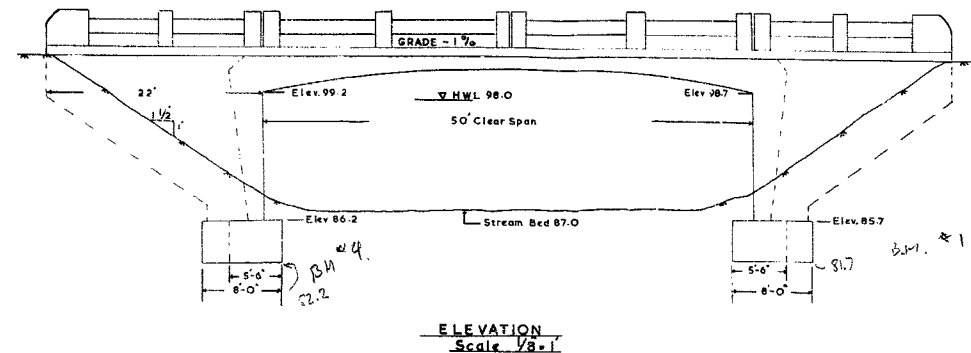
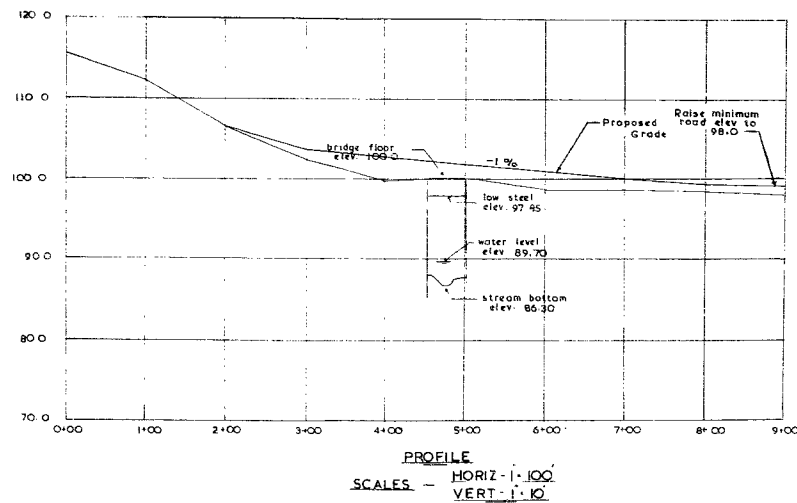
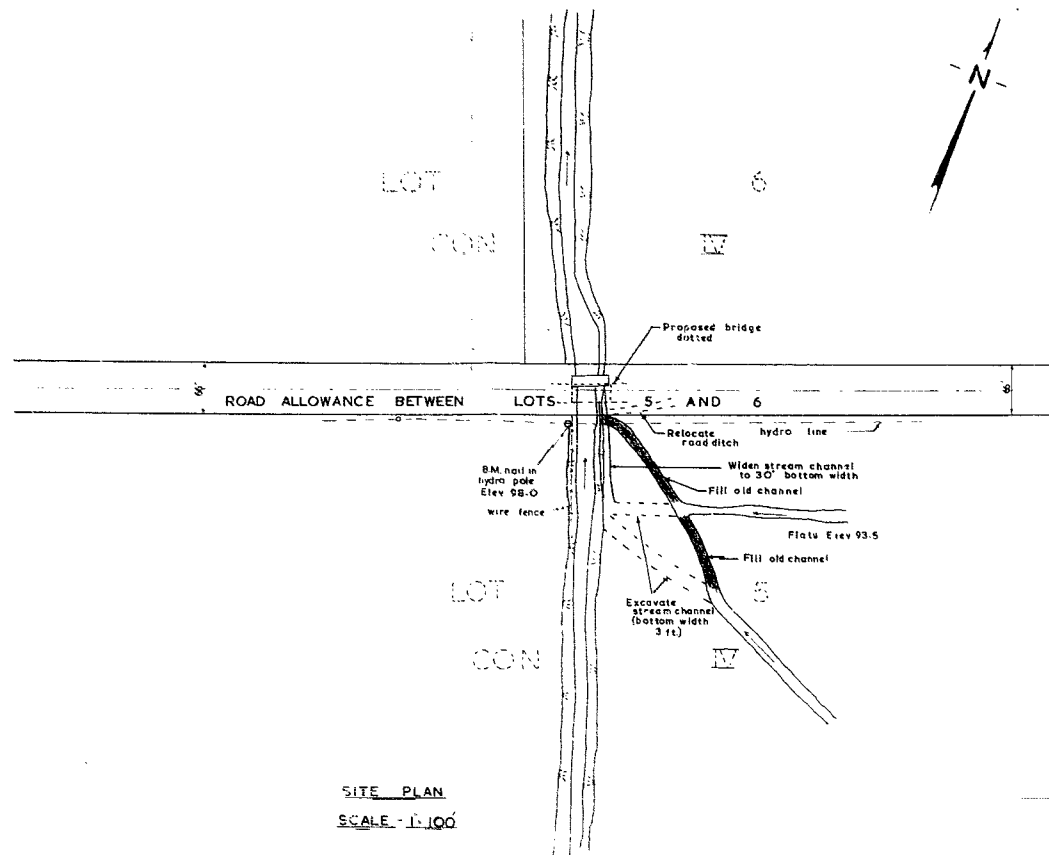


