

G.I.-30 SEPT. 1976

GEOCRES No. 40 P5-9DIST. 3 REGION south western

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. _____

LOCATION LOT 11 CON 12 ¹/₁₃STANLEY TWP.

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____REMARKS: DOCUMENTS TO BE UNFOLDEDBEFORE MICROFILM

40P5

RACEY, MACCALLUM AND ASSOCIATES
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
AND ASSOCIATED STAFF

MONTREAL



OTTAWA

TORONTO

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 DIVISION
59 CURLEW DRIVE
DON MILLS, ONT.

January 22, 1963

Our Reference: S-880/T-4070

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



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

RE: SOIL INVESTIGATION,
PROPOSED CULVERT,
LOT 11, CONCESSION 12-13,
TOWNSHIP OF STANLEY

Dear Sir:

We have completed the site investigation for the above project and we have the pleasure of submitting our report describing the soil conditions at the site together with our recommendations for foundation design.

PROCEDURE

The field work, consisting of one exploratory borehole and two cone penetration tests, was carried out on December 17 and 18, 1962. Our standard procedures for drilling and sampling, as described in Appendix "A", were followed when putting down Borehole No. 1 and the two cone tests. The locations of the boreholes are shown on the attached location plan.

All elevations were obtained using a temporary bench mark established at the top of the curb on the S.W. corner of the existing culvert with an assumed elevation of 100.00.

SOIL CONDITIONS

Borehole No. 1, which was carried down to a depth of 26 feet below the bottom elevation of the creek, revealed the following soil conditions.

Our Reference: S-880/T-4070

January 22, 1963

SOIL CONDITIONS - Continued

Below approximately 6 inches of topsoil there is a 4-foot thick stratum of a dark brown clayey silt containing organic matter. The cone penetration test results indicate that the relative density of the stratum is loose.

Sand and gravel

Underlying the organic silt Borehole No. 1 encountered an 18-inch thick stratum of sand and gravel. The standard penetration resistance was 30 blows per foot, indicating that the sand is in a dense state. The presence of this stratum is inferred at the location of cone hole No. 2 by similar penetration resistances at the same elevations.

Grey silt

A stratum of dense grey silt was encountered at a depth of 6 feet and extending to 14'-6" below ground surface. The silt is non-plastic and the standard penetration resistances, which range from 56 to 109 blows per foot, indicate a dense to very dense relative density.

Silty clay till

Below the 14'-6" depth a stratum of dense glacial till was encountered. The samples contained a considerable gravel content embedded in a silty clay matrix. As the borehole was terminated within this stratum its extent in depth is not known. The standard penetration resistance ranges from 27 to 70 blows per foot, thereby indicating a hard to very hard consistency.

DISCUSSION

It is understood that the proposed reinforced concrete structure of rigid frame construction will be approximately 66 feet long and 10 feet high with a clear span of 15 feet. The footings under the vertical members of the frame have to carry, in addition to the dead weight of the structure, the weight of about 10 feet of fill. Under these conditions the resulting loads will be approximately 15,000 pounds per lineal foot.

The site is underlain by dense alluvial deposits overlying hard glacial till. At present the bottom of the creek is at elevation 87.0. Assuming that the proposed culvert will have the same invert elevation, and because of the high frost susceptibility of the silt and possible scour the footings will be founded at approximate elevation 82.0. The safe bearing capacity at this elevation is 3000

Our Reference: S-880/T-4070

January 22, 1963

DISCUSSION - Continued

pounds per square foot using a safety factor of 3. The settlement under a 5 feet wide continuous footing loaded to 3000 pounds per square foot is estimated to be about 1 inch. The settlement under the centreline of a 22 feet high approach fill will be approximately of the same magnitude.

As mentioned before, the soil is very susceptible to frost action, therefore we recommend a minimum of 5 feet protecting cover on the footings.

The stability of the footings against horizontal sliding, resulting from the horizontal pressure of the approach fill, must be investigated. The coefficient of friction of a rough base on silt can be taken as 0.35. In addition to the frictional resistance the passive resistance of the soil in front of the footings should be taken into consideration provided there is no danger of scour or future excavation. In the calculations we suggest to use 70 pounds per cubic foot as the submerged unit weight of the soil and to take the passive earth pressure coefficient K_p to be 3.0. The recommended safety factor against sliding is 1.75.

CONCLUSION

The investigation revealed that at the site glacial deposits are overlain by dense silt on which the proposed structure will be founded.

