

#63 - F - 260 M

CULVERTS

LOT 30/31, CON. 10/11

LOGAN TWP.

BA 1574

RACEY, MACCALLUM AND ASSOCIATES LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
AND ASSOCIATED STAFF

MONTREAL



OTTAWA

DONALD C. 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-889/T-4027

January 11, 1963.

L-1-F-260 M

Mr. S. E. Ross, P.Eng.,
Consulting Engineer,
P.O. Box 699,
Goderich, Ontario.

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

RE: SOIL CONDITIONS AND FOUNDATIONS,
PROPOSED CULVERTS, LOT 30 & 31,
CONCESSIONS 10 & 11, COAN TOWNSHIP,
PETER COUNTY.

Dear Sirs:

We have completed the soil investigation at the above site and the results are presented in this report together with recommendations regarding the foundation design of the proposed structures.

FIELD WORK

The field work was carried out on December 20th and 21st, 1962. A total of 2 boreholes, each with an adjacent cone penetration test, was put down to depths of up to 20 feet using a standard machine drill rig. The boreholes were carried out in 31 size. Soil samples were recovered by driving a standard split-spoon sampler with a driving energy of 4,200 in. lbs. per blow. The number of blows required to drive the sampler into the undisturbed soil for a distance of 12 inches is recorded as the standard penetration resistance. The resistance bears an empirical relationship to the relative density or consistency of the soil encountered. The cone penetration test was carried out by driving a 60-degree angle cone into the soil with the same driving energy as for the split spoon. This procedure provides a continuous record of the density changes of the subsoil with depth.

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

My reference: -480/1-4827

January 11, 1963

ISSUE NO. 1 - Continued

The locations of the boreholes together with the inferred soil stratigraphy are shown on Drawing No. T-4827-1 attached. The results of the borings are shown on the borehole logs.

The surface elevation of the boreholes was referred to the local datum. The deck at the north-east corner of the existing culvert No. 2 as shown on your site plan Drawing No. BA-77-1 has a given elevation of 100.58 feet.

SOIL CONDITIONS

The results of the borings are given in detail on the borehole logs and are summarized as follows:

- (1) At the ground surface in the boreholes there is a layer of dark brown peaty topsoil about 6" in thickness.
- (2) Underlying the topsoil there is a stratum of brown silty clay. The thickness of the clay is about 7 feet in borehole 1 and about 10.5 feet in borehole 2. Based on the results of the cone and standard penetration tests, the consistency of the clay stratum is estimated to be soft for the upper 2 to 4 feet, and increasing from firm to very stiff with depth.
- (3) A layer of brown sand with some gravel was encountered beneath the silty clay. The thickness of the sand layer is about 2.5 feet in borehole 1. In borehole 2 the sand layer was only penetrated for a distance of 6 inches. Standard penetration tests carried out in the sand gave "N" values of 35 and 36 blows per foot, indicating that it is of dense relative density.
- (4) Underlying the sand layer as encountered in borehole 1 there is a stratum of brownish grey silt till. The till was penetrated to a depth of 7 feet only in the investigation. From visual inspection, the till consists predominantly of silt with some sand and fine gravel. The results of standard and cone penetration tests indicate that the till is of dense to very dense relative density.

WATER CONDITIONS

Due to the relatively impervious nature of the subsoil and the short period of the investigation, observation to the ground water table at the site had not been carried out. However, information

BR-77-1-4027

January 11, 1963

- Continued

given on your site plan Drawing No. BR-77-1 shows that the highest water level at the site is at about elevation 98 feet and the lowest water level at about elevation 90 feet. The bottom of the McNaught Drain and the North-West Drain at the site are both at about elevation 90. Scour has been taking place at both the locations to depths of up to 5 feet below the bottom of the drains. The ice level in the drains at the time of the investigation was observed to be at about elevation 92 feet.

DISCUSSION

At the present the McNaught Drain runs into the site from the north-west to pass under the north-south county road through existing culvert No. 1, and to join with the North-west Drain. The latter, in turn, flows to the south through existing culvert No. 2 to drain into Thames River. The locations of the drains, the culverts and Thames River are shown on Drawing No. BR-77-1 attached to the rear of this report.