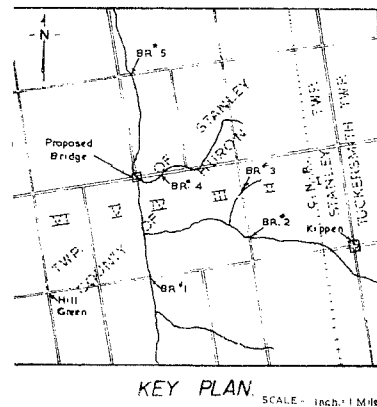
63-F-233M
Lots 5+6, Con. 4
STANLEY



ELEV.	DESCRIPTION	BLOWS PER FOOT	ELEV.	DESCRIPTION	BLOWS PER FOOT
95.17	Ground Surface		92.84	Ground Surface	
93.17	Topsoil	7	91.84	Topsoil	6
	Dense, Grey Fine Sand With Silt Layers	26		Dense Brown Fine Sand With Silt And Gravel	50
		42	84.09	Silty Clay	40
84.17	Stiff Clay	25	81.34	Silty Clay	17
80.67	Silty Clay			Silty Clay Till	
	Sandy, Gravelly Till	57	76.34	END OF BOREHOLE (Boulder)	89
		92			
70.67	END OF BOREHOLE	135			

SOIL REPORT RECOMMENDATION
Dewatering during excavation might cause some difficulties, therefore the use of closed sheeting is recommended.

BOREHOLE No. 1 BOREHOLE No. 4



FOLLOW SEPARATE INSTRUCTIONS FOR PREPARATION OF BRIDGE SITE PLAN WHEN MAKING BRIDGE SURVEY

DATA

- SPECIAL FEATURES WATERFALLS, DAMS, EXCEPTIONAL FLOODS, ICE, DRIFTWOOD, SLIDING BANKS, ETC. None but upstream channel should be widened and creek entrances relocated as shown.
- UPSTREAM & DOWNSTREAM BRIDGES (GIVE LOCATION, LENGTH, HEIGHT ABOVE N.H.W.L., NET CROSS-SECTIONAL AREA AT HIGH WATER & ESTIMATED AGE) 1-25 Span - Net Area 125 sq.ft. 2-35 Span - Net Area 315 sq.ft. 3-10 Span - 40 sq.ft. 4-18 Span - 90 sq.ft. (Total upstream 570 sq.ft.) 5 Downstream 56 Span 1 ft above N.H.W.L. Net Area 560 sq.ft. at H.W.L.
- REASONS WHY THESE BRIDGES ARE, OR ARE NOT, FAIR INDICATIONS OF SIZE OF PROPOSED BRIDGE. These are good. Provide net area of about 550 sq.ft.

DATA (cont'd)

- IS DITCH, STREAM, OR RIVER GRADIENT LIABLE TO BE LOWERED? NO
- NAVIGATION CLEARANCES REQUIRED, IF ANY. N/A
- RAILWAY CLEARANCE REQUIRED, IF ANY. N/A
- IF STRUCTURE IS OVER OR UNDER A RAILWAY HAS APPROVAL BEEN OBTAINED? (A) FROM RAILWAY CO. (B) FROM BOARD OF TRANSPORT COMMISSIONERS.
- HAS APPROVAL BEEN OBTAINED UNDER NAVIGABLE WATERS PROTECTION ACT? N/A
- IS A TEMPORARY DETOUR REQUIRED? YES
- WHO WILL BUILD IT? Contractor
- WHO WILL MAINTAIN IT? Contractor
- INFORMATION AND EVIDENCE OF EXTREME FLOODING WAS OBTAINED FROM Road
- ROAD DESIGN INFORMATION: ESTIMATED A.D.T. less than 100. DESIGN SPEED. STOPPING SIGHT DISTANCE.