1. The safe bearing capacity of the silt at elevation 82.0 is 3000 pounds per square foot.
2. Total settlement of the structure and the approach fill is estimated to be about 1 inch.
3. The protective cover on the footings against frost action should be at least 5 feet.
4. The footings should have a minimum safety factor of 1.75 against sliding horizontally.

We believe that this report, which has been reviewed by Mr. K. H. King, P.Eng., contains all of the information you need for the design of the foundations. However, should you have any questions regarding this report we would be glad to be of further assistance.

Yours very truly,

RACEY, MacCALLUM AND ASSOCIATES LIMITED

IFL/KA



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

APPENDIX ^{20A-10}

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. 2

ORDER NO. S-880/ T-4070

PROJECT PROPOSED CULVERT

AT LOT 11 CONC. 12-13
TWP. OF STANLEY

LOCATION BAYFIELD

GROUND ELEVATION 99.73

DATUM LOCAL

BORING METHOD

DROVE 60° CONE WITH 350 ft - lbs ENERGY

FIELD SUPERVISION BY H.G. DATE DEC. 18. 62

LOG COMPILED BY I.P.L. DATE JAN. 4. 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	STANDARD 20 40 60 80 100	SHEAR STRENGTH (P.S.F.) COMPRESSION TEST VANE TEST	NATURAL LIQUID LIMIT PLASTIC LIMIT			
99.73 0'-0"	GROUND SURFACE											
	FILL	FI										
7'-6"												
84.73 15'-0"	END OF TEST											REFUSAL AT 15'-0"