Because the existing culverts are underdrained, and the roads at the site have been flooded regularly, it is proposed to divert the McNaught drain to flow directly into the Thames River, to remove culvert No. 1 and to replace culvert No. 2. It is understood that the proposed structures for both of the drains will be of rigid framed concrete construction, consisting of a horizontal deck cast on vertical walls. The deck will occupy an area of 20' x 55' for the structure at the North-west Drain and of 18' x 100' for the structure at McNaught Drain. It is further understood that the vertical walls will be about 15' high founded on spread footings at about elevation 80 feet.

The results of the investigation show that at the proposed foundation elevation the footings will be situated within the dense to very dense silt till stratum. The till is considered as suitable for the use of normal spread footing foundations, and an allowable bearing value of 3.0 tons per square foot is recommended. Settlements for footings under the recommended loading founded at the proposed level will be within the tolerable limits.

The results of the investigation also show that a stratum of sand was encountered at about elevation 86 feet and is about 4 feet below the bottom of the drains. In order to prevent upheaval due to the water pressure in the sand it is recommended that the sides of the excavation for footing constructions should be sheeted and the sheetings should be driven into the underlying till. Any groundwater seepage into the excavation can be handled by pumping from sumps. To avoid disturbance of the foundation soil, it is recommended that a layer of lean concrete be poured as soon as the excavation reaches the footing level.

Our Report 8-880/T-4027

January 11, 1963

1.1 Continued

In order to minimize the hydrostatic pressures on the back of the vertical walls, it is recommended that a layer of free-draining granular material be placed immediately behind the walls and connected to a permanent drainage outlet.

The vertical walls should be designed to resist lateral earth pressure from the retained backfill. If the backfill material is granular in nature and is well compacted, a unit weight of 130 pounds per cubic foot and a coefficient of lateral earth pressure of 0.4 can be used in design.

The stability of the vertical walls against horizontal sliding along the base of the footing should be checked when the design has been finalized. In the stability analysis, the friction angle between the base of the footing and the underlying till of 30 degrees can be used. The coefficient of lateral passive earth resistance in front of the walls can be taken as 3.5. The calculated factor of safety should not be less than 2.0. Adequate protection against scour should be provided in front of the walls.

CONCLUSIONS

1. The site is underlain by a stratum of silty clay, followed by sand and till strata.
2. At the proposed foundation level, elevation 80 feet, the silt till is suitable for the use of spread footing foundations. An allowable bearing value of 3.0 tons per square foot is recommended.
3. Stability of the vertical walls of the two proposed structures should be checked as discussed in the report.
4. Recommendations for the construction procedures are also given in the report.
5. Protection against scour should be adequately provided for both proposed structures.

We believe that this report, which has been reviewed by Mr. E. E. King, P.Eng., contains all of the information you need

- 5 -

Our Reference: - ASD/1-4-1177

January 11, 1963

to carry out the foundation design. However, if you have any questions regarding this report please feel free to call us.