STRUCTURE DATA

- NET SPAN LENGTH AND TYPE OF BRIDGE 50 ft. Rigid Frame Bridge
- ROADWAY WIDTH ON BRIDGE 24'
- NUMBER & WIDTH OF SIDEWALKS NONE
- SKEW ANGLE NONE
- TOTAL LENGTH & TYPE OF PILING NONE
- APPROX. VOLUME OF CONCRETE 300 CUBIC YDS
- APPROX. WEIGHT OF STR. STEEL NONE TONS
- APPROX. WEIGHT OF REINFORCEMENT 17 TONS
- APPROX. VOLUME OF APPROACH FILL 100' EACH SIDE OF STRUCTURE CUBIC YDS
- DRAINAGE AREA 35 AC. Flat land

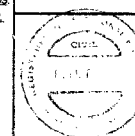
FIELD INVESTIGATION MADE Dec. 3, 1962
BY K.G. DUNN
SURVEY ENGINEER

B.M. ROSS
Consulting Engineer

STRUCTURE SITE No. 13-228

OWNER TWP OF STANLEY MUNICIPAL DIST. No. 13
Co. HURON ROAD No. 13
TWP STANLEY LOT 5 AND 6 CON. 13

SITE PLAN



Feb. 21, 1963
DATE
BRIDGE NAME

LOADING. BRIDGE No. DWS. No.
H2OS16 BR-84 BR-84-1

RACEY, MacCALLUM AND ASSOCIATES LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
AND ASSOCIATED STAFF

MONTREAL



OTTAWA

DONALD I. MACCALLUM, B.ENG., M.E.I.C., P.ENG

H. JOHN RACEY, B.SC., M.E.I.C., P.ENG

GEORGE L. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG

TORONTO

TORONTO DIVISION
59 CURLEW DRIVE
DON MILLS, ONT.

Our Reference: S-880/T-4069

January 22, 1963

Mr. B. M. Ross, P.Eng.,
Consulting Engineer,
41 West Street,
GODERICH, Ontario.

63-F-235M

Attention: Mr. K. Dunn, P.Eng.

RE: SOIL INVESTIGATION,
PROPOSED BRIDGE,
LOTS 5 & 6, CONCESSION IV,
TOWNSHIP OF STANLEY

Dear Sirs:

We have pleasure in submitting four (4) copies of our report containing the detailed soil conditions encountered at the site of the proposed bridge, together with our recommendations for foundation design.

PROCEDURE

The field work, consisting of 2 boreholes and 4 cone penetration tests, was carried out by a skid-mounted diamond drill rig on December 19 and 20, 1962. All work was performed in accordance with our standard procedures detailed in Appendix "A" and was supervised by a trained soil technician. The location of boreholes is shown on the attached Location Plan. All elevations are relative elevations referred to the deck of the existing bridge with an assumed elevation of 100.0.

SOIL CONDITIONS

Soil conditions in detail are given on the individual borehole logs and Figure 2 shows a simplified soil profile through Boreholes No. 1 and 4.

The different types of soils encountered in the boreholes are summarized below.

STRUCTURE SITE No. 13 - 228

Our Reference: S-880/T-4069

January 22, 1963

SOIL CONDITIONS - ContinuedBrown fine sand

Below 12 to 24 inches of topsoil and extending approximately to elevation 84.0 in both boreholes there was a stratum of fine brown sand with layers of silt. With depth the silt content appeared to decrease and the sand became coarser with occasional gravel. The standard penetration resistances ranged from 25 to 50 blows per foot indicating that the relative density of the stratum is dense to very dense. The presence of this stratum at the location of cone tests No. 2 and 3 is inferred by similar cone penetration resistances.

Silty clay

Below elevation 84 a stiff silty clay of lacustrine origin was encountered. The stratum is quite shallow in depth and extends approximately to elevation 81.0. The Atterberg Limits of the clay are a Liquid Limit of 26.4% and a Plastic Limit of 16.9%. The Natural Moisture Content was 20.9%. As no undisturbed sample has been obtained from the stratum, its undrained shear strength can only be estimated on the basis of the standard and cone penetration resistances and is assumed to be about 2000 p.s.f.

Clayey silt till

In both boreholes a hard glacial till was encountered underlying the silty clay. The till, which was encountered approximately at elevation 81.0, has a clayey silty matrix, with embedded sand seams and stone fragments. The natural moisture content of the till is low, near to the plastic limit, and shows a tendency to decrease with depth. The standard penetration resistance range from 57 to 135 blows per foot, indicating a very hard consistency. As both boreholes and all cone penetration tests were terminated upon refusal on boulders within this stratum the extent of the till in depth is not known.

Water conditions

At the time of the investigation the water level in the creek was 91.36 and the water level observed in the boreholes reflected the same ground-water level. Due to the permeability of the upper stratum it can be expected that the ground-water level at the site will follow the fluctuation of the water level in the creek.

DISCUSSION

At present a 48 feet single-span steel truss bridge crosses the creek. Because of extensive ice damage to the abutments this is to be replaced by a new structure. There is very little information available regarding the new structure except that it will have a 55-foot span and will be roughly centred on the existing structure.

