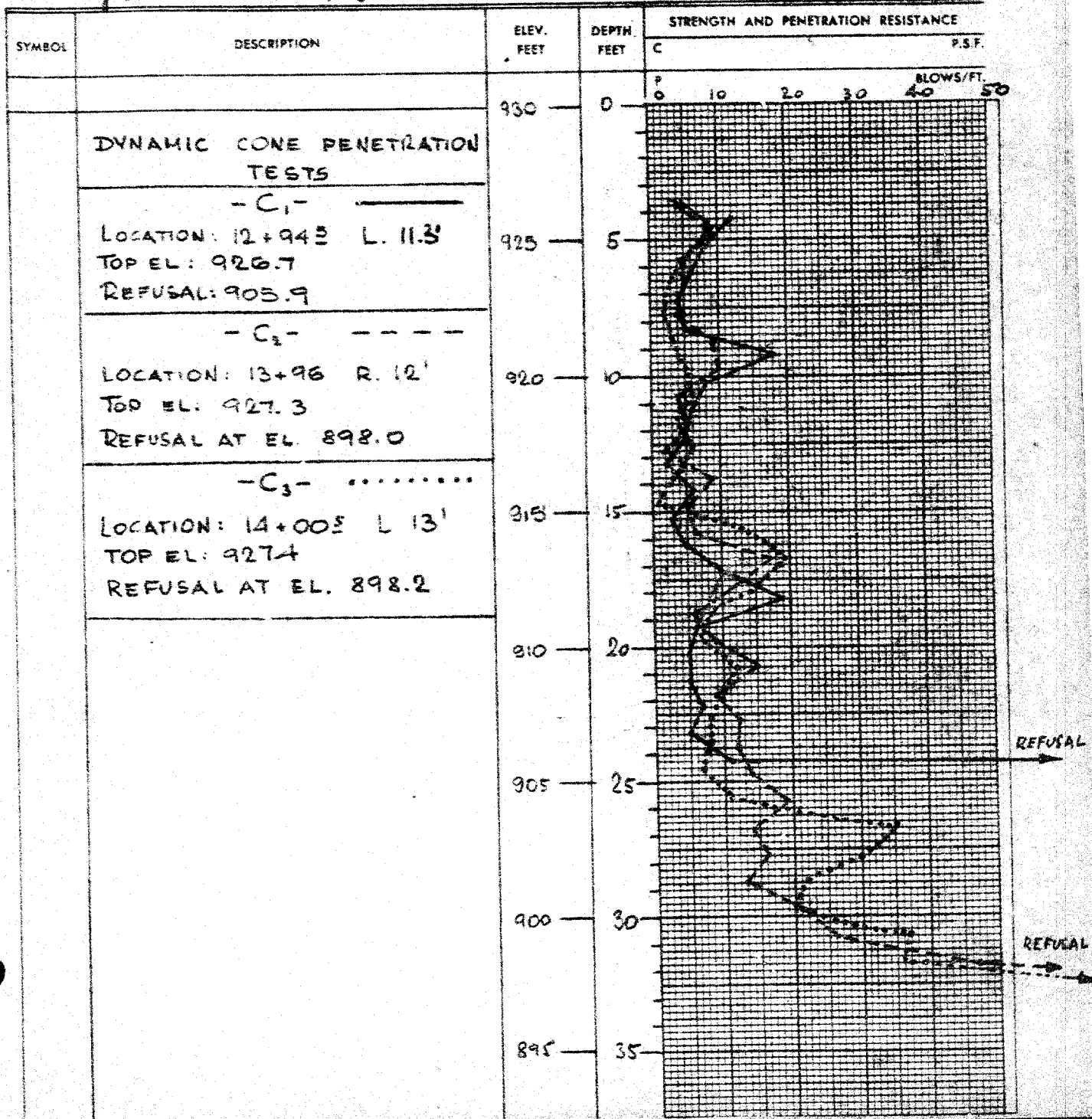
2" Dia. Cone

Casing

Sampling Method

2" Dia. split tube

2" Shelby tube

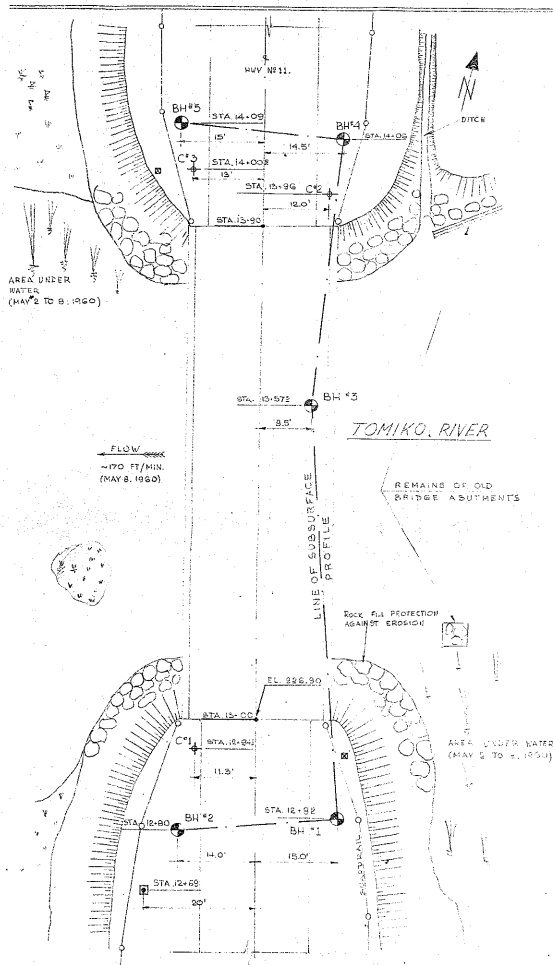


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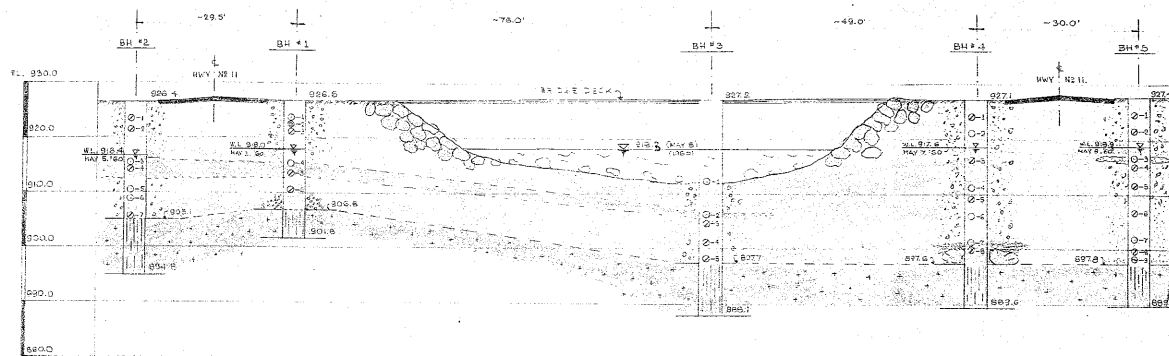
W.P. 95-60

Hwy. #11

TOMIKO RIVER



LOCATION PLAN
SCALE: 1"=10'



SUBSURFACE PROFILE
SCALE: 1"=10'

LEGEND

- ⊕ BOREHOLE
- ⊕ 24" 60" DYWIDAG CONE PENETRATION TEST
- ⊕ 24" SPLIT SPOON SAMPLE
- ⊕ NO RECOVERY
- ⊕ SAMPLE OBTAINED FROM CASING
- ⊕ SAMPLE OBTAINED FROM WASH WATER
- ⊕ SIGN AT ROADSIDE - STOPPED TRUCK
- ⊕ MONUMENT
- ⊕ DYWIDAG CONE DRILLING (MAY 2 & 8)
- ⊕ BUSH AND TREES UNDER WATER
- ⊕ ROCK FILL (1-3 FT &)
- ⊕ GRAVEL-SAND FILL
- ⊕ GRAVELLY SAND - NOT STRATIFIED IN LOOSE TO MEDIUM DENSE CONDITION
- ⊕ VERY FINE SILTY SAND, WITH TRACES OF ORGANIC CONTENT
- ⊕ GRANITE - ERODITIVE GRAY RED ROCK

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION
DOWNSVIEW, ONT.