Yours very truly,

RACEY, MACCALLUM AND ASSOCIATES LIMITED

J. Wong
J. Wong, P.Eng.,
Project Engineer.

JW/YL
In quintuplicate



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

ORDER NO 5-880/ T-4027

PROJECT PROPOSED CULVERTS

LOCATION LOGAN TWP. BETWEEN CON. X & XI GROUND ELEVATION 94.4

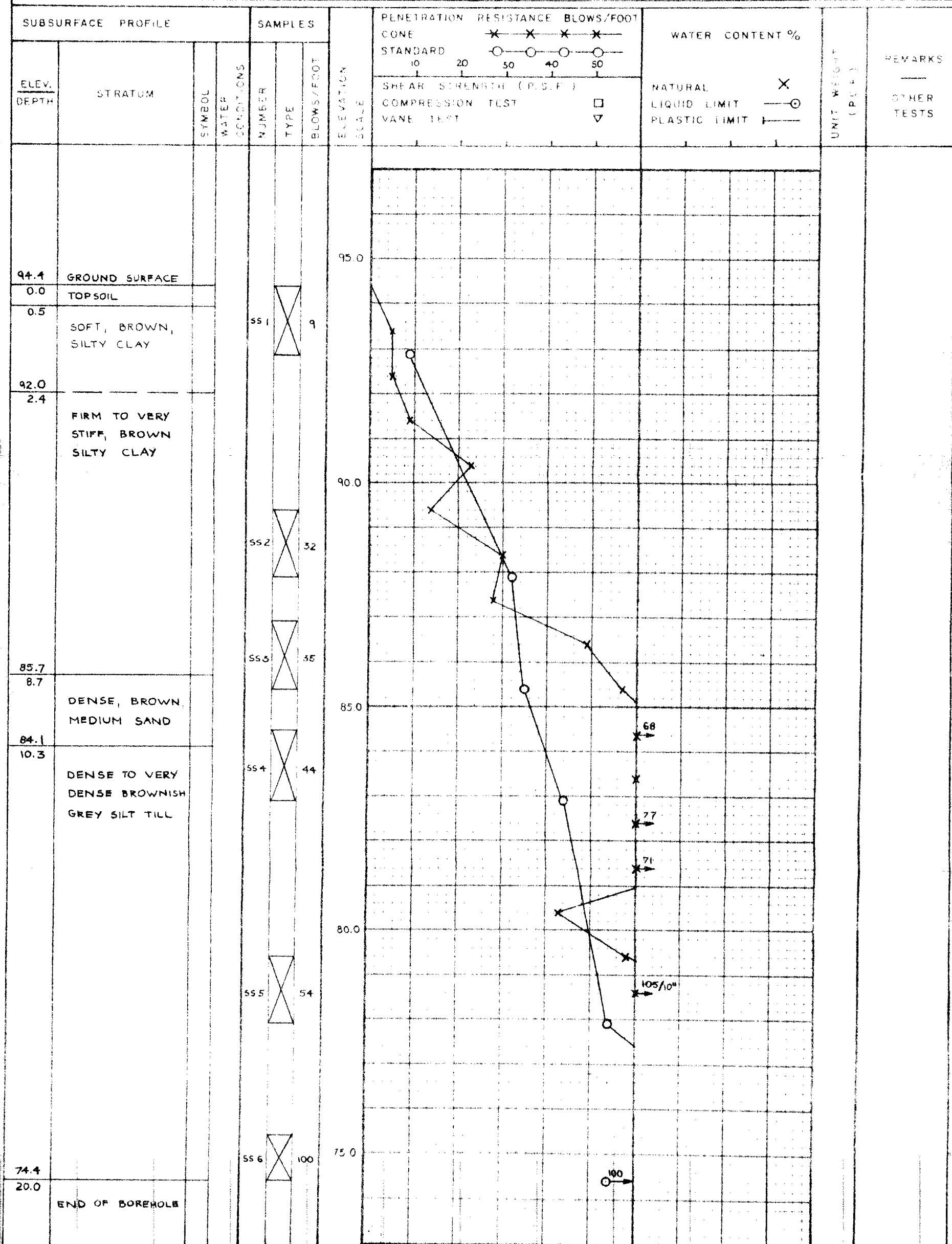
DATUM LOCAL

BORING METHOD WASH - BORING. SAMPLES WERE OBTAINED BY DRIVING
A STANDARD SPLIT- SPOON (S.S.) SAMPLER BY A
140 LB - HAMMER, FALLING 30 INCHES.