Our Reference: S-880/T-4069

January 22, 1963

DISCUSSION - Continued

The investigation has revealed that the site is underlain by dense fine sand with silt and some gravel, which is followed by a thin deposit of stiff lacustrine clay over dense glacial till. The till is a clay till of silty character with considerable gravel content and was encountered approximately at elevation 81.0.

It is assumed that the abutments for the new bridge will be located in the stream bed. Consequently the footings must be taken down to at least four feet below the bottom elevation of the creek, i.e. to elevation 84.0, unless scour protection requires deeper footings. The safe foundation pressure at this level is governed by the bearing capacity of the silty clay deposit. The undrained shear strength of the clay was estimated to be 2000 p.s.f. on which basis the allowable bearing capacity for spread footings can be taken as 4000 pounds per square foot regardless of size or shape of the footings. The same allowable foundation pressure could be used for footings founded in the sand a few feet above the clay. The settlement under a continuous footing loaded to 4000 pounds per square foot is estimated to be about $1\frac{1}{2}$ inches.

However, if the footings are taken down to or below elevation 80.0 the allowable design pressure can be increased to 8000 pounds per square foot. To determine the relative advantage of a shallow but wide footing or a deep, narrow foundation is chiefly a matter of economy and thus beyond the scope of this report.

Because of the relatively high permeability of the upper sand layer some difficulties concerning dewatering can be expected. The excavation has to be sheeted and probably it would be desirable to drive the sheeting a few inches into the silty clay to prevent "piping" at the bottom. The foundations should be designed to resist the horizontal forces exerted by the retained earth behind the abutments, without sliding. If the footings are poured on the rough surface of the clay the sliding resistance at the base can be taken equal to the cohesion of the clay, i.e. 2000 p.s.f. The safety factor against sliding should be at least 1.75.

CONCLUSIONS

1. The site is covered with up to 10 feet of fine brown sand of high density, underlain by a shallow deposit of lacustrine clay followed by dense glacial till.
2. The safe bearing capacity for continuous footings founded at or below elevation 80.0 is 8000 pounds per square foot and 4000 pounds per square foot for shallower footings.
3. Dewatering during excavation might cause some difficulties, therefore the use of closed sheeting is recommended.

Our Reference: S-880/T-4069

January 22, 1963

We trust that this report, which has been reviewed by Mr. K. H. King, P.Eng., contains all the information you require. However, if you feel you would like to discuss any part of this report in more detail, please do not hesitate to call us.

Yours very truly,

RACEY, MacCALLUM AND ASSOCIATES LIMITED



I. P. Lieszkowsky
I. P. Lieszkowsky, P.Eng.,
Project Engineer.

IPL/KA

APPENDIX "A"

November 29, 1962.

FIELD PROCEDURE

Investigation in the field is carried out by means of a diamond drill rig or a truck mounted power auger unit. The holes are advanced either by augers, tubes or by wash water. If holes cannot be kept open because the soil collapses, casing is driven.

Standard sampling procedures are followed. Samples are recovered ahead of the casing at frequent intervals, generally 5 feet, with either a 2-inch or 3-inch O.D. split barrel sampling tube or Shelby tube.

The standard penetration test results are recorded when sampling with the regular 2-inch O.D. split spoon, 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 standard penetration resistance "N" bears an empirical relationship with the relative density or the consistency of the soil. Dynamic cone probes are made by using a 2-inch O.D. 60-degree cone point attached to the end of the drilling rods. The cone is advanced into the soil by ramming, using a 140-lb. hammer falling freely 30 inches. The number of blows for each foot of penetration is recorded. The dynamic cone test provides a continuous picture of variation of soil densities.

In soft or firm cohesive soils, undisturbed samples are obtained by pushing a thin-walled Shelby tube into the undisturbed soil. The samples are returned to the laboratory for later examination and testing as required. Where required, the in-situ shear strength of the soil is determined by field vane tests. Disturbed samples are visually classified in the field, sealed in air-tight jars, and are re-examined, and tested as necessary in the soils laboratory.

Ground water conditions are observed as follows:

The depth where ground water was encountered is recorded, and the change in water level observed. In case of wash water used the test holes are bailed or pumped out, during the work as necessary, at the end of the day and on completion. Subsequent water level readings are taken for the duration of the field work. When artesian water conditions are encountered the head of water in feet is recorded.

RACEY, MacCALLUM AND ASSOCIATES LIMITED
LOG OF BOREHOLE NO. 1

ORDER NO. S-880/T-4069

PROJECT PROPOSED BRIDGE LOT 6 5 & 6 CONC. 4
TWP. OF STANLEY

LOCATION SEE LOCATION PLAN

GROUND ELEVATION 95.17

DATUM LOCAL B.M.