RACEY, MacCALLUM AND ASSOCIATES LIMITED

LOG OF BOREHOLE NO. 1

ORDER NO. S-880 / T-4070

PROJECT PROPOSED CULVERT AT LOT 11 CONC. 12-13
TWP OF STANLEY

LOCATION BAYFIELD

GROUND ELEVATION 92.14

DATUM LOCAL

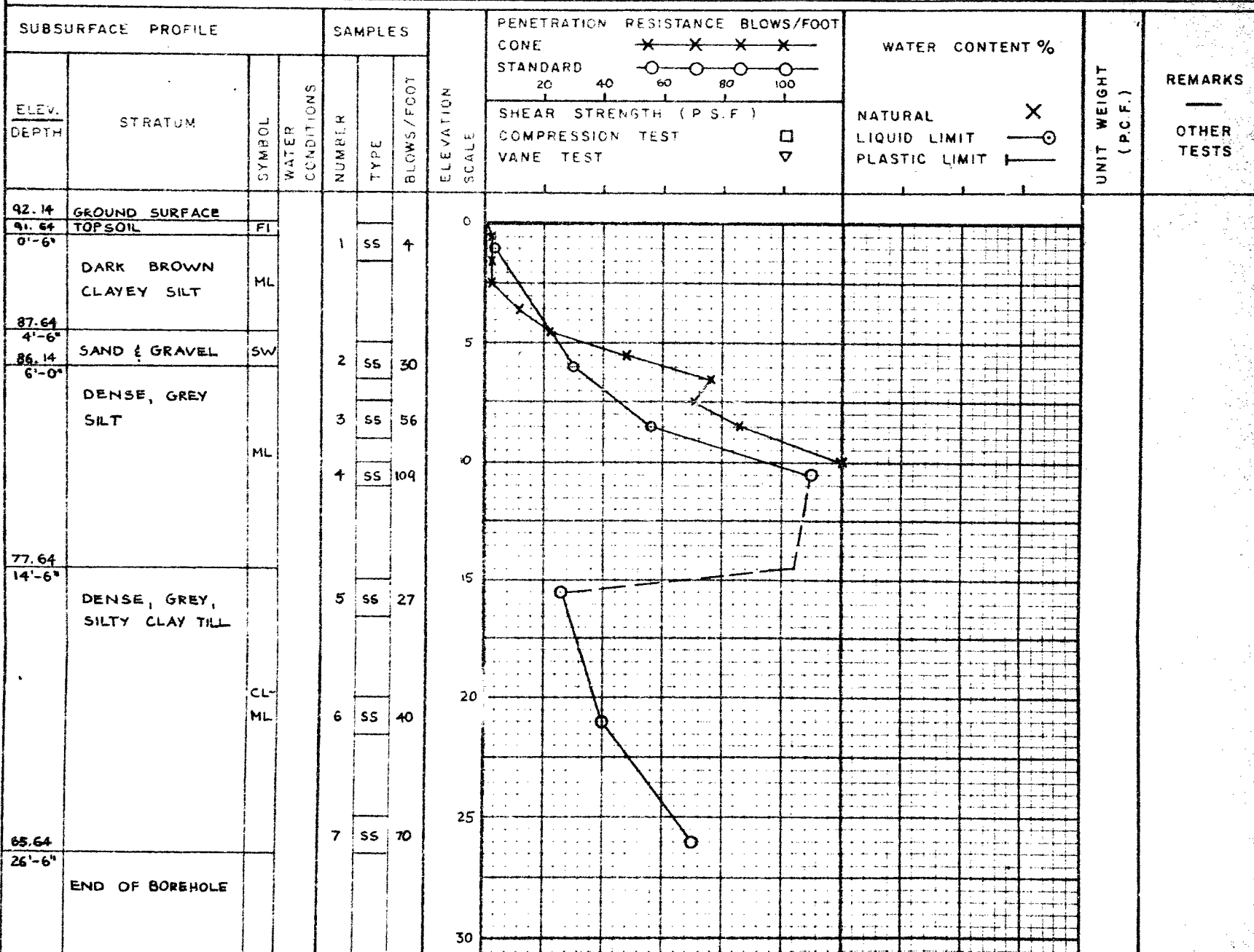
BORING METHOD

WASHING INSIDE BX CASING

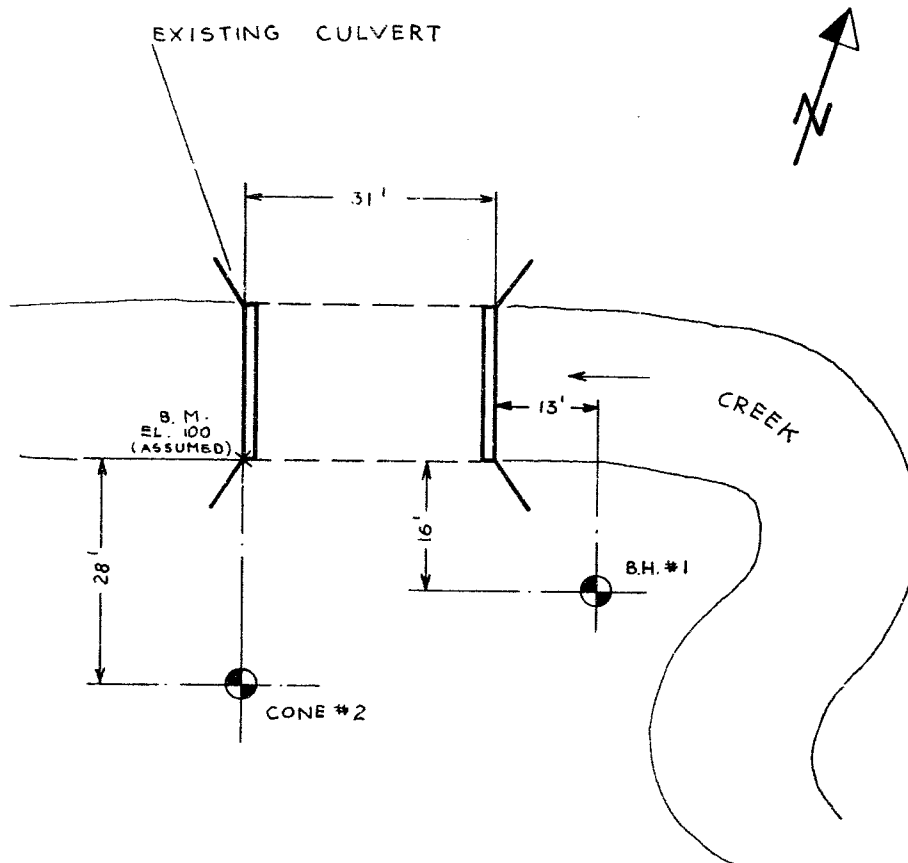
FIELD SUPERVISION BY H.G. DATE DEC. 17, 62

LOG COMPILED BY I.P.L. DATE JAN. 4, 63

LOG CHECKED BY DATE



Prep. By E.F.



BOREHOLE LOCATION PLAN
FOR PROPOSED CULVERT
BAYFIELD
TWP OF STANLEY
LOT 11 CONC. 12-13