FIELD SUPERVISION BY H.G. DATE DEC. 20. 62

LOG COMPILED BY E.F. DATE JAN. 4. 63

LOG CHECKED BY J.W. DATE JAN. 3. 63



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

ORDER NO. S-880 / T-4027

PROJECT PROPOSED CULVERTS

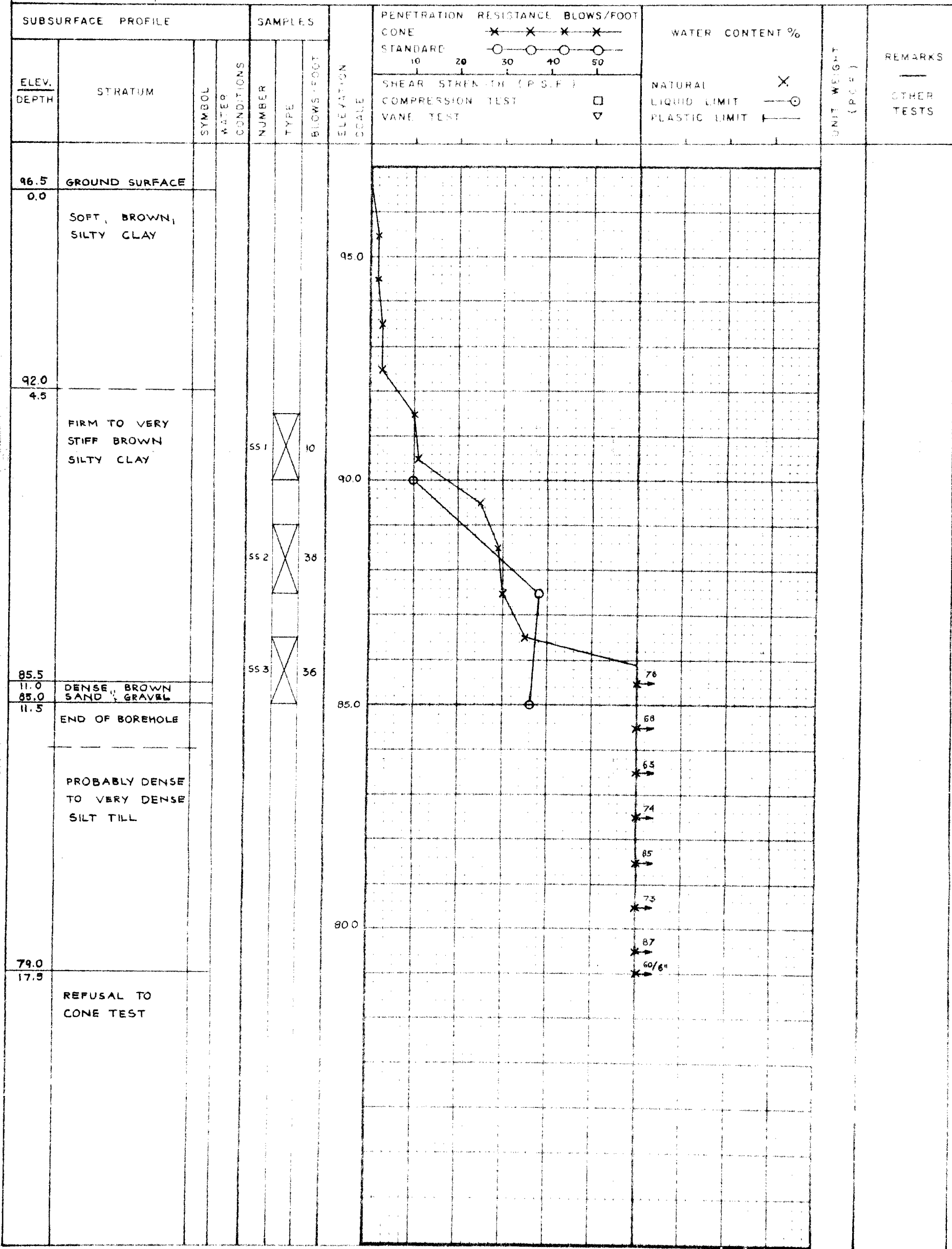
LOCATION LOGAN TWP. BETWEEN CON. X & XI

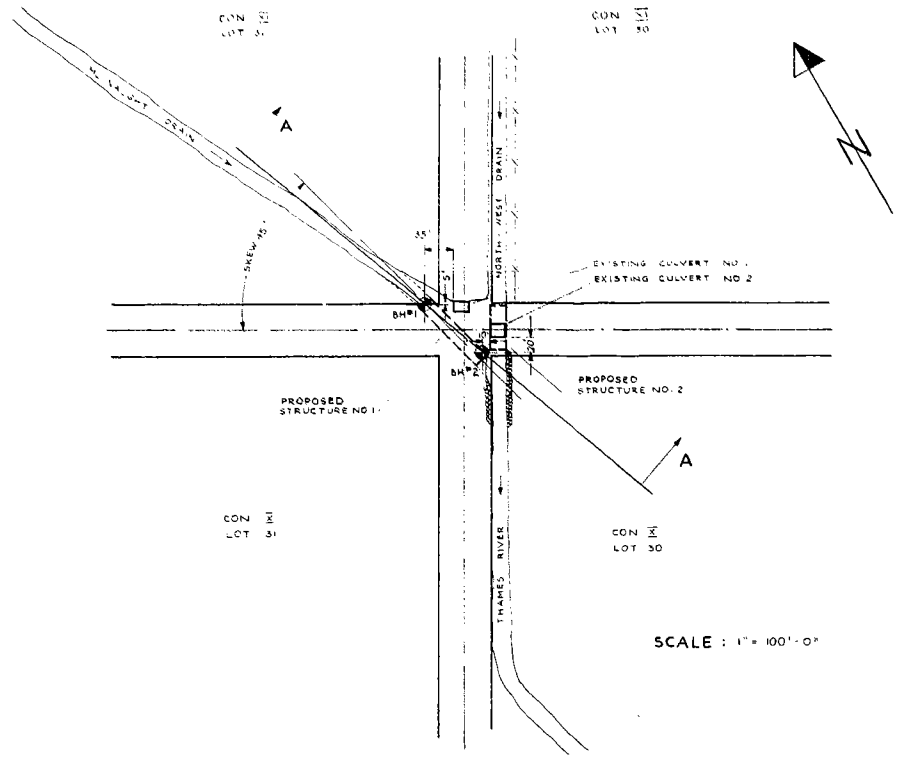
GROUND ELEVATION 96.5

DATUM LOCAL

BORING METHOD WASH - BORING. SAMPLES WERE OBTAINED BY DRIVING
A STANDARD SPLIT- SPOON (S.S.) SAMPLER BY A
140 LB- HAMMER, FALLING 30 INCHES.

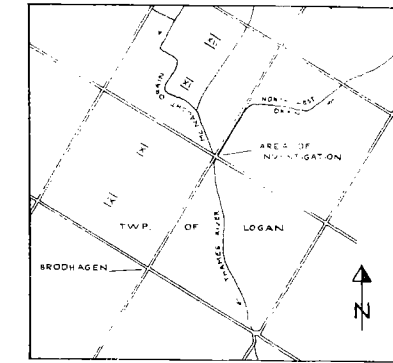
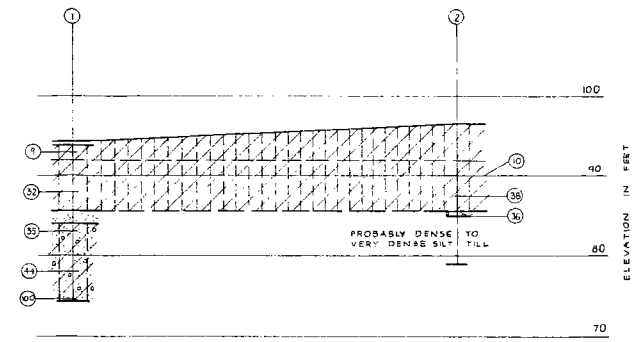
FIELD SUPERVISION BY H.G. DATE DEC. 21. 62
LOG COMPILED BY E.F. DATE JAN. 4 63
LOG CHECKED BY J.W. DATE JAN. 3. 63





DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

SECTION A - A



LEGEND

- BOREHOLE IN LOCATION PLAN
- BOREHOLE IN ELEVATION
- STANDARD PENETRATION RESISTANCE
- END OF BOREHOLE
- END OF CONE PENETRATION TEST

STRATIGRAPHY

- SOFT TO VERY STIFF BROWN SILTY CLAY
- DENSE, BROWN SAND
- DENSE TO VERY DENSE SILT TILL

REVISIONS			PROPOSED CULVERTS IN TOWNSHIP OF LOGAN		
No.	DATE	BY	BOREHOLE LOCATION PLAN, SECTION & KEY PLAN		
			RACEY, MacCALLUM AND ASSOCIATES LIMITED		
			CONSULTING ENGINEERS		
			TORONTO	MONTREAL	OTTAWA
			DRAWN BY	CHECKED BY	DATE
			E. F.	J. W.	JAN 4, 1965
			SCALE	AS SHOWN	
			DRAWING No.	1	