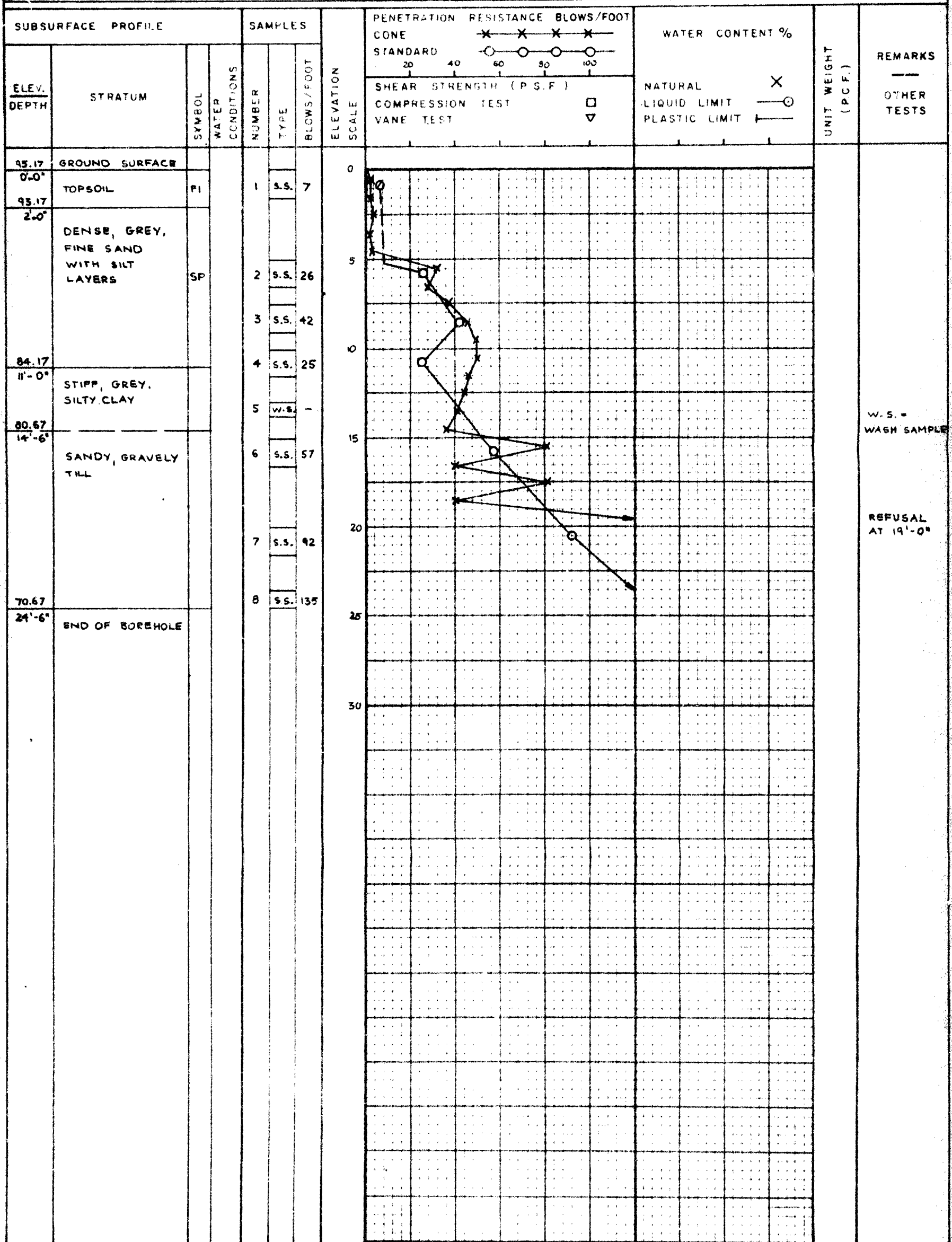
BORING METHOD

WASHING WITHIN 8" CASING

FIELD SUPERVISION BY H.G. DATE DEC. 19. 62

LOG COMPILED BY I.P.L. DATE JAN. 22. 63

LOG CHECKED BY DATE



RACEY, MacCALLUM AND ASSOCIATES LIMITED
LOG OF BOREHOLE NO. 2

ORDER NO. S-880/T-4069

PROJECT

PROPOSED
TWP

BRIDGE
OF

LOTS 5 & 6
STANLEY

CONC. 4

LOCATION SEE LOCATION PLAN

GROUND ELEVATION 91.36

DATUM LOCAL S.M.

BORING METHOD

DRIVING 60° CONE BY 350 ft - lbs ENERGY

FIELD SUPERVISION BY H.G. DATE DEC-19-62

LOG COMPILED BY I.P.L. DATE JAN-22-63

LOG CHECKED BY DATE

SUBSURFACE PROFILE

SAMPLES

PENETRATION RESISTANCE BLOWS/FOOT
CONE

STANDARD

20 40 60 80 100

SHEAR STRENGTH (P.S.F.)