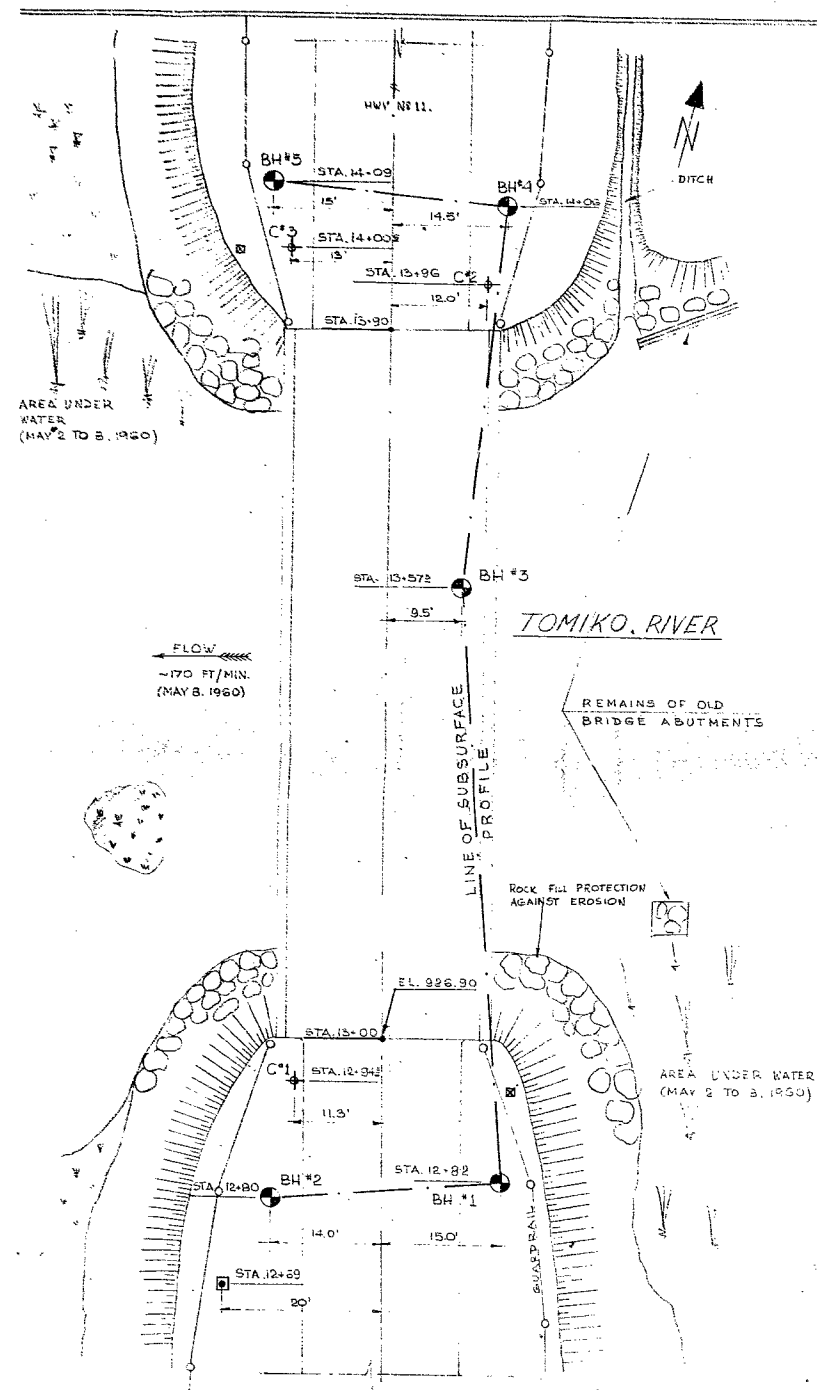
PROPOSED BRIDGE OVER TOMIKO RIVER
APPR 21 MI. NORTH OF NORTH BAY ON HWY #11,
WP 95-60 -- DISTRICT NUMBER 13.