COMPRESSION TEST

VANE TEST

WATER CONTENT %

NATURAL

LIQUID LIMIT

PLASTIC LIMIT

UNIT WEIGHT
(P.C.F.)

REMARKS

OTHER
TESTS

ELEV.
DEPTH

STRATUM

SYMBOL

WATER
CONDITIONS

NUMBER

TYPE

BLOWS/FOOT

ELEVATION
SCALE

91.36
0'-0"

GROUND SURFACE

0

5

10

15

20

25

REFUSAL
AT 16'-0"

RACEY, MacCALLUM AND ASSOCIATES LIMITED
LOG OF BOREHOLE NO. 3

ORDER NO. S-880/T-4069

PROJECT PROPOSED BRIDGE LOTS 616 CONC. 4
TWP. OF STANLEY

LOCATION SEE LOCATION PLAN

GROUND ELEVATION 93.49

DATUM LOCAL B.M.

BORING METHOD

DRIVING 60° CONE BY 350 ft-lbs ENERGY

FIELD SUPERVISION BY H.S. DATE DEC. 19.62
LOG COMPILED BY I.P.L. DATE JAN. 22.63
LOG CHECKED BY DATE

SUBSURFACE PROFILE

SAMPLES

PENETRATION RESISTANCE BLOWS/FOOT
CONE

STANDARD 20 40 60 80 100

SHEAR STRENGTH (P.S.F.)

COMPRESSION TEST

VANE TEST

WATER CONTENT %

NATURAL

LIQUID LIMIT

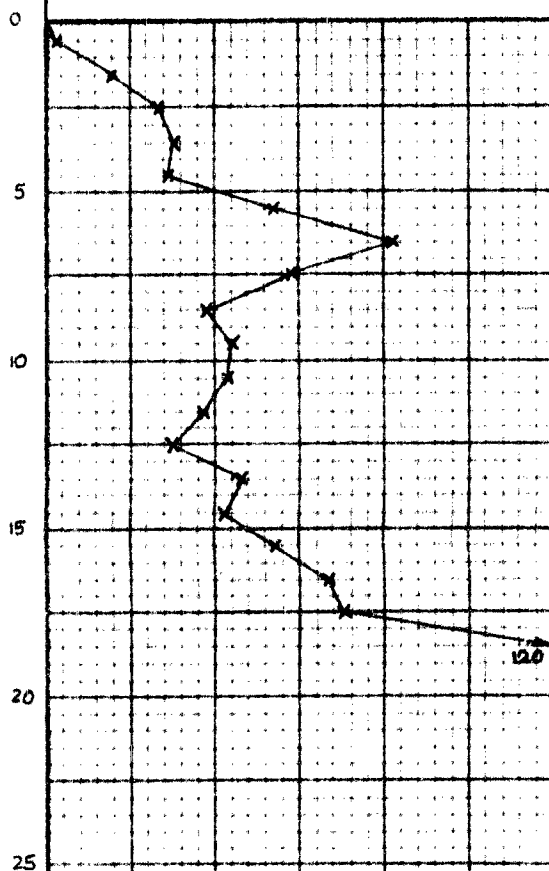
PLASTIC LIMIT

UNIT WEIGHT
(P.C.F.)

REMARKS

OTHER
TESTS

93.49 GROUND SURFACE
0'-0"



REFUSAL
AT 18'-6"