DOMINION SOIL INVESTIGATION - LTD.
TORONTO, ONT. MADE BY LGS MAY 20, 1960

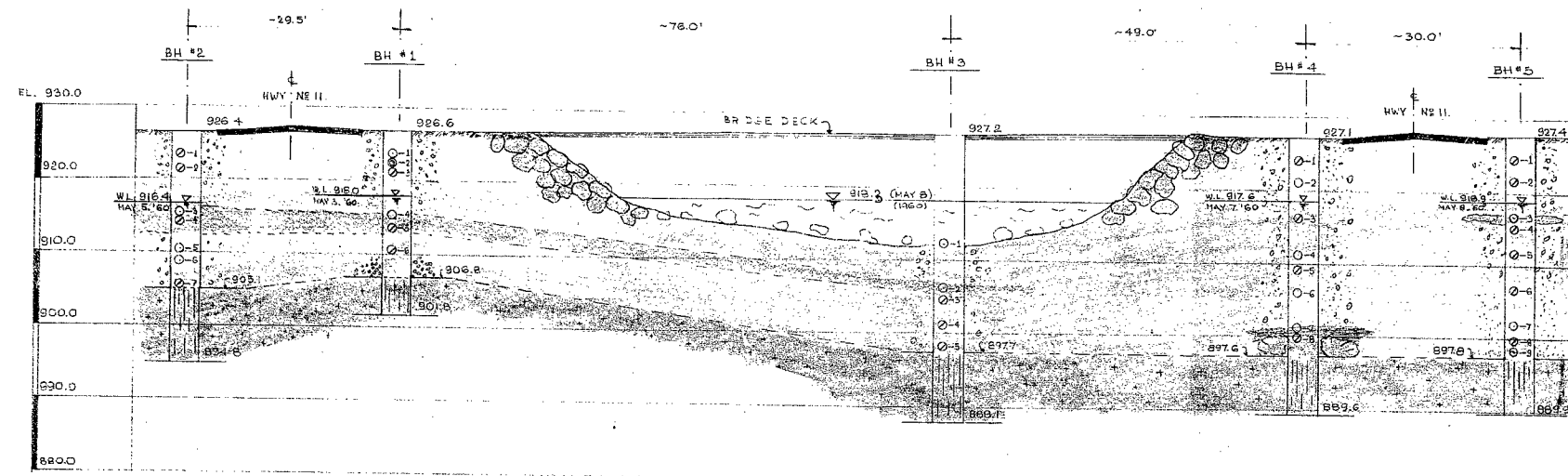
JOB NO. 60-124

ENCLOSURE: #2

60-F-303
W.P. 95-60
Hwy. #11
TOMIKO RIVER



LOCATION PLAN
SCALE 1"=10'



SUBSURFACE PROFILE
SCALE 1"=10'

LEGEND

- BOREHOLE
- ⊕ 2" φ - 60" DYNAMIC CONE PENETRATION TEST
- 2" φ SPLIT SPOON SAMPLE
- NO RECOVERY
- SAMPLE OBTAINED FROM CASING
- SAMPLE OBTAINED FROM WASHWATER
- ⊠ SIGN AT ROADSIDE ("TOMIKO RIVER") MONUMENT
- ⊠ DIAMOND CORE DRILLING (1" φ 2' 4")
- ⊠ BUSH AND TREES UNDER WATER
- ⊠ ROCK FILL (1-3 FT φ)
- ⊠ GRAVEL-SAND FILL
- ⊠ GRAVELLY SAND - NON STRATIFIED IN LOOSE TO MEDIUM DENSE CONDITION
- ⊠ VERY FINE SILTY SAND, WITH TRACES OF ORGANIC CONTENT
- ⊠ GRANITE - BIOTITE GNEISS BEDROCK

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION
DOWNSVIEW, ONT.

PROPOSED BRIDGE OVER TOMIKO RIVER
APPR. 21 MI. NORTH OF NORTH BAY ON HWY #11.
WP 95-60 + + DISTRICT NUMBER 13.

DOMINION SOIL INVESTIGATION - LTD.
TORONTO, ONT. MADE BY: LQS MAY 20, 1960
JOB NO: 60-124 ENCLOSURE: #2