RACEY, MacCALLUM AND ASSOCIATES LIMITED
LOG OF BOREHOLE NO. 4

PROJECT	PROPOSED	BRIDGE	LOTS 5 & 6	CONC. 4
	TWP.	OF	STANLEY	

GROUND ELEVATION 92.84

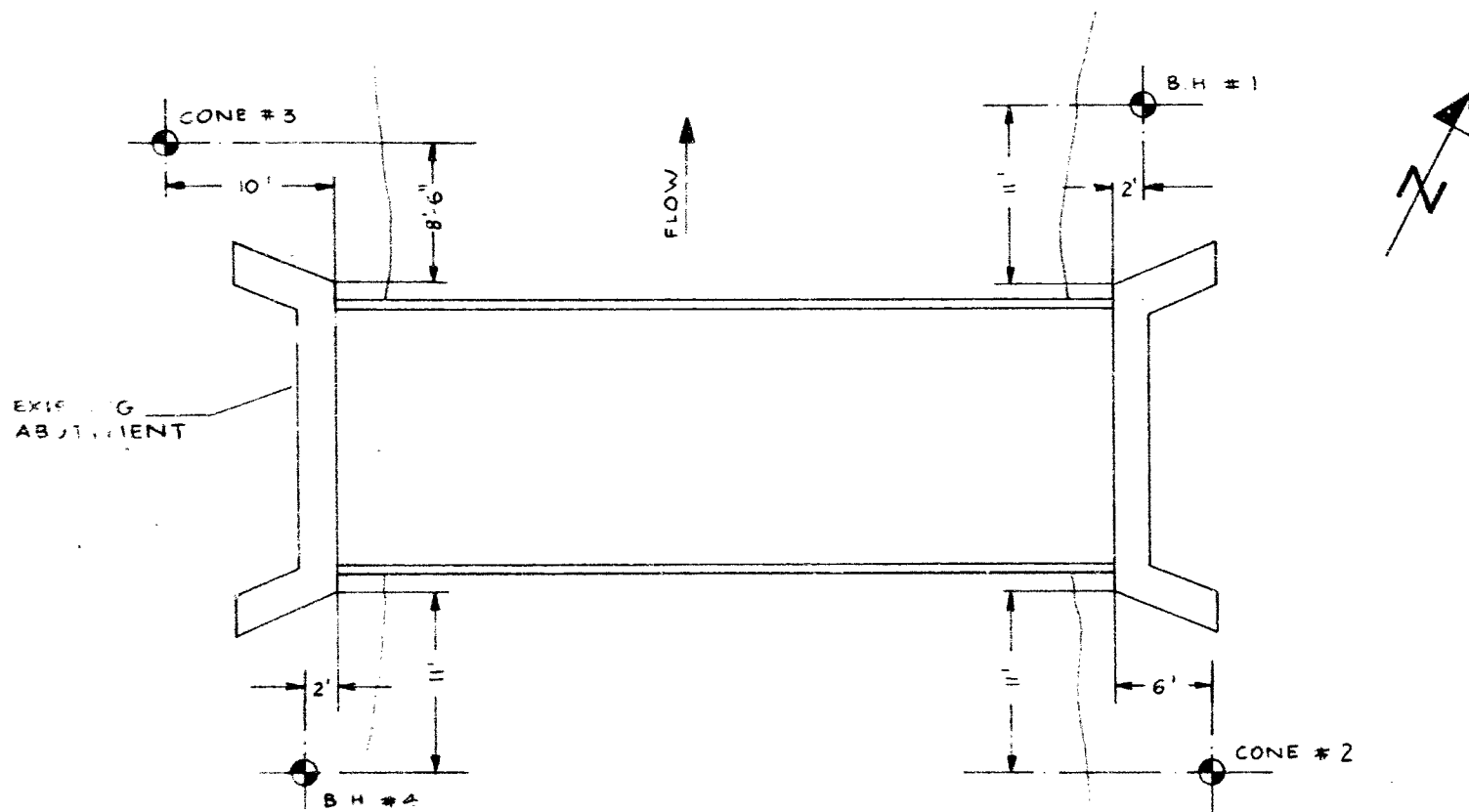
DATUM LOCAL B. M.

WASHING WITHIN BX CASING

FIELD SUPERVISION BY H.G. DATE DEC. 20.62
LOG COMPILED BY I.P.L. DATE JAN. 22.63
LOG CHECKED BY DATE

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE BLOWS/FOOT		WATER CONTENT %		UNIT WEIGHT (P.C.F.)	REMARKS OTHER TESTS
ELEV. DEPTH	STRATUM	SYMBOL	WATER CONDITIONS	NUMBER	TYPE	BLOWS/FOOT	ELEVATION SCALE	CONE STANDARD 20 40 60 80 100	SHEAR STRENGTH (P.S.F.) COMPRESSION TEST VANE TEST	NATURAL LIQUID LIMIT PLASTIC LIMIT		
92.84	GROUND SURFACE						0					
0'-0"	TOPSOIL	PI		1	S.S.	6						
91.84												
1'-0"	DENSE, BROWN, FINE SAND WITH SILT & GRAVEL	SW		2	S.S.	50	5					
84.09				3	S.S.	40						
8'-9"	SILTY CLAY	CL		4	S.S.	17	10					
81.34												
11'-6"	SILTY CLAY TILL			5	S.S.	89	15					
76.34												
18'-6"	END OF BOREHOLE (BOULDER)						20					
							25					

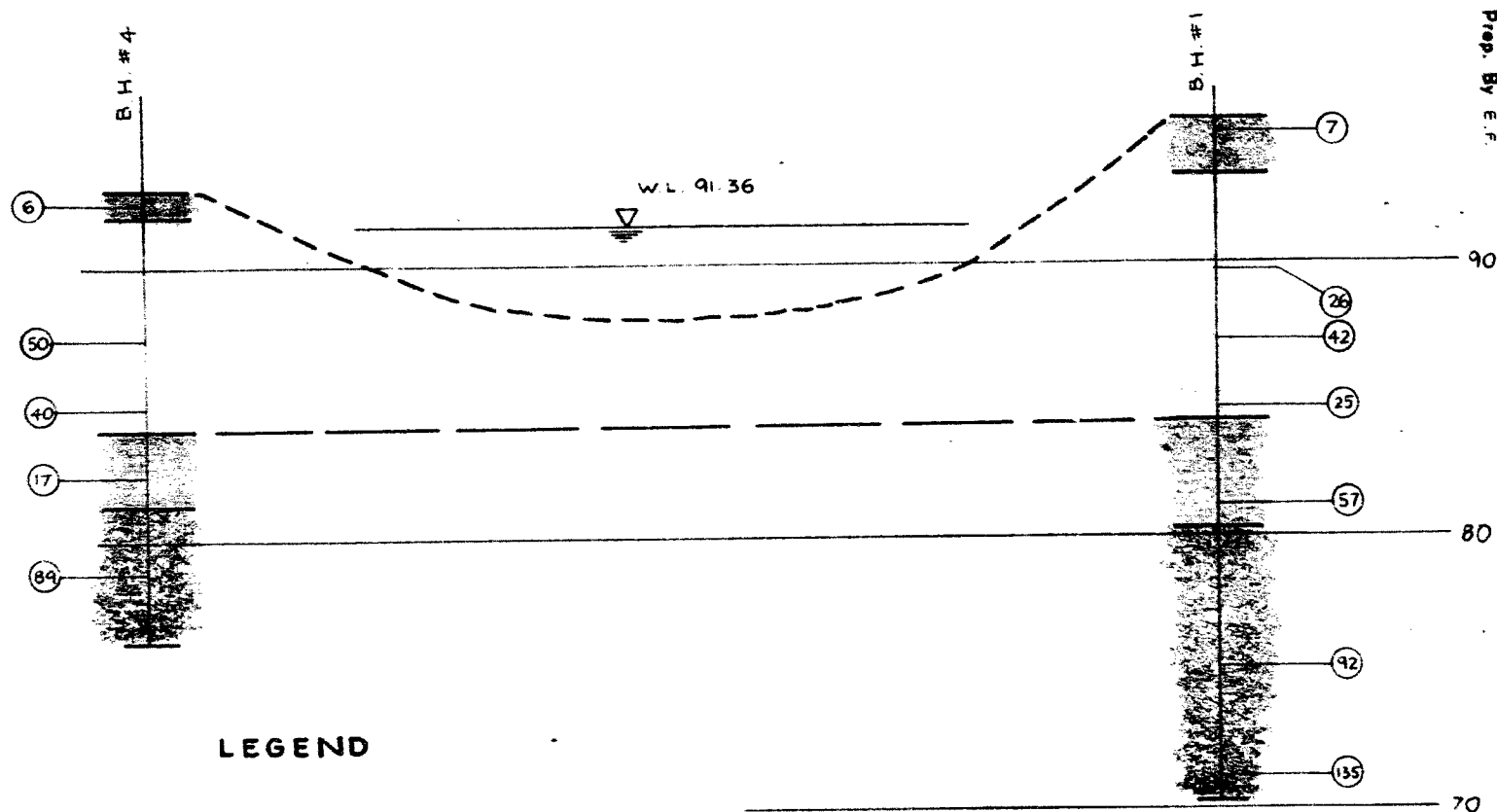
REFUSAL
AT 15'-6"



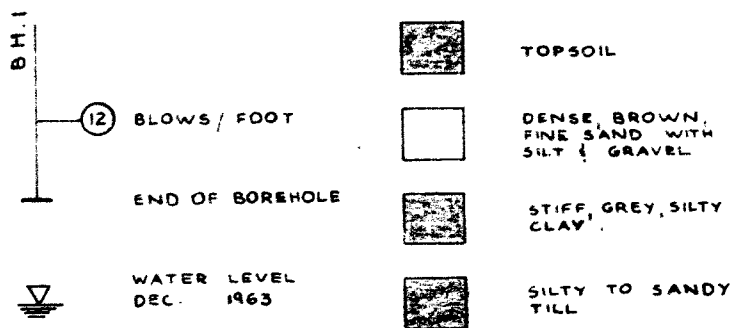
SCALE : 1" = 10' - 0"

DATE : JAN. 22. 63

BOREHOLE LOCATION PLAN
 FOR PROPOSED BRIDGE
 BRUCEFIELD
 TWP OF STANLEY
 LOTS 5 & 6, CONC. 4



LEGEND



PROFILE THROUGH B.H. #1 & #4
FOR PROPOSED BRIDGE
BRUCEFIELD
TWP. OF STANLEY
LOTS 5 & 6 CONC. 4

SCALE: H.: 1" = 10'-0"
V.: 1" = 60'-0"

DATE: JAN, 22, 63